Exploring Explicit and Implicit Influences on Prospective Secondary Mathematics Teachers’ Development of Beliefs and Classroom Practice Through Case Study Analysis

Dissertation

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Abstract

Mathematics education literature supports the complex process of prospective secondary mathematics teacher (PSMT) learning and development, the impact of beliefs on PSMT learning and development, and the lack of demonstrated mathematics classroom practice supported by current constructivist reform perspectives referred to as learner-responsive pedagogy in this dissertation. The purpose of this research was to both explicitly impact and explore the process of the development of beliefs and classroom practice for a small group of PSMTs through a Teacher Development Experiment (TDE) methodology. Using the TDE methodology as a guide, the objective of the researcher was to purposefully work to help PSMTs develop beliefs and classroom practice aligning with learner-responsive perspectives.

Eight PSMTs in a 5-quarter graduate teacher education program at a large Midwestern university participated in this research. The researcher acted as an instructor for the PSMTs’ first mathematics methods course and as their university supervisor throughout all field placement experiences in the teacher education program. Guided by literature supporting methods for impacting belief development and teacher learning through a focus on student thinking, the supervisor provided support to increase opportunities for PSMTs to develop beliefs and classroom practice aligning with learner-responsive approaches. Extensive qualitative data were collected throughout the PSMTs’
mathematics methods course and field placement experiences. These data include:
reflective writings from readings, field placement observations, and field placement
teaching experiences; field notes from observations of PSMTs’ classroom practice;
transcribed discussions before and after classroom practice observations; transcribed
discussions from small group discussions; feedback provided by the researcher on lesson
plans and reflective writing; and responses to a final interview. Quantitative data in the
form of a Likert-survey for beliefs related to teaching and learning in mathematics were
analyzed along with qualitative data to develop case studies of development of beliefs
and classroom practice for three of the eight PSMTs.

Through analysis of individual PSMT learning in each case as well as a cross case
analysis, factors influencing PSMT development of beliefs and classroom practice
aligning with learner-responsive perspectives were found. The cases supported the
influence of enactive mastery experiences, over vicarious experiences or verbal
persuasion, on PSMTs beliefs and classroom practice. Differences in enactive mastery
experiences for teacher-centered or learner-responsive perspectives resulted in a
demonstration of differing belief development. The cases also demonstrated a
relationship between PSMTs’ ability to elicit, attend to, interpret, and decide how to use
student thinking in their instruction and their development of beliefs and classroom
practice.

Findings from this research suggest the importance of explicit consistent
supervisor and university support for specific types of experiences for PSMTs to
influence the development of their beliefs and classroom practice to align with learner-
responsive pedagogy. This supports the importance of an explicit focus on consistent teacher models and support for learner-responsive perspectives and practice in teacher education programs as well as further research on developing research-based models of student learning of secondary mathematics concepts to help PSMTs focus more deeply on student thinking.
To my first born son, Ayden Parker Harrison.

Losing you in the midst of this journey made the universe come to a halting stop. Persevering was difficult without you yet more meaningful in consideration of you and your impact on my life.
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# Table of Contents

Abstract ............................................................................................................................... ii

Acknowledgments .............................................................................................................. vi

Vita ................................................................................................................................... viii

List of Tables .................................................................................................................... xv

List of Figures .................................................................................................................. xvi

Chapter 1: Introduction ...................................................................................................... 1

The Context of Reform in Mathematics Education ......................................................... 1

Guiding Conceptual Framework ..................................................................................... 3

The Complex Construct of Teacher Beliefs ................................................................. 4

Defining Beliefs ...................................................................................................... 5

Focus on Student Thinking ......................................................................................... 7

Thesis Organization ..................................................................................................... 10

Chapter 2: Literature Review ............................................................................................ 12

Beliefs About Learning Mathematics ......................................................................... 13

Beliefs About Effective Teaching .............................................................................. 17
Beliefs About the Nature of Mathematics ................................................................. 20
Teacher Beliefs and Classroom Practice ............................................................... 22
Impacting Prospective Teacher Beliefs ............................................................... 26
Learning about Children’s Thinking ............................................................... 31
Cognitive Modeling Cycles of Learning ............................................................... 31
Professional Noticing of Children’s Mathematical Thinking ............................... 38
Situated Cognition ............................................................................................... 43
Building a Conceptual Framework and Research Objective .............................. 47
Research questions ............................................................................................... 51
Study Significance ............................................................................................... 52
Chapter 3: Methodology ....................................................................................... 55
Methodological Rationale .................................................................................... 56
A teacher development experiment .................................................................... 57
Research Design .................................................................................................... 58
Researcher as Participant Observer .................................................................... 59
Background ......................................................................................................... 59
A Glimpse into my Teacher Educator Approach ............................................... 61
The Teacher Preparation Program ........................................................................ 66
Participants ......................................................................................................... 67
List of Tables

Table 1. Levels of Cognitively Guided Beliefs (Fennema et al., 1996, p.413) ........... 14
Table 2: Levels of Cognitively Guided Instruction (Fennema et al., 1996, p.412) ........ 36
Table 3: Levels of Interaction Between Teacher Knowledge and Lesson Implementation (Sherin, 2002, p.129-130) .................................................................................................................. 36
Table 4: Methods Course Assignments and Rationale .............................................. 63
Table 5: Data Sources and Rationale ....................................................................... 70
Table 6: Field Placement Assignments ..................................................................... 73
Table 7: Jacob's MBS score summary ....................................................................... 162
Table 8: Aubrey's MBS score summary ................................................................... 234
Table 9: Derek's MBS Score Summary .................................................................... 304
Table 10: Numerical Summary of Factors Impacting Development of Learner-Responsive Pedagogy .................................................................................................................. 329
Table 11: Research Timeline .................................................................................. 357
List of Figures

Figure 1: Professional Noticing Growth Indicators (Jacobs et al., 2010, p. 196) ............. 41
Figure 2: Factors of Development of Learner-Responsive Pedagogy .............................. 50
Figure 3: Statement of Research Questions ...................................................................... 51
Figure 4: Reflective Writing Prompts for Summer Methods Course ............................... 63
Figure 5: Sample adjustment to MBS item....................................................................... 72
Figure 6: Restatement of Research Questions ................................................................. 83
Figure 7: Restatement of Research Questions .................................................................. 307
Figure 8: Factors of Development of Learner-Responsive Pedagogy ............................ 307
Figure 9: Jacob's Fall Factors of Development of Learner-Responsive Pedagogy ....... 310
Figure 10: Jacob's Winter Factors of Development of Learner-Responsive Pedagogy . 312
Figure 11: Jacob's Spring Factors of Development of Learner-Responsive Pedagogy .. 314
Figure 12: Aubrey's Fall Factors of Development of Learner-Responsive Pedagogy ... 317
Figure 13: Aubrey's Winter Factors of Development of Learner-Responsive Pedagogy.318
Figure 14: Aubrey's Spring Factors of Development of Learner-Responsive Pedagogy 321
Figure 15: Derek's Fall Factors of Development of Learner-Responsive Pedagogy..... 323
Figure 16: Derek's Winter Factors of Development of Learner-Responsive Pedagogy . 325
Figure 17: Derek's Spring Factors of Development of Learner-Responsive Pedagogy . 327
Figure 18: Mathematics Beliefs Scale ............................................................................ 366
Figure 19: Jacob, 10222010, small group, lines 200-211 (J.1) .............................................. 372
Figure 20: Jacob, 09272010, experience reflection (J.2) ............................................................ 372
Figure 21: Jacob, 09272010, experience reflection (J.3) ............................................................ 373
Figure 22: Jacob, 10062010, vertical 2 reflection (J.4) .............................................................. 373
Figure 23: Jacob, 10192010, lesson reflection (J.5) ................................................................. 373
Figure 24: Jacob, 10282010 post-conference, lines 756-760 (J.6) ............................................. 373
Figure 25: Jacob, 10282010 post-conference, lines 903-906 (J.7) ............................................. 374
Figure 26: Jacob, 10282010, self-critique 1 (J.8) .................................................................... 374
Figure 27: Jacob, 11022010, self-critique 2 (J.9) .................................................................... 375
Figure 28: Jacob, 11032010 pre-conference, lines 1041-1049 (J.10) ........................................... 375
Figure 29: Jacob, 11032010 post-conference, lines 1150, 1174-1179 (J.11) ............................ 376
Figure 30: Jacob, 11032010, horizontal 2 reflection (J.12) ....................................................... 376
Figure 31: Jacob, 11042010, blog post (J.13) ......................................................................... 376
Figure 32: Jacob, 11052010, small group, lines 449-456 (J.14) ................................................. 376
Figure 33: Jacob, 12032010, small group, lines 115-131 (J.15) ................................................. 376
Figure 34: Jacob, 12282010, blog post (J.16) ......................................................................... 377
Figure 35: Jacob, 01172011, blog post (J.17) ......................................................................... 377
Figure 36: Jacob, 02022011, self-critique (J.18) ..................................................................... 378
Figure 37: Jacob, 01202011, lesson reflection (J.19) ............................................................... 378
Figure 38: Jacob, 01242011, lesson reflection (J.20) ............................................................... 379
Figure 39: Jacob, 01312011, lesson reflection (J.21) ............................................................... 379
Figure 40: Jacob, 02072011 post-conference, lines 1716-1723 (J.22) ................................. 379
Figure 41: Jacob, 02062011, lesson reflection (J.23) ..................................................... 379
Figure 42: Jacob, 02102011, lesson reflection (J.24) ..................................................... 380
Figure 43: Jacob, 02102011, reflection on teaching (J.25) ............................................. 380
Figure 44: Jacob, 02112011, lesson reflection (J.26) ..................................................... 381
Figure 45: Jacob, 02232011, lesson reflection (J.27) ..................................................... 381
Figure 46: Jacob, 02272011, blog post (J.28) ................................................................. 381
Figure 47: Jacob, 03042011, lesson reflection (J.29) ..................................................... 381
Figure 48: Jacob, 03082011, blog post (J.30) ................................................................. 382
Figure 49: Jacob, 04112011, blog post (J.31) ................................................................. 382
Figure 50: Jacob, 04132011, self-critique (J.32) ............................................................ 382
Figure 51: Jacob, 04172011, spring reflection (J.33) ..................................................... 383
Figure 52: Jacob, 04202011, lesson reflection (J.34) ..................................................... 383
Figure 53: Jacob, 05042011, lesson reflection (J.35) ..................................................... 383
Figure 54: Jacob, 05232011, lesson reflection (J.36) ..................................................... 384
Figure 55: Jacob, Final Interview, lines 2583-2609 (J.37) ............................................. 384
Figure 56: Aubrey, 10062010 post-conference, lines 407-413 (K.1) ............................. 385
Figure 57: Aubrey, 10082010, small group, lines 96-102 (K.2) ..................................... 385
Figure 58: Aubrey, date, autumn vertical 2 reflection (K.3) .......................................... 385
Figure 59: Aubrey, 10122010, vertical 2 reflection (K.4) .............................................. 385
Figure 60: Aubrey, 10222010, blog post (K.5) ............................................................... 386
Figure 61: Aubrey, 10292010, small group, lines 769-772 (K.6) ................................... 386
Figure 62: Aubrey, 11062010, horizontal 2 reflection (K.7) .......................................... 386
Figure 63: Aubrey, 11062010, horizontal 2 reflection (K.8) .......................................... 386
Figure 64: Aubrey, 11062010, horizontal 2 reflection (K.9) .......................................... 386
Figure 65: Aubrey, 10312010, peer critique of Jacob (K.10) ......................................... 387
Figure 66: Aubrey, 10232010, peer critique of Aubrey (K.11) ...................................... 387
Figure 67: Aubrey, 11142010, blog post (K.12) ............................................................. 387
Figure 68: Aubrey, 11162010 post-conference, lines 1238-1240 (K.13) ....................... 387
Figure 69: Aubrey, 12032010, small group, lines 572-582, 631-641 (K.14) ................. 388
Figure 70: Aubrey, 01262011, experience reflection (K.15) .......................................... 388
Figure 71: Aubrey, 01252011, lesson reflection (K.16) .................................................. 388
Figure 72: Aubrey, 01262011, lesson reflection (K.17) .................................................. 389
Figure 73: Aubrey, 01282011, small group, lines 106-117 (K.18) ................................. 389
Figure 74: Aubrey, 01272011 post-conference, lines 1819-1823 (K.19) ....................... 389
Figure 75: Aubrey, 01282011, small group, lines 240-254 (K.20) ................................. 389
Figure 76: Aubrey, 01282011, small group, lines 300-310 (K.21) ................................. 390
Figure 77: Aubrey, 01312011, self-critique (K.22) ........................................................ 390
Figure 78: Aubrey, 01312011, lesson reflection (K.23) .................................................. 390
Figure 79: Aubrey, 02092011 pre-conference, lines 2054-2084 (K.24) ......................... 391
Figure 80: Aubrey, 02162011, lesson reflection (K.25) .................................................. 391
Figure 81: Aubrey, 02162011 pre-conference, lines 2677-2681 (K.26) ......................... 391
Figure 82: Aubrey, 02152011, lesson reflection (K.27) .................................................. 391
Figure 83: Aubrey, 02162011, lesson reflection (K.28) .................................................. 392
Figure 84: Aubrey, 02162011, lesson reflection (K.29) .................................................. 392
Figure 106: Derek, 10182010, self-critique 1 (L.12) .......................................................... 398
Figure 107: Derek, 10112010, horizontal 2 reflection (L.13) ............................................. 398
Figure 108: Derek, 10112010, horizontal 2 reflection (L.14) ............................................. 398
Figure 109: Derek, 10182010, self-critique 1 (L.15) .......................................................... 399
Figure 110: Derek, 10082010, small group, lines 66-86 (L.16) ........................................... 399
Figure 111: Derek, 10082010, small group, lines 749-765 (L.17) ...................................... 400
Figure 112: Derek, 10082010, small group, lines 103-114 (L.18) ...................................... 400
Figure 113: Derek, 10122010 post-conference, lines 390-392 (L.19) ............................... 400
Figure 114: Derek, 10122010 post-conference, lines 397-402 (L.20) ............................... 400
Figure 115: Derek, 11082010, self-critique 2 (L.21) ....................................................... 401
Figure 116: Derek, 10172010, vertical 2 reflection (L.22) ............................................... 401
Figure 117: Derek, 11082010, self-critique 2 (L.23) ....................................................... 401
Figure 118: Derek, 11082010, self-critique 2 (L.24) ....................................................... 402
Figure 119: Derek, 10222010, small group, lines 469-489 (L.25) ...................................... 402
Figure 120: Derek, 10292010, small group, lines 196-230 (L.26) ..................................... 403
Figure 121: Derek, 11022010, peer critique (L.27) ......................................................... 403
Figure 122: Derek, 11032010, observation reflection (L.28) .......................................... 403
Figure 123: Derek, 11042010 post-conference, lines 844-855 (L.29) ............................. 404
Figure 124: Derek, 11042010, lesson reflection, 11072010, blog post (L.30) .................. 404
Figure 125: Derek, 11082010, observation reflection (L.31) ......................................... 404
Figure 126: Derek, 11112010, blog post (L.32) ............................................................. 404
Figure 127: Derek, 01142011, small group, lines 210-220 (L.33) ..................................... 405

xxi
Figure 128: Derek, 01152011, blog post (L.34) ............................................................. 405
Figure 129: Derek, 01172011, first reflection (L.35) ..................................................... 405
Figure 130: Derek, 01252011, lesson reflection (L.36) .................................................. 406
Figure 131: Derek, 01262011, lesson reflection (L.37) .................................................. 406
Figure 132: Derek, 01272011, lesson reflection (L.38) .................................................. 406
Figure 133: Derek, 02012011, self-critique (L.39) ......................................................... 407
Figure 134: Derek, 02012011, self-critique (L.40) ......................................................... 408
Figure 135: Derek, 02042011, small group, lines 52-65 (L.41) ..................................... 408
Figure 136: Derek, 02042011, small group, lines 83-90 (L.42) ..................................... 409
Figure 137: Derek, 02082011, peer critique of Jacob (L.43) .......................................... 409
Figure 138: Derek, 02152011, goals reflection (L.44) ................................................... 411
Figure 139: Derek, 02222011, lesson reflection, (L.45) ................................................. 411
Figure 140: Derek, 02272011, blog post (L.46) ............................................................. 411
Figure 141: Derek, 03012011, lesson reflection (L.47) .................................................. 411
Figure 142: Derek, 03112011, small group, lines 134-213 (L.48) ................................. 412
Figure 143: Derek, 03112011, small group, lines 384-394 (L.49) ................................. 413
Figure 144: Derek, 03112011, small group, lines 505-523 (L.50) ................................. 413
Figure 145: Derek, 03192011, blog post (L.51) ............................................................. 413
Figure 146: Derek, 04132011, lesson reflection (L.52) .................................................. 414
Figure 147: Derek, 0519/05182011, lesson reflection (L.53) ......................................... 414
Figure 148: Derek, 04132011, lesson reflection (L.54) .................................................. 414
Figure 149: Derek, 0425/05122011, lesson reflection (L.55) ......................................... 414
Figure 150: Derek, 05092011, lesson reflection (L.56) ................................................. 415
Figure 151: Derek, Final Interview, lines 2129-2148 (L.57) .............................................. 415
Chapter 1: Introduction

One’s personal predispositions are not only relevant but, in fact, stand at the core of becoming a teacher. (Lortie, 1975, p.79)

If a random sample of adults was asked to recall their 7-12 experiences in mathematics classrooms, the majority would likely comment about sitting at desks in rows and columns, taking notes while the teacher talked to them. They would also likely mention doing problem after problem in order to memorize the rules and facts of mathematics. This teacher-centered approach to the teaching and learning of mathematics was observed in 185 out of 205 lessons implemented by prospective secondary mathematics teachers completing a teacher preparation program (Frykholm, 1999). In the majority of classrooms across the nation, mathematics has been represented as a collection of isolated facts, terms, rules, and procedures demonstrated by the teacher as the sole authority and arbiter of knowledge (Romberg, 1992). So should it be a concern that mathematics is overwhelmingly taught in a way that assumes students are empty vessels in which to place mathematical rules and procedures?

The Context of Reform in Mathematics Education

Current reform efforts in mathematics education, largely initiated by the Curriculum and Evaluation Standards for School Mathematics published by the National Council of Teachers of Mathematics (NCTM) in 1989, are principally based on
constructivist theories of learning and knowledge development. Constructivism is premised on the theory that knowledge is constructed within an individual’s mind from experiences and interactions with others as well as the environment. This perspective informs an emphasis on meaningful, social, and concrete experiences to engender learning in the classroom. Specifically, a constructivist perspective informs a view of mathematics as a dynamic, socially constructed subject. This perspective of mathematics is supported by the vision of a mathematics classroom as a mathematical community where communication, reasoning and proof, multiple representations, problem solving, and development of connections and deep understanding are common experiences and emphases (NCTM, 2000). According to Thompson (1992), reform-oriented mathematics instruction should be characterized by students engaging in “purposeful activities that grow out of problem situations, requiring reasoning and creative thinking, gathering and applying information, discovering, inventing, and communicating ideas, and testing those ideas through critical reflection and argumentation” (p. 128). Due to some inconsistency in common terminology used to refer to instruction supporting reform perspectives I will be using a new term throughout this dissertation. The above descriptors of reform-oriented mathematics instruction will be referred to as learner-responsive pedagogy in this thesis. This term was developed to emphasize a focus on what is posited in this thesis to be a critical feature of reform-oriented mathematics instruction: a teacher as a facilitator of mathematical thinking informing instructional approaches through assessment and knowledge of student thinking.
After twenty years of reform efforts, the above characterization of a mathematics classroom remains quite different from the mathematics classrooms most experience as students (Hiebert et al., 2005; Stigler & Hiebert, 1999). As a result, future teachers are likely to have perspectives based on their experiences as students about teaching mathematics that differ greatly from a learner-responsive perspective. Despite the focus in teacher preparation on informing prospective teachers of current reform approaches to teaching mathematics, many continue to enact traditional practices (Frykholm, 1999). Why do we continue to observe the perpetuation of teacher-centered classroom practices? The purpose of this dissertation is to interrupt this perpetuation by exploring and explicitly impacting the complex web of influences on the development of classroom practice for prospective secondary mathematics teachers. This chapter introduces the conceptual framework guiding the dissertation followed by a discussion of the structure of the dissertation.

Guiding Conceptual Framework

A ‘framework’ provides “a set of assumptions, concepts, values, and practices that constitute a way of viewing reality” (Mewborn, 2005, p. 1) and is actively used as a guide throughout data collection and analysis. The purpose of a framework in research is to provide a basis for the design of all aspects of the research (Lester, 2010) and the complex nature of teacher development led me to compose a ‘conceptual’ framework as opposed to a ‘theoretical’ framework. Similarly to a theoretical framework, my conceptual framework is informed by prior research; however, it is built from a variety of resources relevant to the purpose of my research. I specifically focused on teacher beliefs
and teacher knowledge of student thinking as guiding concepts for my research. Literature informing my focus is introduced below and elaborated on extensively in Chapter 2.

*The Complex Construct of Teacher Beliefs*

According to Alger (2009), we develop conceptual metaphors based on our experiences. Those perceptions and understandings acquired through experience have been referred to as *practical beliefs* (Ernest, 1989). Unlike other common professions, such as medical doctors, mechanics, or engineers, most people develop strong, *practical beliefs* about teachers and teaching from thousands of hours of participation in classrooms as students throughout their lives (Anderson & Bird, 1995; Buehl & Fives, 2009; Felbrich, Muller, & Blomeke, 2008; Lortie, 1975; Swars, Smith, Smith, & Hart, 2009). Based on these experiences, many develop the implicit belief that they know how to teach and understand what it takes to be a teacher.

For future teachers, these *practical beliefs* play an implicit role in their experiences, learning, and development in teacher education programs (Anderson & Bird, 1995; Fives & Buehl, 2008; Strauss, 1993), their classroom practice (Raymond, 1997; Stipek, Givvin, Salmon, & MacGyvers, 2001; Swars et al., 2009), and how they further develop as a teacher (Fives & Buehl, 2008). The role that beliefs play in the learning, development, and actions of future teachers becomes an issue if those beliefs contrast with theories of knowledge, learning, development, and consequently, theories of effective teaching practices.
Beliefs developed from organized and principled theoretical knowledge have been referred to as *theoretical beliefs* (Ernest, 1989). According to Felbrich et al. (2008), “theoretical knowledge can only guide action if it has been incorporated into a person’s beliefs system” (p.763). However, even when people have similar understandings, it is possible for that knowledge to be put into practice in different ways based on each person’s beliefs (Ernest, 1989). Consequently, the complex construct of teacher beliefs becomes a factor in helping teachers to develop learner-responsive approaches to teaching mathematics (Philipp, 2007).

**Defining Beliefs**

In educational research, beliefs have been explored in many areas including general epistemological beliefs and domain-specific beliefs (Cross, 2009). Researchers have found evidence of the complexity of individuals’ beliefs as well as evidence for “distinct beliefs about different aspects of knowledge” (Buehl & Fives, 2009, p.368), such as the source, stability, and structure of knowledge. Despite the growing interest in beliefs in educational research, there is not a consistent, universal, agreed upon definition (Philipp, 2007).

In this thesis, beliefs are conceptualized based on commonalities found in defining beliefs in the literature. Beliefs have been characterized as personal theories or perspectives, frames of reference, conceptions, values, and ideology (Anderson & Bird, 1995; Ernest, 1989). They are considered to be affective, motivational, and cognitive, demonstrating an overlap with conceptualizations of knowledge, which is considered to be purely cognitive (Felbrich et al., 2008; Fives & Buehl, 2008). Beliefs have been
conceptualized as consisting of multiple dimensions and layers creating a system or mental model that is both conscious and unconscious (Buehl & Fives, 2009; Strauss, 1993). The concept of teacher belief systems encompasses a wide variety and complex range of issues (Pajares, 1992). While all components of belief systems or models are perceived to play important roles in teacher development and practice, two particular belief components are emphasized in the study discussed in order to keep the analysis of data and discussion of findings reasonable. The two belief components are mathematics-specific epistemology and the nature of mathematics. Research supports the complex psychological construct of teacher beliefs about the nature of mathematics and the epistemology of mathematics as playing a role in the continued prevalence of teacher-centered classroom practice. However, research exploring the process of development of beliefs paired with the development of classroom practice is lacking, especially for secondary mathematics teachers.

Educational research has found that beliefs are resistant to change (Grootenboer, 2008; Kagan, 1992; Philipp, 2007; Thompson, 1992), do not necessarily match practice (Grant, Hiebert, & Wearne, 1998), and impact teacher knowledge acquisition and development of practice (Pajares, 1992). Considering the lack of change in mathematics classroom practice observed in an era of reform, as well as the complexity of beliefs and their relationship to classroom practice, the purpose of the study discussed in this thesis was to further explore the development of classroom practice and beliefs for three prospective secondary mathematics teachers (PSMT) in a teacher preparation program. This exploration is through the lens of the implicitly demonstrated beliefs and
experiences of the PSMTs throughout a teacher education program in conjunction with explicit support tailored to help them develop learner-responsive beliefs and classroom practice.

Bandura’s (1977) self-efficacy theory for the types of experiences that may have a larger impact on the development of beliefs informed how I tailored my explicit support for the PSMTs. This theoretical framework is elaborated in Chapter 2 and used to build the conceptual framework for my dissertation. The second part of my conceptual framework was informed by mathematics education research demonstrating the influence of teacher knowledge and use of student thinking (Even & Tirosh, 2002; Fennema et al., 1996; Gearhart & Saxe, 2004; Hallagan, 2004; Lin, 2006; Schifter, 2002). This research also informed the methods of explicit support provided for the PSMTs’ development of learner-responsive beliefs and classroom practice throughout their involvement in a teacher education program. A brief background providing reasoning for the importance of a focus on student thinking is given below and elaborated further in Chapter 2.

Focus on Student Thinking

In the quest to empirically explore the teaching profession and how to effectively prepare teachers to be successful, Lee Shulman provided a lens to bring that exploration into detailed focus with his suggestion of a special type of knowledge for teachers: pedagogical content knowledge (PCK, Shulman, 1986). He characterized this knowledge as consisting of multiple and varied forms of representations as well as understandings of student conceptions, prior knowledge, difficulties, and strategies of thinking about the
content. Theoretically, the teacher uses PCK to make concepts and ideas more accessible to students.

As the years have passed, educational researchers in mathematics education have explored and expanded upon Shulman’s (1986) construct of PCK and the idea of the type of knowledge necessary for teachers to be effective. Some suggestions for teacher knowledge include but are not limited to recognizing and using student mathematical talk to inform future instructional actions (Seymour, 2006), helping students to evaluate and determine valid and efficient approaches to problem solving (Campbell, Rowan, & Suarez, 1998, as cited in Son & Crespo, 2009), and generally finding effective ways of helping students to develop strong mathematical connections and understandings (Son & Crespo, 2009). In general, the current focus in mathematics education is helping teachers gain the knowledge necessary to teach for understanding, including mathematics knowledge, knowledge of children’s mathematical development, and knowledge of how to pedagogically help students develop strong mathematical connections (Gearhart & Saxe, 2004).

Deborah Ball and her colleagues brought attention to the construct of *mathematical knowledge for teaching* (MKT), which they have defined as consisting of subject matter knowledge and PCK. Both constructs have been defined in further detail with PCK specifically defined as consisting of *knowledge of content and students* (KCS) and *knowledge of content and teaching* (KCT). KCS is specifically focused on “teachers’ understanding of how students learn content” (Hill, Ball, & Schilling, 2008, p. 378) while KCT “combines knowing about teaching and knowing about mathematics” (Ball,
Inevitably, KCS and KCT interact and overlap and would be difficult, if even possible, to completely separate, however, in order to keep the research reasonable, PSMTs’ development of KCS is emphasized in the presentation and analysis of findings for this dissertation.

Even and Tirosh (2002) stated, “understanding student conceptions, both those documented in the research literature and those known from experience, would assist teachers to adjust instruction to where their students are in their mathematical understanding” (p. 214). This learner-responsive approach to classroom practice has been the goal of the reform movement in mathematics education for the past couple decades. In that time there has been considerable work done around teachers’ development of this type of knowledge, specifically looking at how teachers gain access to, understand, and put this knowledge to use.

Learner-responsive instruction suggests a need for exposing teachers to a constructivist perspective of learning and getting them to act on this perspective by using research-based models of children’s mathematical learning to gain knowledge of children’s mathematical thinking (Fennema et al., 1996) and focusing on eliciting student thinking in the classroom (Schifter, 1998). Once teachers have access to student thinking, research suggests the need for teachers to develop the ability to interpret and analyze mathematical thinking (Lin, 2006; Schifter, 1998) and then use that knowledge of their own students’ thinking to inform instruction through questions, organized activities, and problems that allow students to reflect on their understandings (Gearhart & Saxe, 2004; Lin, 2006).
Teachers are more likely to teach in these ways when they deepen their understandings of the mathematics they are teaching and the ways children learn. As teachers deepen their knowledge, they come to appreciate the critical importance of assessment, of knowing what students know. (Gearhart & Saxe, 2004, p. 310)

Research focused on the impact of teachers’ use of knowledge of children’s mathematical thinking has produced promising results. Following the enactment of instructional environments supporting the development of deep mathematical understanding, research has found increases in student achievement (Fennema et al., 1996; Gearhart & Saxe, 2004; Schifter, 1998; Sowder, 2007; Wilson & Berne, 1999). There has also been evidence to support the continued learning of teachers from their observation and use of children’s thinking in years following the conclusion of professional development targeted at helping teachers develop the ability and interest in using this approach (Franke, Carpenter, Levi, & Fennema, 2001).

Thesis Organization

In this thesis, relevant research is first reviewed to provide a rationale for the study discussed in this dissertation by expanding upon the issues and methods introduced above. Literature is reviewed to inform the development of a conceptual framework of teachers’ beliefs and a focus on student thinking to encourage development of learner-responsive practice. The literature reviewed provides an in-depth look into teacher beliefs about the epistemology and the nature of mathematics as well as the subsequent observed impact of those beliefs on classroom practice. Following this exploration is a discussion of approaches taken in teacher preparation to impact the beliefs and classroom practice of prospective teachers through the development of teachers’ knowledge of student
thinking. Then literature is presented exploring models of teacher learning about student thinking. The literature review section concludes with a synthesis of literature findings used to develop the conceptual framework for my dissertation and a statement of the research questions. This is followed by a discussion of the possible significance of the research conducted. A description of the research design and methodology is provided in chapter three followed by a presentation of three case studies developed from collected data in chapter 4. The fifth chapter concludes this study with a synthesis of the findings through the lens of the conceptual frameworks as related to previous literature and a discussion of implications for future research and design of teacher education program experiences.
Chapter 2: Literature Review

Prior research on teacher beliefs and learner-responsive practice development encompasses empirical studies focused on many areas of teacher preparation and professional development. In the early 90’s Kagan (1992) claimed that educational researchers knew little about the evolution of a teacher’s pedagogy over the course of a career (p. 74). While our knowledge of teacher development has expanded over the last two decades, the perpetuation of teacher-centered classroom practice suggests the need for a more thorough understanding. Research findings do suggest teacher beliefs impact their acquisition of knowledge (Pajares, 1992), classroom practice (Raymond, 1997), and may be a stronger predictor of behavior than knowledge (Nespor, 1987). Considering prospective teachers enter teacher education programs with well-established beliefs about the teaching and learning of mathematics acquired as passive apprentices in mathematics classrooms (Kagan, 1992; Lortie, 1975), the focus of the following review of literature is on the range of beliefs teachers have demonstrated about the nature of mathematics and mathematical epistemology and how those beliefs have been found to relate to learner-responsive perspectives. This discussion is followed by a consideration of the relationships among the different belief components explored and associations observed between particular beliefs and classroom practice. Research focused on impacting prospective teacher beliefs in teacher preparation programs is then reviewed and
literature providing models suggesting methods for impacting teacher beliefs and teacher learning about children’s mathematical thinking are then explored. The chapter concludes with a development of a conceptual framework to guide the research questions, design, and analysis of my dissertation and a discussion of the possible significance of findings from my research.

Beliefs About Learning Mathematics

Epistemological beliefs refer to beliefs about the nature of knowledge and the process of knowing (Cross, 2009; Gill, Ashton, & Algina, 2004, p. 166). These beliefs are found to range from the idea that knowledge comes from an authority to the perspective that knowledge is actively constructed through experience (Buehl & Fives, 2009). Similarly, beliefs about one’s ability to learn have been characterized to exist on a continuum from the belief that ability is stable or an entity to the belief that ability develops through effort or incrementally (Stipek et al., 2001). Specifically in relation to mathematics learning, Ernest (1989) suggested that, “the mental model of learning mathematics consists of the teachers’ view of the process of learning mathematics, what behaviors and mental activities are involved on the part of the learner, and what constitute appropriate and prototypical learning activities” (p.23). Fennema et al. (1996) developed levels of Cognitively Guided Beliefs based on a teacher’s demonstrated beliefs about how students learn (Table 1). The levels developed by Fennema et al. emphasize a teacher’s belief about student abilities and the role of the teacher in the process of student learning. The Cognitively Guided Beliefs integrate the impact of a teacher’s knowledge of
student thinking. This integration of knowledge and beliefs is discussed in a later section in this chapter about models of teacher learning and development.

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
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<tbody>
<tr>
<td>1</td>
<td>Does not believe that children can solve problems without instruction or believe in children’s use of their own strategies.</td>
</tr>
<tr>
<td>2</td>
<td>Struggling with the belief that children can solve problems without instruction and should use their own strategies.</td>
</tr>
<tr>
<td>3</td>
<td>Believes that children can solve problems without instruction. Believes only in a limited way that his or her students’ thinking should be used to make instructional decisions.</td>
</tr>
<tr>
<td>4-A</td>
<td>Believes that children can solve problems without instruction in specific domains included in workshops and that he or she should use knowledge of his or students to guide interactions with them.</td>
</tr>
<tr>
<td>4-B</td>
<td>Believes that children can solve problems without instruction across mathematics content domains and that what he or she knows about children’s thinking should inform his or her decision making, both regarding interactions with the students and curriculum design.</td>
</tr>
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</table>

Table 1. Levels of Cognitively Guided Beliefs (Fennema et al., 1996, p.413)

With current reform efforts in mathematics education informed by constructivist perspectives where it is believed that individuals construct their own knowledge “through actions and reflections on actions” (Steffe & Kieren, 1994, p. 721), learner-responsive beliefs are consistent with the end of the continuum where ability is believed to develop through effort.

Through a wide range of methodological approaches varying from closed-response surveys to interviews and classroom practice observations of K-12 teachers, researchers have found a prevalence of the belief that mathematics is learned through a focus on practice, repetition, memorization, and correct answers (Beghetto, 2008; Correa, Perry, Sims, Miller, & Fang, 2008; Cross, 2009). This information-processing model of mathematics learning is supported by the belief that knowledge is fixed and external to the mind and must be placed inside (Strauss, 1993). While a fixed view of knowledge
seems prevalent for K-12 teachers in mathematics education research, instances of teachers’ perspectives and practices aligning more with a constructivist theory of learning have been observed and reported. These teachers demonstrate beliefs about learning as a process, using student thinking to inform instructional decisions (Cross, 2009), emphasize the importance of students’ prior knowledge (Correa et al., 2008), and emphasize the importance of creative or imaginative thinking over memorization in mathematics (Beghetto, 2008).

Lonka, Joram, and Bryson (1996) further explored how well the beliefs of people aligned with constructivist theories through a survey requesting a definition of learning and applying that definition through a solution to enhance learning. One hundred and twelve people were surveyed ranging from novice to expert in the subject of psychology, including 29 practicing and 23 prospective teachers. Data were analyzed and scored on pre-determined scales for concepts such as constructivity, active epistemology, and mental representations. Constructivity referred to constructivist beliefs that the learner constructed knowledge through modification of existing schemes as opposed to placing knowledge in memory banks. Active epistemology dealt specifically with beliefs about the role of the learner in the learning process as active, intentional, and personally responsible. Mental representations characterized a belief about how knowledge is held and how new experiences interact with prior knowledge (Lonka et al., 1996, p. 242). Lonka et al. (1996) found that less expertise in psychology seemed to correlate to a belief that learning was a passive process of receiving information from an outside source (p. 247). In general, practicing and prospective teachers in their study perceived learning to
consist of an assimilation of information into existing frameworks, however, participants’
definition of learning and approach to applying that definition to a learning situation were
not consistent. This inconsistency demonstrated the possibility of holding learner-
responsive beliefs but not necessarily knowing how to demonstrate those beliefs in
practice. Similarly to the findings of others (Fives & Buehl, 2008; Strauss, 1993), Lonka
et al. (1996) also found a tendency for teachers with little experience in psychology
coursework to believe that ability is innate and knowledge comes from an external
authority. However, they did find that as prospective teachers completed courses in
psychology, they seemed to demonstrate beliefs aligning more with constructivist
theories of learning.

In consideration of findings on teachers’ beliefs about how students learn, the
belief that students learn through receiving fixed knowledge seems to be prevalent across
research focused explicitly on learning in mathematics as well as in general education
settings (Anderson & Bird, 1995; Beghetto, 2008; Correa et al., Cross, 2009; Lonka et al.,
1996; Strauss, 1993). These beliefs seem to be related to a focus on repetition and
memorization in classroom practice. While these beliefs are common and do not coincide
with learner-responsive perspectives, there are cases of teachers demonstrating beliefs
about student learning more closely aligned with reform theories (Beghetto, 2008; Correa
et al., 2008; Cross, 2009; Lonka et al., 1996). In consideration of the model of beliefs on
a continuum, an objective could be to focus on moving teachers along the theoretical
continuum (Fives & Buehl, 2008) toward the belief that students are active constructors
of knowledge in support of reform efforts. The inherent link between beliefs about
learning and beliefs about teaching leads to the need to consider models of beliefs about effectively teaching mathematics in order to think about impacting overall teacher beliefs.

Beliefs About Effective Teaching

*The sage on the stage still seems to overshadow the guide on the side.* (Fives & Buehl, 2008, p.155)

Based on a review of literature, Kuhs and Ball (1986) developed a classification of perspectives on how to effectively teach mathematics. Their classification consisted of four perspectives: 1) learner-focused, 2) content-focused with an emphasis on understanding, 3) content-focused with an emphasis on performance, and 4) classroom-focused. The first three classifications align with particular perspectives on the nature of mathematics as a discipline as well as perspectives on how students learn, while the last does not emphasize content. Ernest (1989) suggested six models of teaching mathematics: pure investigational, problem posing and solving, conceptual understanding enriched with problem-solving, conceptual understanding, mastery of skills and facts with conceptual understanding, mastery of skills and facts, and day-to-day survival (p. 22). Similarly to Kuhs and Ball (1986), Ernest’s last model was also not specifically content-focused. With current reform in mathematics teaching being based on a constructivist view of learning where knowledge is actively constructed not passively learned through memorization of rules and procedures, particular models of teaching described by Ernest (1989) and Kuhs and Ball (1986) align better with learner-responsive perspectives. Models emphasizing the teacher as a facilitator of a classroom environment based on students’ mathematical thinking and learning through mathematical problem solving reflect constructivist theories of learning. As a result, the models emphasizing
conceptual understanding, problem-solving, and learners would have better alignment with learner-responsive methods than those focused only on content and mastery of skills or behavior.

Similarly to the research on beliefs about learning mathematics, research has provided evidence of a prevalence of K-12 teacher beliefs on effective teaching consisting of a focus on the teacher presenting information to students in accessible ways rather than providing students with opportunities to discuss and construct understanding (Anderson & Bird, 1995; Fives & Buehl, 2008; Strauss, 1993). This elaborative processing model, as described by Strauss (1993), is characterized by a focus on repetition, rehearsal, and practice (p. 282) as well as complete control of the classroom behavior through extrinsic motivators (Stipek et al., 2001). In relation to the models described above, the teachers in these research reports would align more with the model of content-focus with an emphasis on performance or mastery of skills and facts.

Using self-report data asking 110 practicing teachers about their conceptual metaphors for teaching from the perspective of what they thought teaching would be like, what they currently do, and how they would like to teach, Alger (2009) found interesting trends in teachers’ beliefs about teaching effectively. The metaphors teachers could choose from consisted of Guiding, Nurturing, Molding, Transmitting, Providing Tools, and Engaging in Community, with the first four conceptualized as more teacher-centered (expert teacher providing information to students) and the last two conceptualized as more student-centered (more of a focus on the student as an active constructor of knowledge). Alger (2009) found that with increasing years of experience, teachers were
more likely to choose *Guiding* than *Engaging in Community*. Specifically, teachers with 0-3 years of experience were more likely to choose *Engaging in Community* than those with 4-22 years of experience. At the same time 65% of participating teachers with less than 22 years tended to aspire to more student-centered metaphors (p. 747). However, 42% of the teachers in the study indicated a misfit between their current teaching practice and their desired metaphor based on contextual factors (p. 751), alluding to the possibility of inconsistency between actual classroom practice and indicated beliefs about teaching and learning.

Overall, only a small proportion of the models suggested by Kuhs and Ball (1986) and Ernest (1989) are exemplified in research on a regular basis. The most prevalent model seemed to be content-focus with an emphasis on performance where the teacher is an authority in the classroom and an extrinsic motivator (Alger, 2009; Anderson & Bird, 1995; Fives & Buehl, 2008; Stipek et al., 2001; Strauss, 1993). This model aligns with Ernest’s models of mastery of skills and facts, day-to-day survival, and conceptual understanding without an emphasis on problem solving. There were also subtle allusions to teachers’ demonstrating beliefs in the learner-focused or conceptual understanding models with perspectives of the teacher as a facilitator of student thinking who provides tools for learning and engages in the community (Alger, 2009; Anderson & Bird, 1995). While it is promising to see results similar to Alger (2009), where some teachers exhibit beliefs aligned with student-centered instruction, it is important to keep in mind the lack of consideration of teachers’ classroom practice in these research studies since teachers’ explicit, self-reported beliefs have been found to differ from implicit beliefs that inform
their practice (Lonka et al., 1996). Teacher beliefs specifically concerning the subject of mathematics have been evident throughout the discussion of beliefs about teaching and learning. Below is a presentation of research findings specifically addressing the types of beliefs about the nature of mathematics found to be demonstrated by teachers.

Beliefs About the Nature of Mathematics

The question of whether epistemological beliefs are general or specific to subject matter has been a matter of considerable interest. (Gill et al., 2004, p. 167)

Mathematics, like all subjects, can be characterized using many different perspectives (Felbrich et al., 2008; Gill et al., 2004). Bright, Bowman, and Vacc (1998) suggested two perspectives: a dynamic, constantly changing field or a static, abstract field. Ernest (1989) suggested three perspectives on the nature of mathematics: problem-solving, Platonist, and instrumentalist. He described the problem-solving view as a dynamic, socially-constructed view of mathematics where the field is constantly expanding and being revised. The Platonist perspective is characterized as a belief in mathematics as static truths that are unified and connected. The instrumentalist view consists of the belief that mathematics is a collection of facts, rules, and procedures that are unrelated but useful. Felbrich et al. (2008) shared four orientations for the nature of mathematics: formalism-related, scheme-related, process-related, and application-related. The formalism-related perspective focuses on the abstract axiomatic and logical structure of mathematics as an exact science. The scheme-related perspective is similar to Ernest’s instrumentalist perspective in consisting of a view of mathematics as a collection of rules, terms, and formulas. The process-related view is focused on mathematics as problem solving and discovery, similar to the problem-solving view Ernest described. The
application-related perspective is based on the belief that mathematics is a relevant subject for society and life.

In consideration of research focusing on exploring teachers’ beliefs about the nature of mathematics through case studies, interviews, and surveys, teachers seem to lean toward an instrumentalist or scheme-oriented perspective of mathematics whether teaching elementary or secondary grades (Benken & Wilson, 1996; 1998; Cross, 2009; Stipek et al., 2001; Szydlik, Szydlik, & Benson, 2003). These teachers tended to characterize mathematics as consisting of computations, calculations, rigid procedures, and memorization. However, current reform in mathematics education is based on inquiry and a more dynamic, problem-solving, process, and application-oriented perspective. A small proportion of teachers have exhibited a Platonist, problem-solving or process-oriented perspective of mathematics (Benken & Wilson, 1996; 1998; Cross, 2009) or seemed to move away from an instrumentalist perspective following teacher preparation program experiences (Felbrich et al., 2008; Szydlik et al., 2003). However, rarely were these learner-responsive perspectives of mathematics linked to classroom practice. With practicing teachers Cross (2009) observed evidence of consistency between the teacher beliefs and practice for two of her cases. However, with a case of two prospective teachers’ practice development, Benken and Wilson (1996; 1998) found less consistency in demonstrated beliefs and learner-responsive practice was either inconsistent or nonexistent.

Similar to research literature on teachers’ beliefs about how students learn and how to effectively teach, the literature on teachers’ beliefs about the nature of
mathematics demonstrated similar findings in teachers tending to hold the instrumentalist or scheme-oriented perspective of mathematics (Benken & Wilson, 1996; 1998; Cross, 2009; Felbrich et al., 2008; Szydlik et al., 2003). These perspectives of mathematics as a static body of knowledge consisting of rules and procedures to be memorized is not consistent with learner-responsive perspectives. As a result, it is not surprising to note a shift in prospective teachers’ beliefs toward a process orientation or problem-solving perspective in a teacher preparation program emphasizing learner-responsive perspectives. This shift is a possible indicator of the impact of the beliefs of teacher educators on the beliefs of their students (i.e. prospective teachers) as well as the impact of teacher education coursework and experiences on the beliefs of prospective teachers (Benken & Wilson, 1996; 1998; Felbrich et al., 2008; Szydlik et al., 2003). While these findings are promising, a weakness continues to be the absence of a connection between this shift in beliefs and the demonstrated practice of the prospective teachers in these studies.

Teacher Beliefs and Classroom Practice

To know how to speak about teaching is not the same as knowing how to actually teach. (Strauss, 1993, p. 289).

The beliefs that teachers share on self-report surveys can be quite different than the beliefs evident from and expressed in relation to their classroom practice (Philipp, 2007). Ernest (1989) cited the powerful influence of teachers’ general values and beliefs concerning the purpose and nature of education on their approach to planning and reflection and the need for consistency between beliefs about teaching and learning and actual classroom practice in order for those principles to be effective. Ernest provided
three possible reasons for the inconsistency between teachers’ beliefs and classroom practice: the depth of the espoused beliefs, the teacher’s level of consciousness, and the powerful influence of social context (p. 27).

The interactions between beliefs and practice are complex and cannot be assumed to be unidirectional (Correa et al., 2008). There are many factors such as, community contexts, colleagues, administrators, policy, and so on, that impact teachers’ practice and may or may not be consistent with their beliefs (Cross, 2009). The pressures from high-stakes testing may lead teachers to focus more on skills and procedures and less on perceived time-consuming experiences such as problem solving (Swaras et al., 2009). Battista (1994) noted the complexity of factors impacting teachers’ approaches to classroom practice:

Almost all current teachers were educated at the elementary, secondary, and university levels in curricula that promoted the conception of mathematics as procedures rather than as sense-making. Moreover, the school environments in which teachers now teach demand this rule-based view of mathematics. Their mathematics textbooks support it. State and district testing programs assess adherence to it. Most parents, school officials, and politicians – all of whom dictate curricula to teachers – also see mathematics as sets of rules to follow. (p. 468)

While this observation was made over a decade ago, these factors all continue to play a role in classroom practice alluding to the perpetuation of teacher-centered classroom practice observed across the U.S. (Hiebert et al., 2005).

Many researchers have found evidence of beliefs as a mediating factor for developing knowledge for teaching and learning from experiences (Pajares, 1992). Specifically, prospective teachers mediate observations of classroom practice and coursework through their beliefs (Anderson & Bird, 1995; Benken & Wilson, 1996;
Teachers’ choices of learning tasks, interpretations of and actions on student ideas and misconceptions, and the use of curricular materials are also all mediated through their belief systems (Ernest, 1989; Lin, 2006). Cohen and Ball (1990) found evidence of assimilation, rather than accommodation, of new approaches to mathematics instruction through traditional beliefs about the teaching and learning of mathematics. Cross (2009) also found that while teachers were interested and enthusiastic about new approaches to teaching mathematics, minimal change in practice was observed over the course of involvement in a professional development program. She concluded that this was the result of the filtering of those new practices through traditional beliefs about the teaching and learning of mathematics. This may be a result of teachers’ beliefs about practical versus theoretical knowledge as Lonka et al. (1996) considered the possibility of acquiring formal knowledge and not seeing applications to practice. One example Lonka et al. noticed was that teachers’ conceptions of learning were often inconsistent with their approaches to instructional problems. While teachers may have knowledge about student learning as an active construction, they may not know how to put this knowledge into practice (Ernest, 1989), but they do know how to teach in ways in which they were taught.

Many educational researchers have found evidence of different interactions and outcomes with teacher education and professional development based on different epistemological beliefs. A belief in knowledge coming from an authority and being fixed has been related to low levels of motivation and meaningful cognitive engagement (Buehl & Fives, 2009; Stipek et al., 2001). It has also been linked to a lower likelihood of
engaging in reflective teaching practices and involvement in professional communities (Buehl & Fives, 2009). Gill et al. (2004) provided reasoning for this relationship: “It is unlikely that teachers will adopt constructivist principles if they maintain the general epistemological beliefs that there is only one way to solve a problem and that the teacher is the sole authority on what that way should be” (p. 170). Fives and Buehl (2008) also hypothesized that teachers who believe knowledge is fixed would have more difficulty recovering and learning from obstacles encountered during everyday practice. On the other hand, prospective teachers who view knowledge as dynamic may be more open to new methods of teaching. An innate view of learning may lead teachers to focus on learning specific strategies for teaching effectively rather than concentrate on understanding theoretical foundations for teaching methods (Fives & Buehl, 2008). This seemed to be the case with the teachers in Anderson and Bird’s (1995) case studies with each of the three prospective teachers demonstrating a solid belief in her perspective of how to effectively teach throughout the teacher preparation program and expecting teacher preparation courses to provide her with the tools to see that vision come to fruition in her classroom.

Ernest (1989) hypothesized specific relationships between the different perspectives on the nature of mathematics and classroom practice. He saw teachers with a problem-solving belief more likely to work with alternative approaches to mathematics problems suggested by students while teachers with Platonist and instrumentalist beliefs more likely to lead to an emphasis on one correct solution method and answer. He also hypothesized that the instrumentalist perspective aligned with a view of teaching as
transmission, the Platonist belief aligned with the idea of the teacher as an explainer concerned with the construction of meaningful understandings of the connected body of mathematics, and the problem-solving perspective aligned with the teacher as a facilitator of meaningful activities and construction of understanding. Stipek et al. (2001) noticed similar connections from their study concluding that strong associations were demonstrated among five dimensions of beliefs: mathematics as skills and procedures, an emphasis on correctness, complete classroom control by the teacher, a fixed mathematical ability, and extrinsic approaches to motivating students (p. 222). Issues with teachers believing in fixed mathematical ability arise also when teachers choose not to consider teaching for understanding because of a belief that mathematics is beyond the reach of the students they teach (Tschannen-Moran et al., 1998). Associations have also been found among beliefs related to the dynamic aspect of mathematics, students as autonomous learners, and a focus on deep understanding. Considering the prevalence of teacher beliefs coinciding with teacher-centered perspectives found through research, there have been many studies focused on learning more about impacting the beliefs of prospective teachers to be more aligned with learner-responsive perspectives.

Impacting Prospective Teacher Beliefs

Empirical research focused on impacting prospective teacher beliefs emphasizes providing prospective teachers with opportunities to challenge existing educational beliefs (Wheatley, 2002). Thoughtful design of experiences for prospective teachers is important, as prospective teachers’ beliefs have been found to be stable throughout teacher preparation programs and used to filter coursework and experiences in ways not
intended (Anderson & Bird, 1995). Bandura’s (1977) theory of sources of efficacy beliefs provides a lens through which to consider the level of impact different experiences may have on prospective teachers belief development. He based his theory on “four major sources of information: performance accomplishments, vicarious experience, verbal persuasion, and physiological states” (Bandura, 1977, p. 195). These experiences were theorized to have varying levels of influence on the development and impact of efficacy beliefs. Performance accomplishments or enactive mastery experiences were considered to have the most influence and result from the actual performance of a task. Success with a task would raise beliefs while failure would lower them. Vicarious experiences result from observations or modeling of particular tasks. Vicarious sources of information were deemed to be less influential due to the lack of direct evidence of one’s ability to carry out a task. Verbal persuasion consists of encouragement to perform particular tasks and is most persuasive when coming from a credible, trustworthy expert. Even if verbal persuasion impacts one’s beliefs positively, failure to carry out the task would disconfirm that belief and outweigh the influence. Physical or mental processes that may interfere with task performance illustrate physiological and affective states. Bandura’s theory was focused specifically on sources of personal efficacy beliefs not other types of beliefs, however, the theory provides a guide for possible types of experiences that could have different levels of impact on the beliefs of teachers. Teacher preparation program opportunities and experiences emphasized in the research range from mathematics methods course design to experiences in K-12 classrooms. A synthesis of literature discussing the design and impact of different approaches is provided.
Contemporary mathematics methods courses emphasizing learner-responsive teaching incorporate opportunities for prospective teachers to experience mathematics learning in a learner-responsive way, develop understanding of children’s mathematical thinking, observe instructors modeling learner-responsive pedagogy, and engage in collaboration and reflection (Beswick, 2006; Fernandez, 2005; Grootenboer, 2008; Hart, 2002; Mewborn & Stinson, 2007; Swars et al., 2009; Szydlik et al., 2003; Wilkins & Brand, 2004). These methods courses mainly address Bandura’s (1977) vicarious and verbal sources of belief development. “The earlier a belief is incorporated into the belief structure, the more difficult it is to alter. Newly acquired beliefs are more vulnerable to change” (Pajares, 1992, p. 325). Taking this observation into account, the new beliefs prospective teachers exhibit after completing mathematics methods courses are fairly transient without support from other aspects of the teacher preparation program and opportunities to gain enactive mastery experiences solidifying these beliefs. Tschannen-Moran et al. (1998) and Guskey (1986) also suggest that new beliefs may not be solidified until approaches taken supporting these beliefs result in observable student learning. This vulnerability is evident in studies of prospective teachers’ beliefs before and after coursework and field experiences with many findings suggesting a negative influence on teachers’ development of beliefs consistent with learner-responsive teaching (Beswick, 2006; Charalambous, Philippou, Kyriakides, 2008; Ozgun-Koca & Sen, 2006; Swars et al., 2009). This demonstration of the vulnerability and lack of resiliency of prospective teachers’ beliefs provides implications for limitations of teacher preparation program experiences that are disconnected.
Although many argue the demonstrated belief change as a result of contemporary methods courses is significant (Beswick, 2006; Felbrich et al., 2008; Gill et al., 2004; Hart, 2002; Szydlik et al., 2003; Wilkins & Brand, 2004), this is of limited practical significance if the prospective teachers do not demonstrate mathematics instruction consistent with learner-responsive perspectives. This is not to say that the prospective teachers will not demonstrate learner-responsive practice, but this aspect is often not addressed in the reviewed literature on impacting teacher beliefs through design of methods course tasks. Benken and Wilson (1996; 1998) spoke to the complexity in the belief change process in describing the difficulties of a prospective teacher trying to balance old and newly acquired beliefs in her approach to instruction. These results demonstrate the complexities of challenging teachers’ beliefs in a short time period and not providing support to help teachers adapt and become accustomed to new beliefs about teaching and learning. According to Pajares (1992), when educational beliefs are well established, new information is more likely to be assimilated into existing belief structures than accommodated. In each of the studies revealing difficulties or major limitations, the methods course was either not supported by other aspects of the teacher preparation program, occurred at a late point in the program, or did not focus on prospective teachers enacting learner-responsive classroom practice.

Literature investigating alternative approaches to mathematics methods courses such as using microteaching lesson study (Fernandez, 2005), emphasis on learning about the mathematical thinking of children (Kajander, 2005; Mewborn & Stinson, 2007), as well as structured field experiences (Artzt, 1999; McClintock, O’Brien, & Jiang, 2005)
demonstrated stronger conclusions related to the facilitation of belief development in a direction leading to learner-responsive practice. Key characteristics of these studies highlight the importance of helping prospective teachers develop a reflective stance in relation to their development of classroom practice as well as experiences teaching in a learner-responsive way with support from teacher educators, mentor teachers, and/or peers. All of these characteristics emphasize the enactive mastery experiences with learner-responsive methods supporting the development of learner-responsive beliefs. While these findings are promising, there are still doubts about the consistency between teachers’ explicit beliefs provided through direct response to questions on their beliefs and their implicit or unconscious beliefs as Strauss (1993) hypothesized would be more evident in classroom practice.

In working with teachers to develop learner-responsive mathematics instruction, Fennema et al. (1996) noted that they did not notice a consistency in the sequence of belief change and instructional change. This suggests a perspective on belief change as an ongoing process of “awareness, confrontation, and reflection” (Cross, 2009, p. 342) and a movement “back and forth among a variety of settings to learn about new instructional strategies, to try them out in their own classrooms, and to reflect on what they observed” (Stipek et al., 2001, p. 225). Challenging existing beliefs is a difficult process that causes prospective teachers to question fundamental assumptions and life goals (Grootenboer, 2008). Just as it is not realistic to expect prospective teachers to become experts upon receiving their teaching certificate, it is not realistic to expect them to exhibit a drastic change in the beliefs they have developed over decades simply from experiences within a
teacher preparation program (Guskey, 1986). Based on promising results in the
development of learner-responsive beliefs and classroom practice, the research discussed
below is focused on better understanding the process of teacher development with an
emphasis on learning about students’ mathematical thinking.

Learning about Children’s Thinking

Teaching is a complex act that involves many types of knowledge, such as subject
matter, pedagogical, and curricular knowledge; efficacy, such as confidence in your
ability to know, teach, and manage a classroom of students; conceptions and beliefs about
the nature of subjects, learning, development, and students; etc. Taking these factors into
consideration “it is not reasonable to assume that there is a simple connection between
teachers’ knowledge and understanding about students’ mathematical learning and the
process of instruction” (Even & Tirosh, 2002, p. 209). The following review of literature
presents three frameworks that are used to inform the development of a substantive
conceptual framework for thinking about prospective teacher development of beliefs and
classroom practice.

Cognitive Modeling Cycles of Learning

Shulman (1986) discussed a research project called Knowledge Growth in
Teaching where he focused on exploring teacher knowledge, the sources of teacher
knowledge, and the process of acquiring new knowledge and the subsequent interaction
of that new knowledge with old knowledge (p. 8). Through his research he began to
characterize this process as “begin[ning] with an act of reason, continu[ing] with a
process of reasoning, culminat[ing] in performances of imparting, eliciting, involving, or
enticing, and then th[inking] some more until the process can begin again” (Shulman, 1987, p. 13). This endeavor has carried on to this day as researchers seek to be able to understand the learning, knowledge, and act of teaching. If we think of teacher learning as a process of construction, similar to the constructivist perspective of student learning, then it may make sense to think of teaching as a cycle or “a process through which teachers can learn as they interact with students during instruction” (Simon, 1997, as cited in Sherin, 2002). Shulman (1987) also spoke of this cycle as working through comprehension, transformation, instruction, evaluation, and reflection (p. 14).

Similarly, a modeling perspective, which views teachers as evolving experts, is based on engaging teachers in “expressing, revising, and refining” existing mathematical and pedagogical knowledge (Hallagan, 2004, p. 2). Simon (1995) saw teachers developing psychological models to inform pedagogical acts in the classroom. While Simon spoke of teachers’ psychological models as either being created from scratch or from available research-based models, Sherin (2002) presented the concept of teachers’ psychological models as connected pieces of subject matter and pedagogical content knowledge that have been repeatedly accessed during instruction. She called these psychological models content knowledge complexes. Sherin went on to hypothesize that these complexes or models are drawn on during the act of instruction instead of isolated subject matter or pedagogical content knowledge. Possible supporting evidence for this construct can be found in discussions of “ingrained methods” where teachers have become accustomed to telling students how to solve a problem or provide students with direct information about working through a procedure instead of asking them questions to
build off of their existing knowledge. These fixed methods of teaching have been observed during hours of time spent as students in classrooms based on a behaviorist, blank slate perspective of knowledge and learning. In these cases, Sherin hypothesized that content knowledge complexes limit teachers’ abilities to understand recommendations of reform based on constructivist perspectives which in turn leads to difficulties in changing classroom practice (Sherin, 2002, p. 123).

In her research to explore the role of teachers’ knowledge during implementation of a reform curriculum, Sherin (2002) closely observed the interactions of two high-school mathematics teachers with students in their classrooms. Through one-on-one interviews with each teacher, video-tapes of classroom teaching, and meeting with the teachers to watch and discuss classroom videos, Sherin concluded, “novel student comments or methods are a critical factor in provoking teachers to move away from the constraints of their content knowledge complexes” (p. 145). This observation was supported by findings from a professional development program called cognitively guided instruction (CGI) started by Elizabeth Fennema and her colleagues at the University of Wisconsin – Madison. In their research they examined the development of beliefs and instruction for 21 elementary teachers participating in CGI professional development over a 4-year period. Data was gathered through “audiotape transcriptions of classroom observations, interviews, CGI Belief Scale scores, and field notes of many informal interactions” (p. 411). Fennema et al. noticed as teachers began to provide students with more opportunities to demonstrate mathematical thinking, teachers were better able to observe the capabilities of their students. Being impressed with what their
students could do led the teachers to provide students with more opportunities to demonstrate their thinking on harder problems, which again provided teachers with the opportunity to observe and attend to the mathematical thinking of their students (Fennema et al., 1996). This process demonstrated a cycle of teaching and learning engendered when teachers’ are exposed to the complexities of children’s mathematical thinking (p. 431). Sherin (2002) described the learning process of the teachers she observed as “a cycle of negotiations among their understanding of the lesson, views of student learning, and knowledge of mathematics” (p. 125). Through this cycle, teachers could construct new knowledge and new content knowledge complexes that would allow them to develop increased flexibility with pedagogical strategies when encountering similar classroom situations. This view of teaching as a cycle of negotiations leads to the perspective of teaching practices that take student thinking into account as a learning process in itself. What helped the teachers in these research projects journey into the world of children’s thinking?

The two teachers Sherin (2002) observed were implementing a new curricular unit on functions designed to elicit student thinking and provide students with opportunities to deepen their mathematical understanding. The teachers were supported in the implementation of the curriculum through meetings with the curriculum designers throughout the study. Fennema et al. (1996) took the approach of providing teachers with robust, research-based models of children’s thinking in particular mathematical domains. These models were explored in professional development settings through viewing and discussing children’s problem solving in-depth. Participating teachers were also provided
support and encouragement from the researchers to continue reflecting on and building their knowledge of children’s thinking with students in their classrooms. Teachers participating in CGI demonstrated general knowledge of the mathematical difficulties of students and the ensuing exposure to research-based models built onto their existing models of students’ thinking. The accuracy of these models provided teachers with a more specific starting point to consider when looking at student thinking in their classrooms (Fennema et al., 1996). The similarity of the research-based models to the models of children’s thinking they observed may have helped engender an interest in the importance of paying attention to their students’ thinking.

As observed by Sherin (2002) and Fennema et al. (1996), a noted change in instructional practices coincided with increased attention to children’s mathematical thinking. Fennema et al. developed a trajectory of change observed in teachers’ practices consisting of four well-defined levels from little to full attention and use of children’s thinking in instructional practice (Table 2). It is interesting to note that Fennema et al. observed teachers seeming to explore new ways of teaching, however, they would enact them as another traditional fixed routine. Fennema et al. defined this as change from Level 1 to Level 2. Sherin (2002) also developed a framework for identifying interactions between teachers’ content knowledge and a new reform curriculum (Table 3). Sherin defined transform similarly to Fennema et al.’s transition from Level 1 to Level 2: “teachers use their existing content knowledge to implement a new lesson but changes the lesson to be consistent with what he or she is used to doing” (Sherin, 2002, p. 129).
<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Provides few, if any, opportunities for children to engage in problem solving or to share their thinking.</td>
</tr>
<tr>
<td>2</td>
<td>Provides limited opportunities for children to engage in problem solving or to share their thinking. Elicits or attends to children’s thinking or uses what they share in a very limited way.</td>
</tr>
<tr>
<td>3</td>
<td>Provides opportunities for children to solve problems and share their thinking. Beginning to elicit and attend to what children share but doesn’t use what is shared to make instructional decisions.</td>
</tr>
<tr>
<td>4-A</td>
<td>Provides opportunities for children to solve a variety of problems, elicits their thinking, and provides time for sharing their thinking. Instructional decisions are usually driven by general knowledge about his or her students’ thinking, but not by individual children’s thinking.</td>
</tr>
<tr>
<td>4-B</td>
<td>Provides opportunities for children to be involved in a variety of problem-solving activities. Elicits children’s thinking, attends to children sharing their thinking, and adapts instruction according to what is shared. Instruction is driven by teacher’s knowledge about individual children in the classroom.</td>
</tr>
</tbody>
</table>

Table 2: Levels of Cognitively Guided Instruction (Fennema et al., 1996, p.412)

<table>
<thead>
<tr>
<th>Interaction Class</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transform</td>
<td>Teachers use their existing content knowledge to implement a new lesson but, in doing so, they instantiate the lesson differently than was intended by the curriculum designers. The teacher changes the lesson to be consistent with what he or she is used to doing.</td>
</tr>
<tr>
<td>Adapt</td>
<td>Teacher develops new content knowledge and implements the lesson as planned. Novel student comments and actions trigger teachers to look beyond their content knowledge complexes.</td>
</tr>
<tr>
<td>Negotiate</td>
<td>Teachers develop new content knowledge and at the same time make changes in a lesson as it unfolds in the classroom. Changes involve innovative instructional strategies that are new for the lesson and for the teacher.</td>
</tr>
</tbody>
</table>

Table 3: Levels of Interaction Between Teacher Knowledge and Lesson Implementation (Sherin, 2002, p.129-130)

Sherin did not characterize teachers as implementing instructional changes until what she called *adapt*, which parallels Fennema et al.’s (1996) description of Level 3. Level 3 teachers acknowledged children’s methods of solving problems, but did not demonstrate intention of building instruction from those methods. Sherin’s (2002) final case of *negotiate* consists of teachers incorporating novel changes in lesson implementation, deviating from the curriculum based on students’ mathematical thinking. Concurrently, Level 4-B teachers “conceptualized their instruction almost continually in terms of the
thinking of their students” (Fennema et al., 1996, p. 420). This refers to and exemplifies the inherent cyclical process in teaching based on children’s mathematical thinking.

Fennema et al. (1996) concluded that the teachers’ initial general model of children’s thinking was transformed into a framework for developing a deeper understanding of children’s thinking. The research-based model they were provided in professional development served as a dynamic body of knowledge that guided their focus for reflection on children’s mathematical thinking which allowed them to continuously reflect, modify, adapt, and expand their own model of children’s thinking based on their classroom interactions with students (p. 432). This model exemplifies what Sherin (2002) theorized as new content knowledge complexes for these teachers. The research-based models of children’s mathematical thinking and the attention to student thinking in their classrooms played a critical role in informing teachers’ knowledge and starting the cycle of negotiations.

In working with one teacher, Seymour (2006) also observed the importance of observations of student thinking in the classroom for the teacher to solidify her understanding of students’ strategies. In classroom observations of this teacher with new knowledge of students’ thinking from participation in professional development, Seymour noticed evidence of her negotiating her new understandings with her interactions in the classroom. “Understanding this process is essential to validating that PCK does emerge from teaching, and uncovering the ways of talking that could help build the PCK that help teachers navigate the sea of student ideas” (p. 807). One framework that has been developed to better conceptualize teacher’s in-the-moment
decision making is *professional noticing*. This framework is introduced and elaborated below.

*Professional Noticing of Children’s Mathematical Thinking*

The use of children’s thinking to inform instruction is a form of formative assessment. Cognition, observation, and interpretation were described as key elements for the creation and use of classroom assessments (Pellegrino, Chudowsky, & Glaser, 2001, as cited in Lin, 2006, p. 547). Jacobs, Lamb, & Philipp (2010) have suggested taking these key elements a step further with the construct of professional noticing of children’s mathematical thinking. Professional noticing conceptualizes a developmental trajectory for teachers’ ability to obtain, understand, and use children’s mathematical thinking in their instruction. One way that noticing is defined is “making sense of how individuals process complex situations” (Jacobs et al., 2010, p. 171). Researchers have found a tendency for similar groups of professionals to develop distinct patterns of noticing based on shared goals and experiences in their profession. For example, “archeologists develop sensitivities to variations in color, texture, and consistencies of sand, and attending to these details is a critical component of their abilities to reason about a landscape” (p. 170). As noted earlier, teaching is inherently complex and teachers’ actions in the classroom are highly dependent on their past experiences and beliefs about teaching and learning. The unpredictability of classroom happenings forces teachers to have to constantly interpret and analyze classroom observations and connect them with their knowledge about subject matter and pedagogy before deciding how to respond (Franke, Kazemi, & Battey, 2007). Wanting to better understand this whole process, Jacobs et al.
(2010) focused their inquiry on trying to break down and capture the in-the-moment decision-making of teachers through a professional noticing framework.

Based on past noticing frameworks, Jacobs et al. (2010) developed a conceptualization of professional noticing of children’s mathematical thinking as consisting of “three interrelated skills: attending to children’s strategies, interpreting children’s understandings, and deciding how to respond on the basis of children’s understandings” (p. 172). In studying teachers with varying years of teaching experience and experience with professional development, Jacobs et al. sought to explore the ability of teachers to demonstrate evidence of the different parts of the professional noticing framework. They collected data from four groups of teachers: prospective elementary teachers, practicing K-3 teachers with no professional development experience, practicing K-3 teachers with 2 years of professional development, and practicing K-3 teachers with 4 or more years of professional development experience. The three groups of practicing K-3 teachers each had an average of 14-16 years of teaching experience. All teachers were voluntarily involved in professional development focused on helping teachers to develop knowledge of children’s thinking for specific mathematical concepts and helping teachers to think about eliciting and responding to support and develop children’s mathematical thinking (p. 176-177). The participants responded to specific prompts about student work designed to elicit responses that would demonstrate professional noticing of children’s mathematical thinking.

Overall, Jacobs et al. (2010) found evidence for greater years of teaching experience supporting only the development of the ability to attend to and interpret
children’s thinking; they did not use this knowledge to determine instructional approaches. However, sustained professional development focused on children’s mathematical thinking and involvement in leadership activities in the school district (e.g. mentoring colleagues, presenting for colleagues or at conferences) supported the development of all three skills: attending to, interpreting, and deciding how to respond to children’s thinking (p. 182). Their results also demonstrated that, “Expertise in attending to children’s strategies [and interpreting children’s understandings] is neither something adults routinely know how to do nor is it expertise that teachers generally develop from many years of teaching” (Jacobs et al., 2010, p. 184, 188). This finding suggests that professional development emphasizing understanding of children’s mathematical thinking may help teachers to move toward the use of children’s thinking in instructional decisions.

Fennema et al. (1996) had similar observations in their work with teachers in professional development focused on getting teachers to attend to children’s mathematical thinking. They noticed that prior to involvement in CGI, their teachers “have informal, although somewhat unfocused, knowledge about children’s mathematical thinking” (p. 406). The critical point was that the teachers did not demonstrate an understanding of how to connect this general knowledge to instructional decisions prior to involvement in CGI. Using classroom observation data, Fennema et al. noted “90% of the teachers had become more cognitively guided” (p. 429) after four years of involvement in CGI professional development. These findings speak to the impact of knowledge about children’s thinking on what teachers choose to do in the classroom.
From their data analysis Jacobs et al. (2010) developed indicators of a suggested learning trajectory for teachers demonstrating strong evidence of professional noticing (Figure 1).

- a shift from general strategy descriptions to descriptions that include the mathematically important details;
- a shift from general comments about teaching and learning to comments specifically addressing the children’s understandings;
- a shift from overgeneralizing children’s understandings to carefully linking interpretations to specific details of the situation;
- a shift from considering children only as a group to considering individual children, both in terms of their understandings and what follow-up problems will extend those understandings;
- a shift from reasoning about next steps in the abstract (e.g., considering what might come next in the curriculum) to reasoning that includes consideration of children’s existing understandings and anticipation of their future strategies; and
- a shift from providing suggestions for next problems that are general (e.g., practice problems or harder problems) to specific problems with careful attention to number selection.

Figure 1: Professional Noticing Growth Indicators (Jacobs et al., 2010, p. 196)

The overall trend characterized in the growth indicators from thinking broadly to more specifically about instruction and students is evident in other research, such as Fennema et al.’s (1996) levels of CGI and Sherin’s (2002) transform, adapt, and negotiate framework. Bright et al. (1998) also hypothesized that as teachers progressed in exhibiting higher levels of instruction based on children’s thinking they would move away from a general framework for developmental gains to more of a focus on children’s individual understandings and strategies. To test this hypothesis, they analyzed responses
from 20 elementary teachers participating in CGI professional development. The teachers responded to the instrument three different times over three years. The teachers had responded to prompts asking for them to interpret three different dialogues between a teacher and a student about a mathematical problem. Bright et al. (1998) found that teachers in the CGI professional development demonstrated more of an effort to understand students’ thinking than apply generic skills, misconceptions, and evaluations to their work. This finding also supports the trend to think more specifically about students after involvement in professional development emphasizing children’s mathematical thinking.

Jacobs et al. (2010) suggested caution in the interpretation of their findings as a result of the inherent complexity of developing and executing professional noticing.

Attending to children’s strategies requires not only the ability to focus on important features in a complex environment but also knowledge of what is mathematically significant and skill in finding those mathematically significant indicators in children’s messy, and often incomplete, strategy explanations. (Jacobs et al., 2010, p. 194)

While professional noticing may be a promising avenue to continue exploration, it is important to take note of the lack of concrete relation to teachers’ practice in their study. Jacobs et al. (2010) and Bright et al. (1998) did claim that forms of professional noticing or “purposeful attention” to children’s mathematical thinking are a precursor to learner-responsive teaching. However, they also acknowledged that it is not necessarily sufficient in leading to instructional changes due to the inevitable complex nature of instructional actions.
Son and Crespo (2009) demonstrated this complexity between knowledge of mathematics, knowledge of student thinking, and instructional practice in their discussion of prospective teachers’ experiences with analyzing non-traditional student strategies. As part of their research, 17 prospective elementary and 17 prospective secondary teachers’ responded to a task where they were asked to solve a mathematical problem and create a related story problem before responding to students’ non-traditional mathematical strategies. The participants’ demonstration of different mathematical reasoning and instructional suggestions were then analyzed. While many of the prospective secondary teachers demonstrated deeper mathematical understanding, they relied more on teacher-focused approaches to instruction. Prospective elementary teachers largely demonstrated more shallow mathematical understanding, however, they suggested more student-focused approaches to instruction (Son & Crespo, 2009). This finding reiterated the complexity of teacher knowledge and beliefs and the need to more deeply understand the psychological models of content knowledge and conceptions about teaching and learning held by effective teachers and how to help prospective and practicing teachers develop those models. One theoretical perspective used to conceptualize the influences on teacher learning and development is situated cognition. Below is a discussion of research literature demonstrating how this perspective could inform the development of a better understanding of teacher development of beliefs and classroom practice.

Situated Cognition

The situative perspective focuses on knowledge development of individuals through systems of interactions with others as well as the surrounding environment. “The
main distinguishing characteristic of the situative perspective is its theoretical focus on interactive systems that are larger than the behavior and cognitive processes of an individual agent” (Greeno, 1998, p. 6). These interactions in the environment and the physical and social context play an integral role in how and what learning takes place (Putnam & Borko, 2000, p. 5). Consequently, the different settings teachers are exposed to impact the type and depth of learning and knowledge development.

Several studies have focused on teacher knowledge development through focusing on children’s mathematical thinking from the situative perspective. One common approach to setting up these studies is to create professional learning communities where teachers are provided with opportunities to meet with other teachers in their school to discuss and reflect on particular aspects of their practice. In the three studies discussed below, all of the researchers were a catalyst in creating an environment for prospective or in-service teachers to collaborate, discuss, and reflect on children’s mathematical thinking.

In research conducted by Kazemi and Franke (2004) and Lin (2006), they developed and examined the impact of professional learning communities. Kazemi and Franke (2004) facilitated professional learning community meetings and classroom observations with ten elementary teachers in the same school. The meetings with the participating teachers were centered on discussions about the work of students in their classrooms on specific problems. The classroom observations served as a way for the researchers to provide ongoing support to the participating teachers as well as collect data about classroom practice. Lin (2006) worked with a group of four elementary teachers to
“create the opportunity for teachers to sit together to design creative assessment tasks” (p. 554). They met weekly to generate assessment tasks and discuss student responses to the tasks. Lin (2006) used data from the weekly meetings, classroom observations, one-on-one interviews, and teacher reflections to examine the development of the teachers’ understanding of students’ mathematical learning.

In both situations, the teachers demonstrated development of attention to and use of student thinking. Specifically, Kazemi and Franke (2004) found an increase in teachers’ talk about attending to and eliciting student thinking as well as recognition of the mathematical competencies of their students (p. 223). Teachers began to demonstrate more awareness of the importance of listening and communicating with students, as written student work did not always provide enough information (Kazemi & Franke, 2004). Kazemi and Franke (2004) also described what they characterized as shifts in the teachers’ participation in the professional learning community developed as a part of their research project. After attending the first couple out of seven sessions focused on student thinking observed in their classrooms, discussions in the group began to focus more on details of children’s thinking as opposed to general observations of misconceptions or evaluation. The teachers’ discussions also began to focus on the development of instructional trajectories based on the observed mathematical thinking of students (Kazemi & Franke, 2004, p. 211-213).

Lin (2006) found increases in teachers’ awareness of students’ mathematical thinking and misconceptions or difficulties as well as awareness of the importance of helping students to develop critical thinking. Teachers in Lin’s (2006) study were
provided with an environment where they could come together to discuss classroom issues and share assessment strategies. From those meetings, the teachers developed and used assessments in their classrooms that helped to enhance their understanding of their students’ mathematical thinking and learning as well as encouraged them to develop a more reflective view of their teaching. From the situative perspective an important point to consider is that “the use of assessment does not warrant the improvement of teachers’ understanding about student learning; it depends on the presentation of assessment tasks and the way in which students are to respond” (Heuvel-Panhuizen & Gravemeijer, 1993, as cited in Lin, 2006, p. 548). For example, if students are unfamiliar with explicitly sharing their thinking and resist participation in an assessment, the opportunity for the teacher to gain understanding of student thinking would be limited.

In working with 159 prospective elementary teachers enrolled in the first of four mathematics content courses, Philipp et al. (2007) exposed different groups of teachers to four different environments with a range of factors to determine the impact of those experiences on the teachers’ mathematical knowledge and beliefs about teaching and learning. Two groups of prospective teachers viewed research-based models of children’s thinking through videotaped interviews and classroom situations. One of these groups, consisting of 50 participants, also conducted one-on-one interviews with students while the other, consisting of 27 participants, had more time to discuss their video observations. The other two groups of prospective teachers were given field experiences in local classrooms. While one group, consisting of 23 participants, was in classrooms selected based on mentor teachers’ alignment with reform-based agendas, the other, consisting of
25 participants, was completely based on convenience in location. A fifth group of prospective teachers, consisting of 34 participants, served as the control and only participated in the mathematics content course.

Due to the large number of participants, Philipp et al. (2007) collected data using pre-/posttest instruments to measure the beliefs and content knowledge of the prospective teachers. The instruments consisted of a Web-based survey prompting responses to video and written teaching scenarios (p. 451) to measure beliefs and a paper-and-pencil assessment to examine prospective elementary teachers’ mathematical understanding. Philipp et al. (2007) found that the prospective teachers who were provided opportunities to focus more on children’s thinking demonstrated deeper and more sophisticated beliefs about the teaching and learning of mathematics and mathematics content in general. Unfortunately, prospective teachers in conveniently located field experiences demonstrated little change despite the emphasis on reform-oriented views in their university coursework. As a result, Philipp et al. (2007) hypothesized the possible harm or negation of learning from field experiences that are not well planned or too early in an education program. They also hypothesized the growth of the prospective teachers in understanding children’s mathematical thinking was impacted through providing them with opportunities to reflect within a professional learning community.

Building a Conceptual Framework and Research Objective

Putnam and Borko (2000) mentioned an “agenda-setting dilemma” in referring to difficulties teacher educators encounter in trying to get teachers’ to practice in specific ways while still providing teachers with opportunities to build from their existing
understandings and become empowered, individual learners (p. 9). Dewey’s discussion of an apprenticeship or laboratory approach to teacher preparation and professional development (Shulman, 1998) could provide an outlet for the agenda-setting dilemma through emphasis on the experiential component of learning to teach, which Bandura (2006) posited as the most influential type of learning experience. The apprenticeship approach consists of a focus on preparation for practical aspects of a job while the laboratory approach is characterized as being more theoretical and forward-looking, taking the local, particular, and situated aspects into account. Cobb, Wood, and Yackel (1990 as cited in Fennema et al., 1996) spoke of teachers’ classrooms as “learning environments” where there was reciprocal learning taking place between teachers and students. These perspectives of the importance of first-hand experience speak to the second part of the agenda-setting dilemma. How then do teacher educators get teachers to focus on children’s mathematical thinking? What impact does this emphasis have on their beliefs? What experiences were used in the literature reviewed in order to elicit the results and findings discussed?

There are many approaches to professional development focused on children’s thinking that have had successful results. CGI research focused on providing teachers with research-based models of children’s thinking and helping teachers to employ those models in their classroom. Fennema et al. (1996) hypothesized that the two interacted helping teachers to build research-based models into their intuitive knowledge to inform instructional actions. This interaction of models of children’s thinking resulted in changing classrooms into laboratories of learning for teachers and students (Fennema et
Many professional development programs with positive results have also included versions of research-based models in the form of published case studies, videotapes, and written student work (Even & Tirosh, 2002). Others have included more of an emphasis on helping teachers develop reflective and interpretive approaches to their practice and the thinking of students in their classrooms through developing case studies of their own (Gearhart & Saxe, 2004; Hallagan, 2004; Lin, 2006). Many have used the interaction between the research-based models and reflective practice (Fennema et al., 1996; Schifter, 2002). In general, this combination of research-based models of children’s thinking and enactive mastery experiences seemed to play a major role in helping teachers learn about and use children’s thinking in the classroom as well as impact beliefs about mathematics teaching and learning. The findings from the literature discussed above also confirm the complexity of helping teachers to develop instructional practice built from children’s mathematical thinking. This demonstrates the importance of further exploration into what and how beliefs and conceptions of teaching and learning impact development of learner-responsive teaching practice.

While it is important to acknowledge the complexity of factors impacting teachers’ practice, a narrowing of focus to specific factors may be beneficial in order to better understand how everything fits together. Using the literature reviewed, I narrowed my focus to three main factors as critical in the development of learner-responsive approaches to pedagogy. In the conceptual framework portrayed in Figure 2, the critical factors I chose are beliefs consistent with learner-responsive perspectives, experiences
with learner-responsive methods, and explicit support of the development of knowledge
of content and students (KCS).

Figure 2: Factors of Development of Learner-Responsive Pedagogy

In the development of the model, it is posited that consistency among the three factors is
critical in supporting the development of learner-responsive pedagogy. It is not assumed
that one factor must precede or follow another, only that they are all critical. A wide
range of teacher beliefs about the epistemology and nature of mathematics has been
discussed demonstrating the importance of consistency of beliefs coinciding with learner-
responsive perspectives. The influence of these beliefs on teacher development has also
been demonstrated suggesting the importance of impacting those beliefs to be consistent
with learner-responsive perspectives in order to influence the development of learner-
responsive pedagogy. Methods for impacting teacher beliefs through different types of
experiences (e.g. enactive mastery, vicarious, verbal, and physiological) and a focus on
building KCS were demonstrated to have positive influence on the development of
learner-responsive beliefs and, in some cases, classroom practice as well (e.g. CGI). The importance of providing teachers with ongoing support throughout their experiences was also demonstrated as teacher beliefs have been shown to move away from learner-responsive perspectives after student teaching experiences. There also seemed to be a lack of in-depth examination of the process of development of beliefs and classroom practice throughout field experiences in a teacher preparation program, leaving the change in beliefs from these experiences open to investigation. The objective and design of my research was influenced by all these findings.

**Research questions**

Better understanding how prospective teachers implicitly interact with, learn from, and develop beliefs and classroom practice based on explicit focus on increasing KCS in their teacher preparation programs could provide insight into the design of future programs for teacher preparation focusing on helping teachers to develop learner-responsive beliefs and classroom practice. Therefore, the following research questions guided my inquiry:

1. What is the process of learning and development of practice for three prospective secondary mathematics teachers in a graduate teacher education program?
2. How does a teacher educator’s explicit support to focus on the development of knowledge of content and students (KCS) influence the prospective teachers’ learning and development of practice?
3. What specific components of explicit support or implicit influences seem to play a larger role?

Figure 3: Statement of Research Questions
Based on research suggesting the negative influence of field experiences, the importance of consistent support, and the lack of knowledge about the process of PSMT development, I chose a methodological approach where the researcher plays an active role in promoting the development of prospective teachers through experiences encouraging the expansion of their knowledge and use of children’s mathematical thinking. This methodological approach has been referred to as a Teacher Development Experiment (TDE, Simon, 2000) and is further elaborated in Chapter 3. My knowledge, informed by literature discussed above, of the wide-range of teacher beliefs and frameworks for conceptualizing the learning of teachers is used to guide analysis and discussion of findings.

*Study Significance*

While desired approaches to mathematics instruction include an emphasis on problem solving and student communication, these practices are not prevalent in mathematics classrooms and current policies discourage this practice through restrictions on time for instruction, an overload of content to cover, and large class sizes. These contextual issues present direct challenges to the beliefs teacher educators desire to foster in prospective teachers. It is important to learn more about how teachers work within these contexts as well as how best to prepare them to work within these contexts. Overall, it is important to go beyond understanding and conceptualizing the beliefs of teachers and put more emphasis on the relationship between beliefs and practice.

According to Pajares (1992), little work had been conducted in the area of research related to beliefs and teaching by 1992. It is evident that teachers’ beliefs have
been greatly explored over the past 20 years and gains have been made in finding methods that will help facilitate a change in beliefs for prospective teachers. However, the challenge in impacting prospective teachers’ beliefs related to the teaching and learning of mathematics was confirmed. Stand alone mathematics methods courses without some aspect of learner-responsive teaching experience or continuation of support for newly acquired beliefs have not demonstrated an impact on the classroom practice of prospective teachers. The limitations addressed above demonstrate the importance of a close exploration of the development of prospective teachers’ beliefs and classroom practice in a teacher preparation program.

Teacher beliefs have been shown to have an impact on classroom practice and beliefs play a role in prospective teachers’ experiences and development within a teacher preparation program. Despite literature citing the importance of teacher beliefs, there is little known about how prospective teachers’ beliefs interact with their development and experiences in a teacher preparation program and research focused on impacting prospective teacher beliefs has demonstrated mixed results. As a result, this research could inform future studies on fruitful methods of impacting prospective teacher beliefs and practice development in a teacher preparation program. It could also inform possibilities for future designs of teacher preparation programs and professional development in order to more explicitly address the beliefs prospective teachers hold.

Finally, the in-depth, qualitative nature of this research provides a detailed portrayal of prospective teacher development in a teacher preparation program. Mewborn and Stinson (2007) call for the need to further explore teacher education as “structuring
learning opportunities for future teachers, using the same principles we use to design educational opportunities for children” (p.1483). The case study detail of prospective teachers’ development resulting from this research may support an altered approach to teacher preparation focused on providing differentiated experiences for prospective teachers based on differing beliefs and ways of thinking.
Chapter 3: Methodology

We do not really see through our eyes or hear through our ears, but through our beliefs. (Delpit, 1995, p. 46)

Methodological approaches to studying teacher beliefs have been a mix of quantitative and qualitative approaches with quantitative approaches seeming to be more prevalent. While both methods of research have merits, Pajares (1992) presented issues to consider with research methods for exploring teacher beliefs:

Understanding beliefs requires making inferences about individuals’ underlying states, inferences fraught with difficulty because individuals are often unable or unwilling, for many reasons, to accurately represent their beliefs. For this reason, beliefs cannot be directly observed or measured but must be inferred from what people say, intend, and do (p.314).

In consideration of the complex, situated nature of teaching, learning, and beliefs, Lincoln and Guba’s (1985) naturalistic paradigm provides a lens through which research questions may be addressed. The investigation of implicit and explicit influences on prospective teachers’ development of beliefs and classroom practice called for an emergent, grounded theory design, which allowed for flexibility based on findings as the research progressed.

In this chapter, the purpose and rationale behind a qualitative, Teacher Development Experiment (TDE) methodological approach is presented followed by a discussion of the role of the researcher as a participant observer, a description of the
teacher preparation program within which the inquiry is situated, a description of the participants, as well as a delineation of sources of data and data collection. Due to the extensive nature of data collection and analysis over an extended period of time, a timeline listing the general progression of the research is located in Appendix A. The method of data analysis is then described with details of the different stages of analysis. The chapter concludes by addressing issues of credibility and trustworthiness and the limitations of the research design.

Methodological Rationale

Without acknowledgment of relationships to and influences of history and culture on scientific inquiry, research may present incomplete and biased representations of reality (Harding, 1993). Considering the natural complexity and unpredictability of human endeavors such as teaching and learning to teach, quantitative approaches to research may have difficulty accounting for those human aspects of reality (Lather & Moss, 2005). Qualitative research is built around the belief in the situated aspect of research in the human sciences.

With the perspective that human beings are active participants with their surroundings, the process of this engagement is the fundamental base of grounded theory approaches to qualitative research. “Grounded theory methods consist of systematic, yet flexible guidelines for collecting and analyzing qualitative data to construct theories ‘grounded’ in the data themselves” (Charmaz, 2009, p. 2). A grounded theory approach to my research was taken with the goal of using patterns and connections that emerged from data analysis to better understand the development process of prospective teachers.
This approach was informed by the emergent perspective (Cobb, 1995), which is based on the assumption that learning is a reflexive process of psychological as well as social influences. Using an emergent perspective, the focus is not on whether learning is psychological or social but considers the coordination of the two (Simon, 2000). This is taken into account in the conceptual framework developed and presented in Chapter 2, as it is posited that teachers’ psychological beliefs and development of KCS must coordinate with the social aspect of provided support and experiences in order to impact the development of learner-responsive pedagogy.

A teacher development experiment.

The specific qualitative methodological approach that guided this inquiry was the Teacher Development Experiment (TDE) described by Simon (2000) as a methodology that could provide invaluable insight into prospective teacher development of reform-oriented classroom practice. Simon (2000) suggested:

A knowledge base is needed that will guide the creation of novel and effective teacher education programs. It must include identification of key aspects of teacher knowledge and skills (the goal of teacher education), useful frameworks to describe how such knowledge and skills develop, and useful models of interventions that can promote such development (p.335-336).

While his first suggestion of identifying key aspects of teacher knowledge and skills has recently been studied extensively in many areas of research in mathematics education, the other two suggestions have not been addressed as extensively in recent research, especially in relation to the development of prospective secondary mathematics teachers.

The TDE methodology is informed by the theoretical approach of the emergent perspective and is adapted from a combination of the constructivist teaching experiment
(Steffe & Thompson, 2000) and the whole-class teaching experiment (Cobb, 2000). As a result of these theoretical and methodological influences, the key principle behind the TDE focuses on the study of teacher development through fostering teacher development “as part of a continuous cycle of analysis and intervention” (Simon, 2000, p. 336) through the incorporation of a case study approach. In the TDE the role of researcher and teacher are merged in diverse settings of mathematics education coursework, the classrooms of teachers, as well as other professional collaborative settings in order to coordinate the psychological and social mathematical as well as pedagogical development of the teachers.

Research Design

My research design incorporated critical aspects of implementation of the TDE methodology through particular approaches of data collection, promotion of prospective teacher development, and analysis that are described in the following section. Due to the inherent involvement of the researcher in the design of a TDE, I will first provide details about my beliefs and experiences and how they influenced my explicit support of the development of beliefs and classroom practice for the PSMTs. This is followed by detailed descriptions of the teacher preparation program underlying the context of my research, the participants involved, and the methods and types of data collection. A description of the analysis of data for my research will conclude this section on the design of my research.
A critical component of TDE methodology is the dual-role of researcher and teacher educator. In order to deeply study PSMT development while also promoting PSMT development, I played an integral role in the experiences of a small group of PSMTs throughout a graduate teacher preparation program. I was the instructor for the summer mathematics methods course as well as the university supervisor for a small group of PSMTs through all three field experiences from fall to spring. In this respect, I acted as a participant observer (Glesne, 2006) and it is important to take my background and influence into account as a key aspect of the data collection, analysis, and presentation of results. “Just as the methods we choose influence what we see, what we bring to the study also influences what we can see” (Charmaz, 2009, p. 15). As the researcher, my background and perspectives in relation to education are provided to account for my influence in this research. My explicit approaches to the methods course taught and university supervisor role are also provided.

Background

I grew up in a family where educational achievement was a consistent emphasis. While my parents did not graduate or receive a college degree, I was expected to attend and graduate from college. I was the stereotypical “A-student” who spent the majority of time outside of school working on homework and studying. I considered my strengths to be the ability to work hard and commit everything I encountered in school to memory. I was often asked to work with struggling students in younger grade levels and from these experiences, I realized the joy of working with others and helping them to understand and
achieve. I chose to become a mathematics teacher, as I enjoyed the logic and intuitiveness of the subject and I had noticed it was an area where many struggled. After graduating with a bachelor’s in mathematics and receiving a Master of Education and 7-12 license to teach mathematics from the same program in which the participants were enrolled, I had the opportunity to teach entry-level mathematics courses at a small university in the Midwest.

In my graduate teacher preparation program, I had applied myself as completely as possible, similar to all my other educational endeavors. Despite my enthusiasm and interest in the constructivist theories and learner-responsive approaches espoused by the program, I had difficulty planning and implementing lessons supporting this perspective. Following graduation, planning lessons in my new job at the university level became overwhelming. I found myself regularly demonstrating how to solve mathematical problems and assigning large amounts of problems for students to complete and practice. I did my best to incorporate problems to challenge my students and opportunities for them to communicate about mathematics and work together to solve problems, however, I encountered resistance from the students who were not familiar with my expectations and little support from my colleagues with no background in educational theory.

From these experiences and my observations of the overwhelming number of students, especially future elementary teachers, terrified and underprepared in mathematics, I decided to pursue further graduate studies in mathematics education. In the doctoral program I gained deeper understandings of theories of learning and teaching. I was fortunate to have the opportunity to work as a university supervisor for two years,
observing many lessons in 7-12 mathematics and science classrooms and the struggles and celebrations encountered by prospective secondary teachers. I was also fortunate to have the opportunity to work with a large research project focused on preparing mathematics coaches to provide embedded classroom development to elementary and middle school teachers. As a graduate research associate with this project, I was exposed to research-based approaches to professional development focused on helping teachers to develop learner-responsive mathematics teaching. All of these experiences inform my perspectives in relation to theories of learning and teaching and approaches to teaching, supervising, and research.

A Glimpse into my Teacher Educator Approach

My plans and intentions in the design and implementation of the summer methods course as well as supervision were informed largely by my knowledge of the literature on the importance of impacting teacher beliefs through methods shown to be effective and discussed in Chapter 2. Guiding my overall approach was Bandura’s (1997) theory of sources of efficacy beliefs where he suggested varying levels of influence on the development impact of beliefs based on the type of experience one had. Enactive mastery experience was theorized to have the most impact followed by vicarious experience, verbal persuasion, and physiological and affective states. Bandura’s theory was focused specifically on sources of efficacy beliefs not other types of beliefs, however, the theory provided a guide for possible types of experiences that could have different levels of impact on the PSMTs’ beliefs. Below I provide details and rationale for the assignments and teaching methods used in the summer methods course. My overall approach to
supervision is also provided with the specific details of my supervision methods portrayed throughout the discussion of research findings in chapter 4.

The Summer Methods Course

As the instructor for the first mathematics methods course taken by the prospective teachers, the planning of experiences and course assignments were based on my objective of 1) getting PSMTs to think about their past experiences as mathematics students, beliefs about teaching and learning in mathematics, and current theories and approaches to teaching and learning in mathematics that have been shown to be effective; and 2) experience learner-responsive pedagogy from the perspective of a student and practice using learner-responsive pedagogical methods. The assignments and activities and my rationale are summarized in Table 4. I specifically selected and assigned each course reading (Appendix B) as a way to expose the PSMTs through verbal persuasion to the perspective of learner-responsive pedagogy by providing a little background, justification through supporting research, and models of learner-responsive pedagogy in specific content areas addressed in the course. To help PSMTs approach the reading with a purpose and reflect on their learning they were asked to write a 300 to 500-word response using four writing prompts (Figure 4). The readings were clarified and discussed in the subsequent course meeting.
<table>
<thead>
<tr>
<th>Course Activity or Assignment</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course readings and Reflective Writing</td>
<td>I chose readings that focused on providing rationale for and models of learner-responsive pedagogy. The readings were specifically written for practitioners. My objective was to avoid jargon and theory heavy writing that may be difficult for novices in mathematics education to connect directly to classroom practice. (A list of course readings can be found in Appendix B)</td>
</tr>
<tr>
<td>Video Cases</td>
<td>Two short video clips from Boaler &amp; Humphreys (2005) were viewed during class and related readings were assigned where the teacher in the video explained her thinking in relation to the lesson. My objective with the videos was to provide another model of learner-responsive pedagogical methods and the teacher thinking coinciding with the use of those methods.</td>
</tr>
<tr>
<td>Rich Problems</td>
<td>Problems used included: the Locker Problem, the Border Problem, The Sandwich Problem, the Mango Problem, Coffee with Milk, Emergency 911, and Happy Hopper. PSMTs were grouped collaboratively and tasked with producing solutions and explanations to the problems on large poster paper. My objective was to give them an experience as students in a learner-responsive environment and model learner-responsive classroom practice. After discussing their solutions we discussed the pedagogical methods I used and why they may be effective.</td>
</tr>
<tr>
<td>Micro-Teaching</td>
<td>In order to encourage PSMTs to think deeply about what it meant to teach a concept in a meaningful, learner-responsive way, they were asked to develop a 5-10 minute lesson on one of six topics. My goal was to not only give them experience with writing a lesson plan but to also challenge them to implement their plan in front of their peers. (Rubric in Appendix C)</td>
</tr>
<tr>
<td>Tutoring Lessons</td>
<td>My goal was to make the tutoring sessions more structured so the PSMTs were approaching them from a professional standpoint. Their lessons were required to include objectives, specific problems used, and discuss methods of assessment. PSMTs tend to focus more on themselves than their students when they first start teaching so the focus on assessment was to push them to broaden their perspective to include the impact of the lesson on the student’s learning. (Rubric in Appendix D)</td>
</tr>
<tr>
<td>Case Studies</td>
<td>My goal was to give PSMTs an opportunity to think and reflect on the thinking of the student they were working with. In addition to writing about the mathematical development of the student they observed, they audio-taped and transcribed 5-10 minutes of the session and reflected on their use of questioning strategies. (Rubric in Appendix E)</td>
</tr>
</tbody>
</table>

Table 4: Methods Course Assignments and Rationale

1. an idea with which you agree or disagree and why,
2. an idea that surprised you and why,
3. a question you still have, and
4. a teaching strategy that you might try to incorporate into your teaching practice

Figure 4: Reflective Writing Prompts for Summer Methods Course
Based on approaches proposed and described in the literature and the theory of enactive mastery and vicarious experiences being most impactful, I chose to incorporate experiences to allow PSMTs to participate in and reflect on learner-responsive pedagogical methods. I began each class with an engaging problem or hook to jump-start their mathematical thinking and incorporated rich mathematical problems for the PSMTs to engage in during class. While they were working on developing solutions to the problems I would model learner-responsive pedagogical methods such as responding to their questions with questions or directing them to discuss their thinking with their peers through a “think-pair-share” approach. After discussing the mathematical thinking on the problems, I changed the focus to the pedagogical methods used. We then discussed the merits of each method and how they could be incorporated into an effective classroom practice. Videos and written cases of approaches to various classroom practices were included for reflection. There were also opportunities for PSMTs to put what they were experiencing into practice through a micro-teaching experience (Appendix C). Lessons (Appendix D), for weekly K-12 tutoring sessions, along with the creation of two case studies (Appendix E) focusing on the thinking and learning of their assigned students, gave the PSMTs valuable enactive mastery experience not usually available in a summer term. Additionally, in one of the tutoring sessions, the PSMTs were asked to audiotape, transcribe, and reflect on their questioning strategies and the responses of their students in relation to the theories and teaching methods discussed in class and readings (Appendix E).
University supervisor

As a university supervisor, my role was to provide support as well as challenge the PSMTs to think about ways to put what they were learning from university coursework into practice. I helped to facilitate their achievement of program requirements by working with the mentor teacher to help him/her understand the program perspectives and create an environment where the PSMTs were given opportunities to put their knowledge into practice. While I am frequently tempted and expected by PSMTs to provide quick-fix solutions and approaches to classroom management and teaching content, I believe in a constructivist perspective where PSMTs learn and retain the most from their own reflection on their experiences. As a result, I approached classroom observations and the ensuing discussion as well as feedback on lesson plans and reflections as opportunities to prompt the PSMTs with questions and scenarios to reflect upon.

Based on my knowledge of research related to particular tasks and interventions that may provide powerful experiences for PSMTs as well as my past experiences with teaching, leading professional development, and supervision, I focused on specific types of suggestions for implementation in classroom practice. Most tasks suggested emphasized providing increased opportunities for the students in the PSMTs’ classrooms to share their thinking in order for PSMTs to have the ability to acknowledge and learn more about students’ mathematical cognition and capabilities. Examples of pedagogical tasks include questioning strategies, problem posing, and formative assessment opportunities. One particular task was called the lesson in teacher silence (Harrison &
Harrison, 2010) and was designed to prevent PSMTs from a traditional approach to teaching typically characterized by a teacher explaining his/her thinking for the majority of the lesson. I supported the PSMTs in the development of a lesson focused on an engaging, open-ended problem(s) for students to work on collaboratively followed by a student-led discussion of their thinking about the problem. In this lesson, PSMTs were asked to hold back their desire to interject their thoughts into the students’ solution strategies and record evidence of student thinking on a clipboard as they circulated the classroom. Due to uncontrollable constraints for PSMTs in contexts where there was less freedom to fully implement the lesson in teacher silence, I suggested ways to work in critical methods from the lesson in teacher silence without overstepping the comfort of the mentor teacher.

My original intention was to personally provide consistent support to PSMTs throughout fall, winter, and spring field placement experiences. Unfortunately, I learned the hard way that life cannot be taken for granted and was unable to continue providing consistent support throughout the spring field placement. My fellow supervisors stepped in to support the PSMTs when I was unable to. This inevitably left the PSMTs with less consistent explicit guidance toward the development of learner-responsive pedagogy and provided me with some insight into how they would possibly continue to develop without support in their first year of teaching.

The Teacher Preparation Program

The teacher preparation program within which the PSMTs were enrolled was a five-quarter Master of Education program at a large Midwestern university. The program
consisted of a cohort of approximately 60 prospective secondary mathematics and science teachers, of which approximately half specialized in mathematics and half specialized in areas of science. Prospective teachers entered the program with the equivalent of a bachelor’s degree in their specialty field. The program was premised on theories of constructivism and learner-responsive, inquiry-based teaching and learning. Coursework began in the summer and continued through winter quarter with emphases in teaching methods, learning theories, technology, assessment, and education for a diverse student population. Throughout the fall, winter, and spring quarters, the prospective teachers were in progressively more teaching intensive field experiences while taking courses in the evening. During each 10-week quarter the prospective teachers were in the field for 12 hours per week in the fall, 15 hours per week in the winter, and full-time student teaching in the spring. Field experiences consisted of a combination of middle (grades 7-8) or high (grades 9-12) school in an urban or suburban setting. The final summer quarter was devoted to finishing an individual masters project based on classroom data collected during spring quarter student teaching and was not included as part of my research design.

Participants

Participants for this study included PSMTs enrolled in the Master of Education program at a large Midwestern university across five quarters starting and ending in summer terms. The size of the cohort of graduate students seeking licensure in 7-12 mathematics was just under 25. All graduate students seeking licensure in 7-12 mathematics were asked to participate in initial data collection during the summer
methods course. In order to reasonably focus on PSMTs’ development and learning over the course of the teacher preparation program, a sample of eight prospective teachers were purposefully selected for maximal variation (Patton, 1990) of initial beliefs in relation to the teaching and learning of mathematics. The sample selection was based on responses to a mathematics beliefs instrument, reflective written responses to course readings, and a writing prompt describing the ideal mathematics classroom. The instrument and writing prompt were administered on the first and last day of PSMTs’ enrollment in the first summer methods course. Responses to the instruments were scored and organized into high, medium, and low overall scores. Responses on the writing prompt were analyzed for articulateness as well as beliefs about the teaching and learning of mathematics.

PSMTs participating in the study were placed in different 7-12 grade mathematics classrooms throughout the surrounding geographical area. These field placements lasted for an entire quarter (10 weeks) and all PSMTs in the program received placements in different schools each quarter. PSMTs in this teacher preparation program had as many as three different mentor teachers throughout the year. Some PSMTs returned to a previous field placement. Data related to mentor teachers resulted from statements from PSMTs concerning their experiences and observations of their mentor teacher’s classroom practice. No other data was collected in relation to the mentor teachers in order to keep the research manageable for a single researcher.
Data Sources and Collection

Multiple sources of data were collected to support data analysis and findings and strengthen the trustworthiness of the research through triangulation (Lincoln & Guba, 1985). Data sources and the rationale for their use are summarized in Table 5.

Mathematics Beliefs Scale Instrument.

The Mathematics Beliefs Scale (MBS) instrument (Appendix F) consists of Likert-type items from an instrument developed by Fennema, Carpenter, and Loef (1990). Possible responses to statements on the MBS range from Strongly Agree = 6 to Strongly Disagree = 1. The scale originally consisted of 48 items designed to assess four subscales on: 1) the beliefs of teachers about how children learn mathematics, 2) about how mathematics should be taught, 3) the relationship between learning and concepts and procedures, and 4) what should provide the basis for sequencing topics in mathematics instruction (Capraro, 2000, p. 71). “The internal consistency of teachers’ scores was determined on each subscale using Cronbach’s alpha using a sample of 39 teachers. The internal consistency of teacher scores on the total belief scale was .93” (Peterson, Fennema, Carpenter, & Loef, 1989, p. 8). Capraro (2001) also tested the reliability of the scale with the objective of reducing the total number of items for the instrument and checking the emergent factors.
<table>
<thead>
<tr>
<th>Data Source (date of collection)</th>
<th>Rationale</th>
<th>Location in Thesis</th>
</tr>
</thead>
<tbody>
<tr>
<td>MBS (June 2010, July 2010, &amp; May 2011) 29 Likert items</td>
<td>To gain a preliminary quantitative idea of PSMT beliefs before and after the summer methods course for case study participant selection and at the conclusion of the three field experiences to inform the final interview protocol.</td>
<td>Appendix F</td>
</tr>
<tr>
<td>Writing Prompt (June 2010 &amp; July 2010) 1 page</td>
<td>To gain a preliminary qualitative idea of PSMT beliefs before and after the summer methods course for case study participant selection.</td>
<td>Description of data sources Ch. 3</td>
</tr>
<tr>
<td>Reflective responses to readings (June 2010-July 2010) ~6 typed pages per participant</td>
<td>To gain a preliminary qualitative idea of PSMT beliefs during the summer methods course for case study participant selection.</td>
<td>Description of methods course design Ch. 3</td>
</tr>
<tr>
<td>Audio-taped small group transcripts (September 2010-March 2011) ~302 total pages of transcript, ~20 hours of recording</td>
<td>To gain qualitative insight into PSMTs beliefs and development in a socially relaxed setting. A significant amount of time was spent discussing perspectives on teaching methods, issues in field placements, and personal goals for classroom practice.</td>
<td>Appendix G (sample agenda from 10-1-2010)</td>
</tr>
<tr>
<td>Observation Field Notes (September 2010-May 2011) ~20 total handwritten pages per participant</td>
<td>To gain qualitative insight into PSMTs development of classroom practice. Evidence in the literature suggests PSMTs can hold conflicting beliefs and that deep beliefs may be visible through actions.</td>
<td>Appendix H (protocol)</td>
</tr>
<tr>
<td>Pre-/post-conference transcripts (September 2010-May 2011) ~73 Total pages per participant</td>
<td>To gain qualitative insight into PSMTs beliefs and development. Discussions focused on PSMTs reasoning and thinking behind their actions in the classroom. Support and advice were also frequently provided to help PSMTs focus on learner-responsive pedagogy development.</td>
<td>Appendix H (protocol)</td>
</tr>
<tr>
<td>Formal reflective writings (September 2010-June 2011) ~73 Total pages per participant</td>
<td>To gain qualitative insight into PSMTs beliefs and development. Formal reflections on assigned topics such as specific teaching experiences and viewing of videos of their own teaching provided opportunities for PSMTs to express and demonstrate their beliefs about teaching and learning in mathematics.</td>
<td>Appendix H (protocol)</td>
</tr>
<tr>
<td>Informal reflective writings (September 2010-June 2011) ~12 Total pages per participant</td>
<td>To gain insight into PSMTs beliefs and development in a setting where they would not feel it necessary to mask their feelings for program evaluation purposes. Provided a way to check for consistency.</td>
<td>Appendix H (protocol)</td>
</tr>
</tbody>
</table>

Table 5: Data Sources and Rationale
Table 5 continued

<table>
<thead>
<tr>
<th>Data Source (date of collection) length</th>
<th>Rationale</th>
<th>Location in Thesis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supervisor feedback (September 2010- May 2011) varied on each participant’s lessons and formal reflective writing</td>
<td>To gain insight into the methods of support provided to PSMTs on lessons and formal reflective writing.</td>
<td>Description of data sources Ch. 3</td>
</tr>
<tr>
<td>Researcher reflective writing (July 2010-October 2011)</td>
<td>To document the role of the researcher as participant observer.</td>
<td></td>
</tr>
<tr>
<td>Final Interview Transcripts (June 2011) ~13 Total pages for each participant</td>
<td>To gain insight into the beliefs and development of PSMTs at the conclusion of their program field experiences.</td>
<td>Appendix I (protocol)</td>
</tr>
</tbody>
</table>

She revised the scale to include 18 items and found 3 factors: Factor 1: the beliefs of teachers about how children learn mathematics, Factor 2: the role of the teacher in sequencing of teaching both computational and application skills, and Factor 3: the relationships between teaching computational skills and problem solving skills. The MBS instrument used for this research was developed using the revised 18 items as well as an additional 11 items from the original MBS. The intention of adding items was to provide more support for consistency among the three factors with a small sample of participants. However, there was no intention of using responses to the instrument to make broad generalizations about impacting teacher beliefs. The responses were mainly used to provide me with an idea of possible beliefs the participants may hold and inform questions posed during the final interview. As a result, no data was collected on the internal consistency of the revised scale. The MBS was also originally designed for
elementary teachers. Therefore, minor adjustments were made to statements to increase applicability to 7-12 teachers and classrooms (Figure 5).

| Original Item: Most young children have to be shown how to solve simple word problems. |
| Revised Item: Most children have to be shown how to solve simple word problems. |

Figure 5: Sample adjustment to MBS item

The MBS instrument was administered to all participants on their first day in the teacher preparation program, at the end of the first summer methods course, and at the conclusion of the teacher preparation program a year later.

Field Placement Assignments.

As part of the required coursework for field placement experiences, the PSMTs developed and completed a myriad of assignments (Table 6). The assignments consisted of the development of lesson plans for teaching experiences, reflections based on observations and teaching experiences, reflective critiques from viewing a video of their teaching as well as a peer’s, and a summary of their assessment of their development based on pre-determined program teaching competencies. As the university supervisor, I provided feedback on a subset of these assignments to encourage the PSMTs development and reflection. My supervisor feedback was a typical component of the program. My objective in providing feedback was always to explicitly encourage the development of the PSMTs with an emphasis on learner-responsive beliefs and methods.
Assignment | Description
--- | ---
Lesson Plans | A detailed lesson plan was required of each PSMT for every lesson teaching experience required in each placement. The minimum number of required teaching experiences increased for each placement experience. Fall quarter – eight required lessons Winter quarter – thirty required lessons Spring quarter – varied dependent on the number of different class preparations and class periods of teaching in spring placement over a 6 week time period
Formal Reflections | Two formal reflections of a minimum of two, double-spaced, typed pages were required during each of three placement experience. Reflection topics were generally focused on one observation experience and one teaching experience per quarter.
Video Critiques | PSMTs video-taped lessons they taught each quarter. They were required to tape two lessons during fall and winter and one in spring. To complete the formal reflective critique for themselves they were provided with a template requiring reflection on what they did well and what they could improve. They were also asked to comment on a specific time where student learning was evident during the lesson. For the formal peer video critique the PSMTs were required to comment on areas where the peer did well and what they could improve in the form of a letter to that peer. These critiques were shared with the peer they were critiquing.
Personal Assessment of Development of Teaching | At the conclusion of each field placement experience, the PSMTs, their mentor, and their supervisor provided evaluations and comments on the PSMT’s development of teaching based on specific program predetermined competencies.

Table 6: Field Placement Assignments

**Informal Reflective Writing**

As part of their agreement to participate in the research, the eight case study participants were asked to create a private blog and write reflective thoughts on a regular basis from the beginning of their fall field placement until the end of their spring field placement. Occasional prompts designed to solicit thinking concerning their development, learning, and beliefs were provided, however, participants were encouraged to use their own experiences as a topic for reflection. The purpose of these private areas for the PSMTs to share their reflective thoughts was to provide them with a space where
they could share their thinking without concern about their thinking being evaluated as part of program coursework.

Observation Field Notes.

Each case study PSMT was observed teaching in his/her field placement at least three times per quarter in fall, winter, and spring. In the fall and winter field placements, I was the sole supervisor visiting to observe and meet with the PSMTs. For the spring field placement, fellow supervisors conducted observation visits providing me with alternative perspectives on the development of classroom practice of each PSMT. During each observation, field notes were taken to provide a written account of lesson implementation. A copy of the field notes was provided to the PSMT to solicit reflection on the lesson implementation and was collected by the program as part of the PSMT’s academic files. These observations and field notes were a typical component of the teacher preparation program. The method of note-taking I used to record my observations was to keep track of the progression of time throughout the lesson with notes recording dialogue from the PSMT and students as well as general actions. I provided suggestions and posed questions about the dialogue and actions I observed as the lesson progressed. These suggestions and questions were used to guide discussions with the PSMT in the post-conference meeting. Methods of recording observation notes carried out by fellow supervisors varied.

Pre-/Post-Observation Interview Audiotape Transcripts.

An approximately thirty-minute discussion was conducted before and after each classroom observation in each field placement. I was the sole supervisor conducting pre-
post-observation interviews during the fall and winter field placements. Fellow supervisors conducted these meetings during the spring field placement and their methods may have varied from mine. The questions I used to guide the discussions were focused on soliciting PSMTs’ reasons for lesson plan and implementation decisions and beliefs related to the teaching and learning of mathematics (Appendix H). I also specifically emphasized opportunities where student thinking could have been elicited or posed questions to elicit PSMT reflection on the student thinking I had observed. These discussions were a typical component of the teacher preparation program and were audiotaped and transcribed to allow for analysis of discussions.

*Small group discussion audiotape transcripts.*

Sixty- to ninety-minute weekly meetings with the group of case study PSMTs were a typical component of the teacher preparation program. During the fall and winter field placement experiences, I conducted these meetings. However, fellow supervisors conducted the spring placement small group meetings and different methods were employed. Within these discussions, I asked participants to reflect on their experiences and share their beliefs through discussion prompts. A sample agenda for a small group meeting is provided in Appendix G. I typically began each meeting with a mathematical problem or pedagogical case to guide the discussion or reflection. The rest of the meeting was devoted to opportunities for the PSMTs to share their observations and experiences in their placements and solicit and provide feedback to each other. The meetings were audiotaped and transcribed to allow for analysis of discussions.
Reflexive journal.

Within an interpretivist, naturalistic paradigm, the researcher plays an active role in the research. A critical component to qualitative research is the ability to be objectively subjective through vigorous self-reflexivity (Lather, 1986) by identifying and sharing my values and beliefs and discussing how they play a role in the collection, analysis, and presentation of data (Harding, 1993; Wideen, Mayer-Smith, & Moon, 1998). As a researcher, course instructor, and supervisor, the importance of documentation and awareness of researcher subjectivity is vital. I documented reflective thoughts and experiences on a private blog for the duration of the research study.

Data Analysis

*Data analysis is a systematic search for meaning.* (Hatch, 2002, p.148)

Qualitative analysis of all data collected was approached using inductive and interpretive grounded theory methodology (Charmaz, 2009; Glaser & Strauss, 1967; Hatch, 2002). According to Hatch (2002) an interpretive approach to data analysis is about giving meaning to data when the researcher plays an active role in the process of the research. The combination of inductive and interpretive approaches was to provide more rich and convincing findings through systematic and meaningful selection of a subset of the large data set. As a result, several phases of analysis took place, which were informed by the steps of inductive and interpretive analysis provided by Hatch (2002). The situated and creative nature of qualitative research does not lend itself to rigid methods of analysis (p.180) so modifications were made when appropriate.
Phase 1 – Emerging Themes

The first phase of data analysis focused on the inductive approach: generate understandings “by starting with specific elements and finding connections among them” (Hatch, 2002, p.161). Data were coded for each participant in the order it was collected throughout the data collection period in order to work within an emergent design framework to adjust methodological approaches based on emerging themes. Using the conceptual framework developed in Chapter 2 to guide my analysis, coded data was categorized based on connections to beliefs, experiences, or support for development and whether they supported or negatively impacted development of learner-responsive pedagogy.

Data were collected until coding categories were saturated, “when gathering fresh data no longer sparks new theoretical insights, nor reveals new properties of core theoretical categories” (Charmaz, 2009, p. 126). Once all data was collected, through constant comparative analysis methods, I continuously looked for and questioned “gaps, omissions, inconsistencies, misunderstandings, and not-yet understandings” (Addison, 1989, p. 41). Data from each participant were coded using line-by-line qualitative methods as a “progressive process of sorting and defining and defining and sorting” (Glesne, 2006, p. 135). Coding of data, as suggested by Coffey and Atkinson (1996), enabled me to rigorously review what the data were saying (p. 27) and “break up and segment the data into simpler, general categories and expand and tease out the data in order to formulate new questions and levels of interpretation” (p. 30). From this analysis I developed and defined categories of impact on development for each participant with
supporting data excerpts. From the frame of the categories I moved to the interpretive phase of analysis.

Phase II – The Big Picture

The first step in the interpretive phase of analysis is to take a step back from specific pieces of data and consider the big picture. “Researchers must start by being immersed in the data to the extent that whatever impressions are formed throughout the analytic process are considered within the context of the overall data set” (Hatch, 2002, p.181). The subset of data excerpts created for each participant in the inductive analysis were reorganized into chronological order to provide me with an idea of how the varying categories impacted the process of development throughout the participant’s experience. At this point the “goal is to read through the data with a mind to systematically making and recording interpretations of what is happening within the social contexts captured” (Hatch, 2002, p.183). Tentative interpretations were recorded in memos and compared to interpretations recorded in my reflexive journal and then the data were reread to check for supporting or non-supporting evidence for the tentative interpretations. Draft summaries were written and then revised to communicate the interpretations in a meaningful whole for each participant.

Credibility and Transferability

“We are inevitably part of the contexts which we seek to understand teachers’ knowing and learning. Rather than pretending to be objective observers, we must be careful to consider our role in influencing and shaping the phenomenon we study” (Putnam & Borko, 2000, p. 13). The contextual, emergent nature of this research
methodology called for qualitative validity criteria. For qualitative research, issues of validity must be approached using different criteria in comparison to issues of internal validity and trustworthiness in quantitative research methodology. Lincoln and Guba (1985) proposed techniques for establishing the trustworthiness of qualitative research. The following discussion will describe how the criteria of credibility and transferability were addressed in the research methodology.

Parallel to internal validity, credibility attends to the issue of assuring the use of methodology to demonstrate the length to which the researcher has gone to represent research participants in a trustworthy manner. Credibility is gained through prolonged engagement and persistent observation: spending an extended period of time in the research setting in order to get a good idea of the typical ebb and flow of interactions, relationships, and experiences in that setting. Data were collected from June 2010 to June 2011. Throughout this period of data collection, I was the instructor for the mathematics methods course in the summer of 2010 as well as the supervisor of the case study participants from September 2010 through June 2011. During this time, I had opportunities to observe the interactions and experiences of the case study participants in different settings throughout the year. This period of time encompassed the majority of the time participants were prospective teachers enrolled in the teacher preparation program. By June 2011, the participants had completed all field experience requirements of the teacher preparation program and I was able to participate and observe their experiences throughout this period of time. This allowed me to develop a detailed
description of the experiences and development of the case study participants in a variety of situations over an extended period of time.

Credibility is also built through triangulation: a collection of a wide range of data using a wide range of methods. As described above, a wide variety of data sources were collected over the course of an extended period of time and provided multiple modes of mediation through which participants’ beliefs about the teaching and learning of mathematics could be demonstrated. The wide variety of data sources provided the opportunity to look for consistency in the demonstration of participants’ beliefs.

Peer debriefing and member checks (Lather, 1986) were also used as a way to check the credibility of my interpretations and analysis. A colleague and myself independently coded a portion of the data collected for the study and compared and discussed differences in analysis in order to check for possible biases through unwarranted interpretation. I also frequently used member checks by sharing my ongoing analysis and interpretation with the participants. In frequent open discussions about my observations of their development the participants had opportunities to provide additional details to better inform my interpretations and analysis.

In consideration of the above criteria, the most crucial is the researchers’ ability to be transparent in all aspects of the research (Lincoln & Guba, 1985). The research design, theoretical analysis (Demerath, 2006), self-critical analysis, and sharing of empirical decision-making (Wideen et al., 1998) should all be clearly shared with the audience. I allow for transferability through the thick description of all aspects of the study. This component is achieved in part by the inclusion of the reflexive journal in the analysis and
presentation of the data as well as a thorough description of my method of analysis and development of the cases.

Limitations

In the process of conducting and presenting results from any inquiry, it is important to be aware of possible limitations of the study. The existence of limitations is inherent yet significant to consider in analysis and interpretation of data. The limitations of the design of the study are discussed below.

The first limitation is the sample of participants. Participants for the study were limited to the PSMTs admitted into a selective graduate teacher preparation program at a major university. Also, although PSMTs admitted into the program are required to have met the same admission criteria in relation to mathematics preparation, they will have diverse backgrounds and their age could range from 21 to late adulthood. The small, specialized, yet diverse sample limits the generalizability of the results to other teacher preparation programs or PSMTs.

The second limitation of this study was the use of a quantitative measurement to provide support for the PSMTs’ beliefs about the teaching and learning of mathematics. The concept and measurement of teacher beliefs is abstract and widely studied and debated in educational research in relation to the effect of beliefs on practice. In all survey situations, participant responses could have been affected by their mood and apprehension at the time of completing the survey or prompt. Although participants were well informed of the confidentiality and lack of influence of the results on their
evaluation in the program, nervousness about these aspects may have resulted in poor representation of their beliefs about the teaching and learning of mathematics.

The final limitation of this study was the researcher’s role as the instructor of the mathematics methods course in which the PSMTs were enrolled and as a supervisor for the PSMTs. While this dual role did provide the researcher with prolonged and regular access to participants, it presented a potential for bias in data collection and analysis.

Our respect for our research participants pervades how we collect data and shapes the content of our data. We demonstrate our respect by making concerted efforts to learn about their views and actions and to try to understand their lives from their perspectives. This approach means we must test our assumptions about the worlds we study, not unwittingly reproduce these assumptions. It means discovering what our research participants take for granted or do not state as well as what they say and do. (Charmaz, 2009, p. 19)

This dual role could have resulted in behaviors and responses from PSMTs related to pleasing their instructor or supervisor instead of their true beliefs or desired actions. The development of close, trusting relationships with participants could also result in a difficulty for the researcher to be objectively subjective in data collection and analysis.
Chapter 4: Results & Findings

The goal of this chapter is to present findings supporting the investigation of the stated research questions (Figure 6).

1. What is the process of learning and development of practice for three prospective secondary mathematics teachers in a graduate teacher education program?
2. How does a teacher educator’s explicit support to focus on the development of knowledge of content and students (KCS) influence the prospective teachers’ learning and development of practice?
3. What specific components of explicit support or implicit influences seem to play a larger role?

Figure 6: Restatement of Research Questions

Considering the variability in the process of learning and development for three different prospective secondary mathematics teachers (PSMTs), each PSMT’s entire case will be presented separately using qualitative data to support the portrayal of his/her journey into the teaching profession. Through the methodological approach of a Teacher Development Experiment (TDE), I played the role of researcher as well as teacher educator. In order to provide insight into the role I played in each PSMT’s development of beliefs and classroom practice each case is written in a dual-voice. Each voice provides a different lens of interpretation to provide sufficient detail to support the questions guiding this
research. From the perspective of an inductive, interpretivist research approach, the role of the researcher is to interpret presented data with relevant literature in mind. This researcher voice is portrayed in regular typeset throughout the presentation of results and is the dominant voice in the interpretation of findings in the discussion found in Chapter 5. *My role as a teacher educator was to interpret the words and actions of the PSMTs with my experience and knowledge of research in mind and take action based on these interpretations. Therefore the voice of the teacher educator is portrayed in italics and provides insight into my thoughts as a teacher educator and reactions to the participants and situations.* This approach allows the reader to differentiate the voices present in each case.

This chapter is divided into three major sections. Each section consists of a case for one of the three PSMTs. All original names, other than mine, have been replaced with pseudonyms or removed. The cases begin with a brief introduction to the participant with his/her stated reason for wanting to be a mathematics teacher. The case continues by following the development and experiences of the PSMT starting with demonstrated beliefs in the summer methods course data collection, data from each placement experience in fall, winter, and spring, and concludes with a portrayal of the PSMT at the conclusion of the program supported by data from the final interview. Summaries of and conclusions about the PSMT’s beliefs and development from the lens of the conceptual framework are in Chapter 5. In the development of the narrative for the journey of each PSMT some raw data were determined to cause disruption and was summarized to allow the story to read more smoothly. All summarized data can be found in a separate
appendix for each PSMT and is labeled accordingly within the case. A difference in
terminology used to refer to reform-oriented perspectives and practice may be observed.
My development of the term learner-responsive resulted from ongoing analysis of final
interview data. Understandings of the meaning of student-centered perspectives and
approaches to teaching were varied among the PSMTs. The term was often interpreted to
only refer to attention to students, not necessarily use of student thinking to inform
instruction. As a result, there are data excerpts including use of this term, however, I use
learner-responsive in my discussion and interpretation of findings.

Jacob’s Journey

Teaching popped to my mind and I was like, that is the dumbest thing, there’s no
way I’ll ever be that and then the more I thought about it, it just stuck. (Jacob,
10222010 small group, lines 207-209)

Jacob was a male in his early-twenties. Like many of his peers he completed his
B.S. in mathematics and continued without any time off at the same institution to pursue
his M.Ed. in mathematics education. At a small group meeting during fall quarter Jacob
shared how he saw himself falling into his interest in teaching, as it was not a profession
anyone in his family had pursued. He had decided to go into mechanical engineering
based on his high school guidance counselor’s recommendation in order to be able to
make “a lot of money.” But he eventually landed on teaching and was driven by the
ability of a teacher to have influence on “people’s lives and stuff for the positive” (Jacob,
10222010 small group, lines 200-211, Figure J.1). Jacob’s reasoning reminded me of a
common reason for entering the teaching profession, “I did not know what else to do.”
While Jacob did mention his desire to have a positive impact on students, the same
reasoning had been mentioned by many of his peers before he shared his thinking. This was something I came to expect from Jacob, difficulty with finding ways to share his own thoughts resulting in a jumble of his experiences, observations, and others’ thoughts.

Summer Methods Course – Eye-Opening

Why is it that in over 6 years of difficult mathematics courses that I never crossed paths with a teacher or an instructor that encouraged me not to get the right answer, but to understand rightly? (Jacob, 06282010 summer reflective writing)

The summer methods course experience was influential for Jacob. As is demonstrated in the quote above, he frequently questioned his own experiences and lauded learner-responsive pedagogical approaches. At the beginning of the summer methods course, he provided four bullets to describe how he envisioned his mathematics classroom: 1) “Lesson plan would probably be very basic”, 2) “I would have to prep for a long time beforehand”, 3) “My students would probably be confused”, and 4) “If under pressure, I would probably take off and talk about math way above their head” (Jacob, 06212010 initial prompt response). It seemed that Jacob had not completely understood the prompt but he also demonstrated a lack of confidence in his abilities as a teacher but demonstrated confidence in his understanding of mathematics. This confidence in his own mathematical understanding would be challenged as he gained experience with teaching in his placements.

The readings, discussions, and experiences in the summer methods course were eye opening for Jacob. He often spoke highly of the new methods he was seeing and was quick to speak in support of new methods and criticize the traditional, teacher-centered teaching he had experienced. Early in his exposure to the course readings he was
attracted to the idea of motivating students to learn. “The problem that seems to continually come up is not necessarily how can teachers get students to learn and retain mathematical concepts and equations, but how their curiosity can be sparked in such a way that they desire to understand” (Jacob, 06232010 summer reflective writing). This attachment to student motivation was common for me to see. It was actually what I had focused on as a beginning teacher. Unfortunately, if not paired with concern about how to effectively help students learn, I saw it leading to a focus on making lessons fun but not necessarily engaging (i.e. meaningful for student learning). However, Jacob also demonstrated excitement about the perspective of focusing on helping students to understand why, not just how.

This was so exciting for me because this has been my educational career thus far! “[Students] (myself included) want to understand what they are learning”, but they are able to achieve and succeed without doing so. This encapsulates so well the internal struggle that I experienced pretty much every quarter of math I have taken. This is sad! Why is it that in over 6 years of difficult mathematics courses that I never crossed paths with a teacher or an instructor that encouraged me not to get the right answer, but to understand rightly? To dive deep into the foundations of math and comprehend the system behind the right answers – not just parroting nonsense. I am passionate about this but at this level right now, it is all talk. I look forward to learning how to practically live out this process we call teaching. (Jacob, 06232010 summer reflective writing)

Jacob admitted that he had experienced mathematics at a surface level as a student and questioned why he had not encountered any teachers that encouraged him to understand at a deeper level. This idea seemed to energize Jacob and provided him with a focus for his own teaching perspective. However, he admitted that his desire was not something he had the skill to put into practice yet. I appreciated his realism and hoped I could help him to have concrete learner-responsive experiences to build on his excitement.
He also reflected on the approach and impact of a traditional, teacher-centered approach to teaching mathematics.

It seems sad that there is as much of a disjoint as there is from the meanings of the words, “teaching” and “learning”. It is true that if learning does not occur, then what has been taught? I really like the author’s definition of the traditional classroom: “Traditionally mathematics has been perceived as a ready-made discipline to be handed down by a teacher skilled in the art of transmitting, or explaining clearly” (39-40). It seems like the author worded that very carefully. I do not agree with this process in the least though. Everything about it seems stifling. With this in mind, it makes sense why there are so many math-traumatized people. (Jacob, 06282010 summer reflective writing)

Seeing Jacob’s point about the importance of learning in order to claim teaching was exciting. This was an area that is often disregarded as teachers focus on “covering” the curriculum instead of making sure students were actually learning the concepts, or “uncovering” the curriculum, as a wise professor once told me. I also saw Jacob’s perspective on the traditional approach to teaching as “stifling” as an accurate characterization that would help him to build more interest and belief in the effectiveness of learner-responsive pedagogy.

Jacob also demonstrated excitement about the different learner-responsive pedagogies he was exposed to in the summer methods course. He made note of different “strategies” such as “questioning, reasoning, representation, flexible use of numbers, and journaling to develop mathematical thinking” (Jacob, 07022010 summer reflective writing) that he wanted to incorporate into his own classroom practice. As he read further in the course he noted areas where he would be able to influence as a teacher.

I totally resonate with Boaler’s statement, “It is about providing settings in which children’s own mathematical ideas and questions can emerge and in which children’s mathematical thinking is validated and encouraged” (176). As a perpetual student of math, I have seen this lived out both positively and
negatively. An oppressive teacher can literally remove any chance of creativity, where it’s almost amazing how the same room could change with an encouraging and uplifting teacher. This may seem obvious, but the setting within the classroom is a huge determining factor of success for the students. (Jacob, 07192010 summer reflective writing)

He commented on the ability of the teacher to impact the learning environment several times in his reflective writing. *This was something I tried to emphasize, as I knew the PSMTs would most likely be in field placements where the environments were not conducive to learner-responsive pedagogy. They needed to be prepared to expect resistance and realize the power they had over the classroom environment.* I saw Jacob’s comment as indicative of promise for him to make progress in his field placement experiences. However, while Jacob’s demonstrated interest in all of the important characteristics of learner-responsive classrooms was encouraging, I was apprehensive about his continued struggle to come up with concrete examples and express himself clearly. Even his final response to the writing prompt had not improved in the amount of detail provided but he demonstrated a little more confidence in his understanding of teaching.

I would have a much better idea at how to run it, what to expect, and I would have a much better plan. Hopefully I can get my students to think for themselves and learn with each other, but I might lock up and try to start teaching. (Jacob, 07212010 final prompt response)

*Jacob demonstrated the influence from the summer methods course by mentioning his hope for students to think and work together. It was also interesting for him to admit that if he was nervous he would probably revert to some method where he was doing the talking. From his initial responses I was concerned about his ability to express himself*
clearly but I was curious about building from his piqued interest in learner-responsive approaches to teaching.

Jacob’s responses to the MBS were additional evidence supporting the influence of the summer methods course on his perspectives. His overall MBS score was a 93, the lowest beginning score out of the eight case study PSMTs. His final MBS score also demonstrated the largest change to a 129. While it was encouraging to see an influence on his beliefs it was also concerning because I was not sure if he was deeply considering the ideas or just adapting to the current environment.

Fall Placement – Baby Steps

Jacob’s fall placement was in a suburban middle school observing eighth grade algebra. He enjoyed this placement with a mentor who was young, laid back, and approachable. His mentor supported him by spending extra time reviewing Jacob’s lessons after realizing Jacob struggled with nervousness and discomfort in front of the students. Jacob initially pointed out methods that his mentor implemented that he felt were not in alignment with program philosophy, however after struggling with developing and implementing learner-responsive approaches he began to integrate his mentor’s more traditional methods of lecture and guided notes.

Picking up on the Wrong Things

Jacob’s first formal reflection about his observations in his mentor’s classroom and his response to my feedback demonstrated how he was easily influenced. His initial reflection focused on his interest in the competitive component of his mentor’s classroom. His mentor had allowed his students to form small teams that would compete
to correctly answer questions and problems during class. The scores were then recorded and displayed in the classroom. Jacob spoke highly of many positive aspects he believed would come out of the focus on competition: getting students to work cooperatively, getting students to “theoretically” learn from peers, encouraging student attention to mathematical content, making it fun for the students, and rewarding students who were good at math in a way other than grades (Jacob, 09272010 experience reflection, Figure 1.2). Jacob’s “theoretical” comment showed that he had noticed the students were more likely to work independently and then copy each other’s answers instead of communicate with each other. This hint of skepticism provided me with a place to encourage Jacob to think more deeply about other consequences of a competitive atmosphere. So I challenged him to consider possible drawbacks to the way the competitive atmosphere was set up.

Interesting that it seems they are allowed to choose groups. Do you see this as possibly being unfair? Could it leave some students out? Do they switch groups at any point during the year? If not, how could it be useful and a good experience for the students to work with different people throughout the year? (Jacob, 10042010 experience reflection feedback)

I also challenged him to think about ways he could redesign the competition to make the benefits he theorized more likely. I suggested Jo Boaler’s (2009) book as a reference to help think about the possible drawbacks. He responded with evidence that he did refer to the book and quoted a part about how competitive males could lead to a disadvantage for females who were less likely to be competitive in the classroom. This quote was followed with a note about the irony of a team of girls currently being at the top of the leaderboard in his mentor’s classroom. He then suggested focusing the competitions around
“understanding instead of correct answers but did not see “judging” student responses as feasible to accomplish fairly or in a reasonable amount of time (Jacob, 09272010 experience reflection, Figure J.3). Jacob did reference the book, however he seemed to literally copy ideas from the book and seemed to discount it based on what he observed in his mentor’s classroom. He also struggled to think about how a classroom could possibly be structured around the motivation to understand. Instead he could only suggest that a competition focused on understanding was not really feasible based on the difficulty of assessment. My response tried to get him to think more deeply about the implications of the reading. “It is important to remember that the research cited should not be generalized to every female and male. I see it as more important to take note of the fact that different people prefer different approaches to learning” (JH, 10042010 experience reflection feedback). My goal was to get him to not focus on competition but possibly picture a classroom built around motivation to understand, not motivation to win. This approach did not seem to make progress with Jacob’s thinking.

Toward the end of his reflection he wrote about his observations of important characteristics of a successful teacher and shared his thoughts about the abilities of the students he would be teaching.

On a different topic, I’m continually noticing how important that it is to be creative and resourceful as a teacher. It seems that the more that you can make the students forget they’re in a classroom by interacting with them in a creative/different way, the more engaged they will be. [My mentor] and I have talked about how his main goal is just to get the students to work on problems and to succeed in doing so. He does a great job at getting his students to do problems but I question how grounded they are in reality. Can these same students who can solve these simple equations produce scenarios for which this type of equation is used? I certainly could not in middle school and judging from the depth of questions being asked on [my mentor’s] handouts and tests, I cannot see his
students thinking at this level either. I guess we will find out; I am asking them to create scenarios where algebraic equations are used in the discussion of the lesson I am teaching Wednesday. (Jacob, 09272010 experience reflection)

Jacob demonstrated a belief in the importance of the teacher being creative and almost a distraction from the traditional educational setting. He was interested in engagement, but it seemed like a shallow engagement, which I would refer to more as a distraction from learning rather than involvement in learning – just keeping students happy and having fun. I cautioned him in my feedback “while it is important for students to experience success, it should not be at the cost of being challenged. Giving students something to struggle with can be engaging if it is posed well” (JH, 10042010 experience reflection feedback). At the same time Jacob began to criticize the depth of learning occurring in his mentor’s classroom. His thoughts within this section of his reflection seemed contradictory, claiming the importance of getting students to think they are leaving the reality of the classroom but criticizing his mentor for not grounding his students in reality. He then admitted to his plan to try to challenge the students in his lesson but revealed his doubt about whether they would succeed from the beginning. Jacob also demonstrated his nervousness about using learner-responsive approaches during an early small group discussion.

My teacher is very similar to that I think three days out of the five he has, go over homework, bring up new material-ish, he proposes the issue and then they work on it, go get up and start working on it on the smartboard, they’ll play around with it and then they’ll start working on the worksheet on their own and he’ll hand out the homework. But I just wrote a lesson plan where I just, threw in a discussion to try to maybe throw in a curve ball, I don’t know. I mean, I don’t know if it’ll work, cause your problem is you don’t know if they’ll take to that. (Jacob, 10012010 small group, lines 72-79)
The description of his placement classroom had teacher-centered characteristics. In bringing up what he was planning for his lesson he described the method of incorporating discussion with his students as being unfamiliar and seemed nervous about whether his students would be open to that pedagogical method. *This was a frequent topic of discussion as most of the PSMTs were likely to experience resistance from students. I always suggested that they approach implementation of new methods by being very open with their students about their expectations and objectives. In my feedback on his experience reflection I reminded him to be patient with his students, as they may not be used to being challenged.*

*It is important to keep in mind the students’ possible inexperience with what you are asking of them. Be patient and think hard about how to make sure they understand your expectations and have the opportunity to really think about what you are asking before just throwing in the towel because “it seems too hard.”* (JH, 10042010 experience reflection feedback)

*It was not uncommon for me discuss this idea with all of the PSMTs as I saw being explicit with students and persistent with learner-responsive methods as critical factors.*

I met with Jacob the day before his first teaching experience to discuss his plans for his first lesson. He had initially turned in a lesson that did not include use of any learner-responsive methods and I provided extensive comments requiring that he improve and change his lesson approach in the future as well as ideas for different ways he could have approached each aspect of the lesson.

*I do not see how this lesson would interest or engage the students or incorporate a more student-centered philosophy. While you do involve students working on problems at the board, how are other students involved? How could you adapt this portion of the lesson to make it more interactive and engaging for the whole class and not just one student at a time? What type/level of thinking would you see students engaged in throughout this lesson? How about a hook of some sort?*
What will grab the students’ attention (beyond the interest or routine of just doing school)? How will you give the students a reason to want to pay attention in class today and get their brains working? While I understand that you may be being conservative and simple with your first lesson, I want to let you know that it is not going to be acceptable for you to plan to have students work on homework during class time in the lessons you plan. This is not supported by the philosophy of the program. (JH, 10012010 lesson plan feedback)

Jacob decided to scrap his initial lesson, which contributed to the nervousness expressed above in his reflection and at small group and his uncertainty about the lesson details as discussed in our first pre-conference meeting. I typically approached the first pre-conference meeting by asking the PSMT to visualize their lesson and share their thinking with me in order to get an idea of their thinking and how well they are able to think about the lesson. Throughout our pre-conference discussion, Jacob was very unsure and questioned a lot of what he was planning to do demonstrating a lack of thought about critical aspects of how his lesson would be implemented and what the student responses could be for the different parts of his lesson. “I kind of want to do this discussion of, what, I don’t know, it being more important to understand conceptually as opposed to simply doing algorithmic equation solving” (Jacob, 10052010 pre-conference, lines 18-20). This statement indicated Jacob’s desire to include discussion in his lesson in order to emphasize conceptual understanding however; he lacked details to describe how he planned to achieve this. I noted that Jacob depended on his lack of experience to explain his difficulty with thinking about the specific aspects of his lesson. “I have no preconceived notions of, I’ve never done this before, teaching in general, I’ve never, like in terms of TA’ing or tutoring” (Jacob, 10052010 pre-conference, lines 112-115). This

95
was one example of many where he leaned on his inexperience as an excuse for not having ideas and details about his lesson plan implementation.

I inquired about why he planned to have students work individually in his lesson instead of at the board.

I’ll get more feedback from them doing it individually because I’ll be able to look at each group on a one on one basis, the person up at the board is the one in the spotlight so I’m only getting one per problem (Jacob, 10052010 pre-conference, lines 135-137)

I appreciated Jacob’s demonstrated interest in assessment, however, he was not considering the difficulty in getting to every student and the benefits of having students share their thinking with each other. I decided to allow him to experience this as an opportunity to reflect on his inevitable difficulty with assessment using this method. Then I challenged him to think about the type of thinking being reinforced through the homework he chose based on his mentor’s suggestion.

JH: What is challenging them to extend their understanding in this homework?
Jacob: in this homework, nothing
JH: What’s the type of thing that you could give the students if you had complete control over homework?
Jacob: I mean I want to say, first glance, word problems, but bigger than that, I want to just, because word problems provide situations where math can be applied
JH: So that’s applications of it, but how can you get them to think about what they’re doing when they’re solving these problems and the process that they’re using
Jacob: Just you’re talking about inverse operations and different, literally solving these problems, how to get them to become aware, so I mean literally become metacognitive of their solving process, in worksheet form or by talking
JH: Just a homework, I mean could you give them a question on their homework that would help them express that or think about that and they could respond to it and you could see it when they turn it in the next day
Jacob: What they’re thinking about the solving process?
JH: Yeah about the process they’re using and understanding why they’re doing what they’re doing
Jacob: yeah, I’m sure there is a question (10052010 pre-conference, lines 218-239)

I was attempting to get Jacob to think about ways to get his students to think more about the mathematics instead of rote procedure practice. Jacob had difficulty following the discussion. His immediate thought was applications, which is typical, but I challenged him to just think about the foundational concepts and while he seemed to agree he did not have suggestions to offer. Jacob then went into a discussion of his frustration with the approach his mentor was taking to teach the concept of infinite solutions for linear equations.

Jacob: he broke it down to, I’m kind of annoyed he doesn’t, well get rid of the variables and so the numbers, he’ll simplify it down to like 9=0 whereas I would simplify it down to, like over here, I mean it’d just be s=s

_JH: those are two different situations_

Jacob: yeah I know, okay, so if there’s infinite solutions it’d be 9=9 or s=s, depending on how it sets up, and that makes it much more clear that s will always = s no matter what number you throw in, whereas 0=0 that’s just one

_JH: that’s just like saying we have one solution almost_

Jacob: yeah but then from that you’re supposed to imply that like infinitely so you’re pretty much just tagging

_JH: you’re just looking for situations and saying oh if I match the situation then I know it is this, not thinking about what it means_

Jacob: exactly, so, I would like to kind of maybe delve more into that topic (10052010 pre-conference, lines 247-259)

Jacob seemed to think his mentor approached the concept in a rote way and wanted to focus on something that would allow the students to think about the underlying concept.

Again Jacob’s suggestions, while concerned about conceptual understanding, were still broad ideas without any details of how he would attempt to address the ideas. I was noticing this lack of detail and tried to provide Jacob with several different suggestions to help him get a start (10052010 pre-conference). As I provided ideas he eventually came
up with a homework problem that could get students to think about the underlying concepts.

Okay so, kind of answer your question, I would give them one of the solutions with no solutions and then give them, maybe the next one, and then kind of compare contrast different, just make them look at it more closely, cause I feel like no one ever explained a null set to me or why are there no answers (Jacob, 10052010 pre-conference, lines 271-274)

This demonstrated Jacob’s commitment to trying to find ways to challenge his students even if he often struggled to come up with ideas or implement them. *His suggestion to have his students compare and contrast different mathematical situations would provide them with a high-level thinking opportunity. I saw his suggestion as evidence of his ability to discern opportunities for deeper mathematical thought.*

As we finished our conversation Jacob shared his appreciation for the discussion.

I feel more comfortable having talked through with someone who knows what the heck they’re doing, because I mean walking into this, I’m like, oh that sounds good, that sounds good and I have [my mentor] guide and then what he’s doing isn’t what the program wants, so it’s kind of like, so I mean I started with that and then it’s like, no, U-turn (Jacob, 10052010 pre-conference, lines 406-410)

*Jacob provided a reason for struggling to develop a more learner-responsive lesson with his mentor not using approaches supported by the program philosophy and suggested he felt better and more confident about trying more learner-responsive approaches after being able to talk with me. This demonstrated the difficulty of supporting the PSMTs in environments with mentors that were not consistent with learner-responsive perspectives.*

The following day I visited to observe him teach the lesson we had discussed. Jacob had decided to teach the lesson to three of his mentor’s classes in a row. At the point when I came to observe he had already taught the lesson twice. *Overall, Jacob had*
struggled with the lesson not going as he had envisioned, which did not surprise me based on his lack of details in his vision from the day before. Our discussion about the lesson was focused on some of his struggles and I tried to bring in some positives throughout.

Jacob: They seem to have a lot more difficulty with these problems than I anticipated.

JH: So what were some of the difficulties they were having with them?

Jacob: They just couldn’t set them up, I mean they weren’t defining variables, they weren’t setting up equations, I don’t know, it’s just they weren’t doing anything, I don’t know and it varied, some, I feel, in this class it was a lot worse, but I feel like in the beginning they’re getting them.

JH: They really struggled with the word problems, mainly because they’re being forced to set up an equation maybe.

Jacob: yeah, ideally, I mean as you saw the one, there was only one girl that actually set it up in a full out equation,

JH: but they can solve them it’s just setting them up that

Jacob: yeah and I mean they were able to, the one kid in the corner that just now found the rate per second or whatever, I mean he found it, he just had a backwards way of going about it and that’s not wrong, but, I mean obviously they’re able to, they’re capable (10062010 post-conference, lines 447-466)

Jacob’s first difficulty was in the students not being able to set up equations from the information provided in word problems. He had not anticipated this issue. I suggested that the students maybe did not struggle with the problems but the method Jacob expected them to use. He did acknowledge that he had noticed they were able to solve them in “backwards” ways but did not seem to really value the student’s thinking. He also acknowledged his feeling of student perceptions as he was providing examples at the front of the classroom.

I mean the reason why I was doing it is because it would of just taken so much longer for them to go up there and work through them, but I felt like it was just so boring for them, it was just we do this all the time, so I almost want to just stop half way through and be like just do them later and then jump to the word problem (Jacob, 10062010 post-conference, lines 475-479)
Jacob demonstrated feeling that he had talked through the problems himself because of time constraints but he sensed his students were bored. *It was promising for him to note his approach was boring and he seemed to have considered changing his lesson at that point. I was curious about getting him to at least begin to reflect on how he would have changed the lesson if he could.*

*JH: is there anything that you would change about this lesson if you had the chance to say okay, you get to teach the same lesson again tomorrow, what would you do differently, I mean you don’t have to teach the same lesson you planned, you can teach this same topic again tomorrow*  
Jacob: I mean I’d probably say something, it’s weird because I almost want to lecture at the beginning  
*JH: lecture about what*  
Jacob: about the whole process of variables and determining meaning to it, and it’s just a symbolic representation that, I mean it’s putting it in a mathematical format really is all we’re trying to accomplish here, and then maybe, I mean this seems trivial because they know how to do it, they know inverse operations, maybe, kinda have the same talk, like if today were erased and if I were able to redo it, have the same kind of talk, maybe do one of these, and then start with baby equations maybe (10062010 post-conference, lines 492-504)

Despite his feeling that students were bored while he was talking at the front of the classroom he still saw it as a necessary component to the lesson but he would try to focus more on the idea of setting up equations from word problems since he felt students struggled with that idea. Jacob’s awkward feeling of boredom while he was standing at the front of the room talking to students had not had as much of an impact on him as his concern about his students struggling to set up the word problems. When his response to my question was “lecture” I had to stop myself from just saying that was a bad idea and tried to focus more on why that was his choice. Unfortunately, I felt he did not have confidence in his students’ abilities and believed he had to tell them how to approach word problems in order for them to learn. Despite his staunch conflict with the “stifling”
teacher-centered approach in the summer methods class, he seemed to still hold onto the belief that students had to be told how to think about mathematics.

Knowing that Jacob was struggling to think about the methods he was using I tried to get him to reflect on the method he had implemented at the end of his lesson. He had instructed the students to wait for him to check their answers before moving on to a different problem.

JH: Is it productive, and if they’re having to wait, I mean you have 24 kids in this class, if they’re having to wait for you to come and check them and most of them aren’t even trying, I mean it seemed like they’re just writing something down and then, oh, check me, and they don’t even think about it, there’s no maybe I should talk to my partner, see if they got the same thing or maybe I should talk to the group next to me and see if they got the same thing, it’s all dependent on you, you’re one person and there’s 24 of them

Jacob: I felt, yeah, I mean that was, I don’t know, that encapsulates it well, I feel like it was poorly managed on my part, I set myself up for failure, I’m the only person who can help you (10062010 post-conference, lines 522-531)

JH: at that point you could have said, why don’t you go ahead, if you’re done, I’ll be around to check you I see who’s got their hands up, go ahead and move on to number 8, you know, you can make snap decisions like that, you’re in charge

Jacob: okay, yeah, but I just didn’t have that in my arsenal, I didn’t think that through (10062010 post-conference, lines 651-654)

Jacob admitted that he had not even thought of the possibility of changing directions and his lack of experience limited him in the situation. As I was discussing the way Jacob had implemented the individual work portion of the lesson I was getting the feeling that he had not even considered that he could change how he was implementing the activity based on perceiving that his original choice was not working well. This solidified my desire to just provide him with ideas and models to refer to and reflect on as he was struggling to think about how to have an impact on the classroom environment and get students comfortable with learner-responsive pedagogy.
JH: think to the [summer methods] class, first day, we do the locker problem, right? And everybody’s used to, can you tell me if it’s right, and they’re all asking me the same question, and I just say, do you know if it’s right, can you tell me if it’s right, you know? By the end of the 5 weeks, Derek has it in his head, oh, I’ve observed this teacher who doesn’t give students the answers, she reminded me of you. So you just do it, you just decide this is what I’m gonna do, and the students adapt to it, you guys adapted to it, you got angry about it, but you got used to it, I mean it’s a little bit different because they’re middle schoolers and you’re adults, so you might want to be more upfront about it and say something, I mean the focus in a lot of math classes is on the answer right, check and see if my answer’s right, it’s like I don’t care what your answer is, I care about what you’re doing to get that answer, you know, while it is important for you to get the right answer, what really matters it that you’re able to get there and the process that you use to get there and you kind of talked about that a little bit today where you had three different methods and you shared that, it’s just a matter of making a decision on your part to say maybe not this quarter because it’s hard because you’re teaching lessons here and there, you can’t change a ton of stuff because you don’t have them on a regular basis but maybe you could change it for that horizontal three, just say for the next three days this is what we’re gonna be doing, and these are the approaches I’m gonna take, but we can work on constructing lessons that help that to be the focus, I didn’t want to push you too hard in this lesson in trying to do a ton of new things or things that are different from what you’ve seen or what you’ve experienced, I mean you’ve been a student, you’ve been in classrooms, you’ve experienced things that are probably different from what I’m trying to get you to do, or the program’s trying to get you to do, so I don’t want to push you to do too much all at once, just get your feet wet, figure out what it’s like

Jacob: it was just literally, I think at 4:12, I just remember looking up at the clock and being like, well, it’s funny cause the two classes prior we ran out of time, and this one I was like, I want this to end, cause I’m like, this was horribly planned, nothing’s going right, I want this to be over with so I can learn from it and move on, I had accepted that it had just gone awry

JH: I don’t think it was poorly, I think that there were great ideas in your lesson, there’s just things that could be implemented better (10062010 post-conference, lines 542-585)

Jacob seemed more focused on his negative feeling about the lesson than considering my suggestions. I tried to bring him back to the model I provided in the summer methods course and help him to think about the importance of building an environment where that idea is supported. I wanted to make sure to acknowledge the difficulty of changing an environment, especially with the scattered lessons taught during fall placement, but I still
wanted to push him to try new things and plan specifically to try new things in his upcoming lessons and reflect on the student response and adjust accordingly. I was careful to emphasize that I was seeing potential and he had room for improvement, he was not failing.

In our discussion following his first teaching experience we also talked about the development of his mathematical understanding.

After going through all this education, I mean I kick myself for not doing it, but I love being able to now, take that problem that you gave us and go home, work through it in three different ways and understand it fully, that’s awesome (Jacob, 10062010 post-conference, lines 623-626)

Jacob admitted that he did not put much into building his mathematical understanding before entering the education program and that he enjoyed having the opportunity to try to think more deeply about mathematics. He also admitted to his struggle to mentally process all of the information necessary while teaching. “I feel like I’ve just been over stimulated cause you have to think hard on what the kids are doing, like okay, what are you thinking, how can we approach this and I’m just like, there’s too much going on” (Jacob, 10062010 post-conference, lines 707-710). His inexperience with teaching as well as problem solving seemed to impact his ability to handle the complex act of teaching. I acknowledged his difficulty but also made a mental note at that point that he may struggle more than other PSMTs as a critical aspect of learner-responsive approaches to teaching is being able to quickly process the mathematical ideas of students and make decisions based on that understanding.

Jacob reflected on the lesson further in his formal reflection. He started off by admitting that a “major error” was not being familiar with his students’ understanding of
the content and not considering their lack of experience with the higher levels of thinking he had incorporated in his lesson. He also criticized his inconsistency with emphasizing the importance of conceptual understanding and then spending 10 minutes to practice procedures. He suggested areas for improvement in his use of follow-up questions to encourage student thinking and suggested gradually getting the students to adjust to more challenging problems. Then Jacob concluded the reflection by stating that his expectations were too high (Jacob, 10062010 vertical 2 reflection, Figure J.4). **His thinking was initially on the right track. Unfortunately, Jacob concluded that his expectations were too high for the students while my perception was that he was just not clear about his expectations and did not provide the students with a solid opportunity to demonstrate their understanding. I shared some of my thoughts about his students in my feedback**

> I disagree, I do not think your expectations were too high. I do think those students would be capable of producing an algebraic representation for that problem but only after solving it in their own way by working backwards or whatever worked for them. I have no doubt that a great conversation and learning experience would result from having time to spend developing an algebraic representation based off of their work process. (JH, 10102010 vertical 2 reflection feedback)

*His conclusion was the opposite of what I had intended with including a rich problem for students to work on. He had not been able to take the opportunity to focus on student thinking and realize what they were capable of and seemed ready to give up on challenging his students. It seemed that Jacob’s nervousness in the classroom led to poor implementation of learner-responsive methods resulting in negative perceptions of his*
students’ abilities. I decided to try to build from his interest in learning more about his students in my feedback.

Do you think that with your next lesson you could create a short pre-assessment that [your mentor] could give the students a day or two before you teach so you could look over their abilities and use that to adjust your lesson accordingly? (JH, 10102010 vertical 2 reflection feedback)

A pre-assessment seemed like a good place for Jacob to start getting experience with considering the thinking of his students. He also wrote about his teaching experience in his blog

I got to see how stressful teaching consecutive classes can be. What added to this was that I was not extremely comfortable with the lesson plan that I was to teach that day. Generally speaking, after teaching Wednesday, I feel like my eyes were opened to how much I have to learn. There were definitely moments of hopelessness where I had no clue how to help a confused student while I looked around only to see 5 other students with their hands up. Having a background in doing manual labor (landscaping, home repair, and carpentry) since childhood, I have always been comfortable building or fixing things. These are tasks are very concrete and tangible relative to teaching. With teaching, I am trying to get students to think a certain way. This is a much more abstract task with (it feels like) infinitely more factors. As with any other job, the more experience you get, the easier it becomes and the simpler it feels. I can’t wait to be able to describe teaching like this! (Jacob, 10082010 blog post)

Jacob admitted that his teaching experience was meaningful in foundational ways for helping him to realize the importance of planning well and the difficulty of teaching effectively. He also reflected on how his life experience of working in manual labor while related to teaching did not directly correlate to the complex act of teaching and demonstrated the perspective that as he gained experience, teaching would be easier.

While this is possibly true in some ways, I see it as becoming more difficult and complex in other ways because as you gain experience with the foundational characteristics of teaching such as multi-tasking and organization, you begin to see areas of improvement
at a deeper level. His belief that he was trying to get his students to “think a certain way” was a little concerning, as it seemed that he viewed the students as programmable. This was more evidence of a perspective on learning that emphasized one way of thinking.

One Step Forward, One Step Back

As Jacob became more acquainted with the students he was working with he began to notice different things when he worked with them. In one lesson reflection he recorded his observation of student reactions based on whether he responded to their questions with a question or a “yes” or “no” answer. He was surprised to note how students were quick to move on as soon as they were given an answer but more likely to think more about the problem if he responded with a question (Jacob, 10192010 lesson reflection, Figure J.5). He realized the power of responding to students with a question and the possible detriment to just telling students the answer. This was a potentially powerful observation for him to make as he prepared to teach his second lesson. He was enthusiastic about his second teaching experience due to finding an online resource to use as the centerpiece for his lesson. The worksheet was set up as a creative way to help students think about the concept of function through a type of puzzle. During the post-conference Jacob’s initial reaction was that he had managed to challenge the students to think about a difficult, abstract concept. He acknowledged that he did not think the students had complete understanding but that his lesson had helped them to begin to think about it (Jacob, 10282010 post-conference, lines 756-760, Figure J.6).

While Jacob continued to demonstrate a commitment to focusing on conceptual understanding, he also continued to struggle to clearly articulate conceptual ideas to
students. We discussed his struggle with his own lack of confidence in his mathematical knowledge. “Well I got kind of nervous about the situation and I was like, oh man do I have a full understanding of this myself.” (Jacob, 10282010 post-conference, lines 821-822). Jacob admitted that he questioned his own knowledge of the mathematical concept during his lesson. The result in the lesson implementation was that he was not comfortable considering students’ responses that were different than what he expected because he did not trust in his own thinking. Again, I was seeing Jacob struggle with learner-responsive methods as a result of a disconnected understanding of mathematical concepts. I brought up the design of the worksheet he had chosen and how it allowed students to easily carry out steps in a rote manner without thinking about the underlying concepts.

_JH: the only thing I was concerned about with the worksheet was, it's easy to proceduralize it, cause I heard a student telling another student, don't worry about the symbol the symbol means nothing, all you need to do is take the one value and the other value and graph it, that's all we need to do_

Jacob: which that, I understand exactly what you're saying

_JH: so where's the concept though?_

Jacob: yeah, and that’s, I feel like that’s the curse of education, is how to prevent students from playing the game, and getting them to learn, because I feel like you can play the game at this level of difficulty and then you can learn which is just slightly higher, but kids get satisfied, and oh I mean, they get awarded even, because I mean ultimately your grade is dependent on how much you learn, like theoretically, I feel like

_JH: well that's what it should be, but then it's really how well you play the game_

Jacob: yeah, and that’s what I did all through high school and then college until I hit the upper level math courses and then all of my concepts and everything were jumbled and didn’t even make, I didn’t even have conceptual understanding, and so I hit a wall literally, and then I had to rebuild and actually learn it, and that took forever but that taught me wow, my entire education this far has been worthless (10282010 post-conference, lines 863-880)
Instead of thinking about how the worksheet was designed and ways to modify it Jacob jumped to the issue of students not caring about learning as if it was completely out of his control how students chose to approach their learning. Just as in the summer methods course, he was focusing on the student motivation as the issue and not necessarily the way the worksheet had been designed or presented. Again he admitted his difficulty with understanding mathematical concepts and his need to essentially relearn mathematics when he realized he had just memorized everything and did not truly understand it. While this discussion provided insight into Jacob’s perspective and drive to focus on building conceptual understanding, the focus on the details of how to get there was still lacking.

I had also observed Jacob disregarding student suggestions about a concept that was closely related to his objectives in this lesson but were planned for a lesson the following week and decided to get him to reflect on his decision.

JH: A lot of students were saying things about slope and about coming up with the rule and you’re just like, no, let’s focus on the graph, it’s like, can we use the graph to come up with the rule, can that help us in any way, just use what they’re bringing, not just shut them down with the knowledge that they’re bringing to the class, I mean that’s hard to do cause then you have to sort of change on the fly figure out how you’re gonna incorporate that, you know

Jacob: yeah, which I mean ultimately I’d like to do, but I feel like I need to gain my bearings and do something somewhat positive and successfully before I can start to improve (10282010 post-conference, lines 1018-1024)

I tried to focus on the usefulness of building his students’ thinking into the lesson. While Jacob acknowledged that he would like to do that eventually he needed to feel like he was succeeding in some areas before he could think about improving in others. This demonstrated the difficult complexity of his development as he tried to balance improvement and reflection on many different fronts. While I understood his need to not
try to do too much at once, I saw him focusing on wanting to succeed at methods that were not necessarily supportive of taking a learner-responsive approach.

Overall Jacob was very proud of this lesson and discussed why he felt better about it in comparison to his feelings with his first lesson. He shared how he preferred the “streamlined” nature of the lesson through a set of clearly defined steps to complete (e.g., introduction of the concept, discuss the concept, hand out a worksheet, work on it, etc.). He also commented on the design of the lesson allowing for more of a focus on concepts where he felt his first lesson did not “accomplish anything” (Jacob, 10282010 post-conference, lines 903-906, Figure J.7). Jacob demonstrated his comfort with being able to think of a lesson with distinct sections that built off each other. He admitted that his first lesson had not been well developed and that he had very little confidence in his first lesson but had been able to think more clearly about how this lesson would unfold. Jacob was approaching teaching the same way he liked to approach his previous profession and life, with a set plan. While he was interested in trying to find ways for students to think deeply about mathematical ideas, his main objective was just to cover content using a step-by-step guide. This approach directly conflicted with the philosophy behind learner-responsive methods so I decided to try to work on Jacob’s overall approach bit-by-bit in future discussions.

Jacob reflected on his lesson more in-depth in a formal reflective critique after viewing a video of the lesson. His excitement for his use of a pre-assessment to inform a focus on the “deeper concept” through the worksheet he had found was still evident. He was also critical about the clarity of his explanations and lack of questioning at the
beginning of the lesson (Jacob, 10282010 self-critique 1, Figure J.8). Jacob was still impressed with the worksheet he chose to use, despite my suggestion that it easily led students to rote thinking, and decided to focus on his need to improve his ability to explain mathematical ideas clearly – a teacher-centered perspective. In my observation notes I had made several comments about the students not understanding his expectations and opportunities where he could have emphasized figuring out how students were thinking (JH, 10282010 observation notes). Referencing these comments he suggested several changes that would have allowed students to play a larger role in the lesson and provided more opportunity for him to witness student thinking. He also commented on the importance of knowing his students’ abilities and suggested running through his lesson with his mentor in order to get practice with possible student responses (Jacob, 10282010 self-critique 1, Figure J.8). I found it interesting that Jacob was putting so much trust in his mentor to learn about student thinking, especially after he had acknowledged the usefulness of the pre-assessment for this lesson. It was also concerning that Jacob seemed to see his mentor as the best source of information about his students and did not consider actually learning more by talking to his students. Jacob concluded his reflection with discussing a point in his lesson where he felt his questioning strategies demonstrated his interest in getting students to think more conceptually (Jacob, 10282010 self-critique 1, Figure J.8). These questioning strategies were what I suggested and modeled in the summer methods course so it was nice to see Jacob putting them into practice and noticing the possible effectiveness.
He also reflected on the lesson experience and what he gained from having the opportunity to watch his mentor teach his lesson after him in his blog.

Yesterday after I got done teaching, I got to experience [my mentor] teach the same lesson. This process of watching another teacher teaching a lesson, learning from that, and then being able to teach that lesson again seems to be very effective. [My mentor] himself said that he changed his teaching significantly based off of how I taught it the first time. After talking with Jenny 7th period about the lesson, I was able to think about it significantly and then I was able to think about it even more after watching [my mentor] teach it 8th period. I feel more comfortable in the teaching position than the first lesson and I feel like I’m making progress, but after seeing [my mentor] teach the lesson after me, I was able to see many places for improvement. [My mentor] is able to manage the room, ask questions in a way that is not closed minded, get the students up at the board for productive tasks with a great amount of fluidity and ease that I look forward to gaining someday. I feel caught in a time where I want to be an experienced, effective teacher but am still metaphorically learning how to walk. (Jacob, 10292010 blog post)

Jacob picked up on his mentor’s comfort and different aspects of his methods that allowed the lesson to flow smoothly. He also demonstrated frustration with knowing how he wanted his teaching to look but not feeling that he had the skills to achieve it. While it was good to see that our discussion had helped him to think about his teaching, he seemed more focused on his mentor as a model. This was concerning based on his initial criticism of his mentor’s teacher-centered methods. In his reflective critique of a following lesson he provided more insight into his perspective on his personal teaching and development. In his description of the lesson he seemed comfortable with his decision to just lecture to his students about an idea and then provide them with a worksheet activity. His suggestions for changes in the lesson focused on his thinking about “lecturing the material” more clearly. He also mentioned how helpful it was for him to run through the lesson with his mentor (Jacob, 11022010 self-critique 2, Figure
The result was suggestions from his mentor to essentially make the lesson the way his mentor would have originally taught it. While his mentor seemed to provide good suggestions to help Jacob organize the lesson in a more meaningful way, Jacob’s lesson seemed to become his mentor’s lesson and Jacob had mentioned at the beginning of the placement that his mentor’s methods were not necessarily supported by the program. Jacob’s reflective suggestions for change focused on ways he could improve his lecture clarity instead of how he could make his lesson more learner-responsive. He did suggest a dislike for guided notes providing too much structure but felt he had to use them based on his mentor’s use of them.

As his reflection continued, he focused on his use of a hook to begin the lesson. Jacob specifically picked the “hook” part of his lesson to focus on as a point where he was able to get students to think abstractly about the concepts (Jacob, 11022010 self-critique 2, Figure J.9). His incorporation of a hook was a method modeled in the summer methods course as well as something I emphasized incorporating and he seemed pleased with his use of this method and his ability to incorporate his focus on conceptual thinking in some way despite adjusting the rest of his lesson based on his mentor’s perspective.

When I visited for my final observation of his teaching the day after he taught this lesson, I was interested in getting some context for my observation and asked about how his previous lesson had gone. In his description Jacob shared his use of traditional lecture and guided notes in order to stick with his mentor’s routine and the established environment of his placement. He even talked about his lesson using “we” as if it was not his lesson anymore but a joint lesson between his mentor and him (Jacob, 11032010 pre-
Jacob seemed to come to the conclusion that it was just easier for him to use the methods his mentor had already established with the students than to try to impact the environment. This was something that unfortunately became a common approach for Jacob and greatly impacted his ability to include, implement, and reflect on learner-responsive methods.

Jacob did demonstrate some positive development based on one of my suggestions early in the quarter. I had asked him to incorporate formative assessments through exit tickets in order to learn more about his students. He did incorporate exit tickets into his lessons a few times and was able to use them to adjust his lesson. He spoke briefly about his experiences with using exit tickets and how he had learned the importance of making them challenging in order to see what students were struggling with and provide individual feedback (Jacob, 11032010 pre-conference, lines 1068-1078). This demonstrated the importance of having experience with specific methods in order to reflect on their usefulness and adjust accordingly. Without this experience Jacob would not have discovered what he could do with assessment results.

As we discussed his plans for the lesson I came to observe it became apparent to me that his incorporation of his mentor’s methods had limited his ability to incorporate learner-responsive pedagogy.

JH: while they’re working you said you maybe wanted to point out if somebody has a vertical line and horizontal line, talk about the differences between those and why one’s undefined
Jacob: I think with our guided notes, we’ll hit those, so those are really the only problematic ones, I don’t really know what else to talk about besides these two points
JH: other things that could come up would be parallel lines, perpendicular lines, so one of my things to suggest was, could you have a couple students present their
picture and talk about some of the things they found, as you’re walking around and talking to some of the students, you could just say, would you be interested in sharing, your picture and talking about that with the rest of the class
Jacob: yeah, so just in going around and looking yeah
JH: you might find something interesting that you think would be good to share with the rest of the class (11032010 pre-conference, lines 1082-1101)

The introduction of guided notes while providing structure for the students, also removed any opportunity for Jacob to challenge the students to think about concepts as they were working on his activity. The guided notes approach he took presented all concepts before the activity took place. I attempted to get Jacob to think about ways he could get students to think about other interesting concepts related to his objectives by suggesting he look for students to share their thinking. However, he did not actually implement this strategy in the lesson.

In our discussion after the lesson, Jacob immediately commented on the lecture part of his lesson. He shared that he felt it was boring and uninteresting but did not offer ideas about what he could do to make it more interesting or alternatives to lecture. He almost seemed resigned to the necessity of a lecture. Later in the conversation he brought up the issue again and suggested he should focus on how his mentor made the lecture portion more interesting (Jacob, 11032010 post-conference, lines 1150, 1174-1179, Figure J.11). It seemed that his mentor was able to entertain the students more in the lecture part of the lesson where Jacob took the approach of standing in front of the room and telling the students how to think. While Jacob was concerned with how boring his lesson was, his current model was his mentor who seemed to just be better at entertaining the students during a lecture, not necessarily engaging the students in meaningful learning.
In a formal reflection paper he continued to reflect on the lesson I had observed along with the lesson he had taught the day before. He focused on his use of his mentor’s guided notes and how the students were used to this method and then reflected on what he would want to do in his own classroom. Jacob struggled with the guided notes perceiving it as “spoon feeding”. He seemed more compelled to not provide the students with a guide but to check and make sure they were using some method of organizing their notes from his class. The reasoning he used was the importance of teaching students responsibility as well as the issue of the amount of time it would take him to prepare guided notes (Jacob, 11032010 horizontal 2 reflection, Figure J.12). While Jacob’s thinking demonstrated some concern about doing what would be beneficial for students he was still focused on the work required of the teacher. Unfortunately this issue of teacher work time does seem to be one that highly impacts decision making more so than whether something is beneficial or effective. I wanted to encourage him to continue his thinking about his students in my feedback.

This is a great question to think about. I have seen teachers provide students with four or five different methods for recording notes and students get to choose at the beginning of each lesson the method that works best for them. I definitely think that it is beneficial to provide some type of model for organization, especially at the middle school level, but maybe even more so at the high school level, depending on your students’ experiences. I think your suggestion for allowing students to try their own ways is great but what is important is that taking and keeping notes does not get in the way of student learning, so if they cannot come up with a way on their own, it is your responsibility to help them so learning is the main focus. (JH, 11042010 horizontal 2 reflection feedback)

My main goal was to try to bring Jacob’s thinking to the issue of student learning more than anything else. I knew this was something he was concerned about in the summer methods course and wanted to try to appeal to this belief. Jacob’s blog post following his
horizontal lesson experience provided more insight into his perspectives and approach to teaching. He shared how he saw himself as being “systems oriented” and described his regimented “daily routine” and how he was still working on being able to approach his lessons in such a way where he knew exactly how he had planned to approach each part. He ended on a positive note stating that he knew he would develop a system for teaching as he gained more experience (Jacob, 11042010 blog post, Figure J.13). *Jacob’s approach to his life being very structured lead him to approach teaching similarly. He demonstrated a belief that there was one right way to respond to each moment in a lesson. This perspective does not support the flexibility that is helpful to have for a more learner-responsive classroom.*

During a small group meeting toward the end of the quarter we discussed the issue of being open to new teaching methods. Jacob’s perspective was focused around being open to trying new things, even after 20 years of teaching. He added that he thought it was important to be open “for the sake of [his] teaching, for the sake of the student” (Jacob, 11052010 small group, lines 449-456, Figure J.14). *While it was good to hear Jacob taking an open-minded approach to new teaching methods and educational research, I also interpreted his response through a different lens, knowing that he had a tendency to just ‘go with the flow’ of his surroundings and would possibly incorporate methods into his practice without real evidence of effectiveness. It was also interesting that he again spoke about being open minded for the sake of his teaching and then for the sake of the students suggesting that while the students were important, they were a second thought.*
He also shared some of the results from his students’ feedback at small group. He was impressed at his students’ ability to notice his lack of confidence and was excited about working on this area in his future placement experiences (Jacob, 12032010 small group, lines 115-131, Figure J.15). The feedback from his students echoed what I had observed and talked to Jacob about. He was just not comfortable in the position of teacher and was unfortunately trying to enact the image of what he had observed as a student more than the learner-responsive pedagogy that was the focus of the teacher education program. However, he was struggling with implementing any methods due to his lack of confidence. Jacob wrote more about the feedback he received from his students in his reflective blog. He again noted that he needed to work on his clarity and confidence and made those areas as well as a continued focus on creative lessons and fostering a safe environment for student communication his goals for his next placement experience (Jacob, 12282010 blog post, Figure J.16). In our final meeting at his placement I also wanted him to work on his clarity by trying to create detailed plans of the way he wanted to talk about specific content. I also noticed that he had not learned his students’ names in his fall placement and required him to learn the new students’ names within the first couple weeks. My third goal attempted to acknowledge the small progress he had made in trying to encourage student discussions and suggested he continue to focus on building that learner-responsive environment. (JH, 11232010 FEAG). Jacob’s goals for himself also included learning the students names, developing systems for dealing with teacher responsibilities like attendance, and incorporating results from formative assessments into his lessons (Jacob, 11202010 FEAG).
Jacob’s developmental progress by the end of his fall placement was concerning to me. I saw many areas where he was demonstrating beliefs about learning and teaching that were inconsistent with the learner-responsive perspectives I had focused on from the beginning. Unfortunately, I viewed Jacob’s struggles with deep mathematical understanding and comfort in the classroom as distracting from being able to focus on experience with learner-responsive methods. I was also familiar with the mentor and environment for his winter placement and knew they would not provide a learner-responsive model for him to build from.

Winter Placement – Halted Development

Jacob’s winter placement was in a suburban high school teaching an honors pre-calculus class. His mentor was not very strong in terms of learner-responsive guidance as had been determined from previous evaluations, however Jacob was placed with the mentor out of necessity. His lessons were initially interactive, engaging, and focused on encouraging student participation but it did not take long before he began to realize that he could not keep up with the section-a-day pace his mentor wanted and eventually resorted to lecture. Overall his students were not happy with his teaching and Jacob struggled throughout the placement to completely understand critical content aspects making obvious mistakes during lessons that his students noticed.

Difficult but Workable

At the first small group meeting during winter quarter, Jacob asked for advice about working around or within his mentor’s schedule.

I’m starting on Tuesday, and, my mentor has pretty much a dead set, well not a dead set but she has what she wants per day and I’m just kinda supposed to follow
along with her so she’s gonna pick up and go, on Tuesday and so I have to kinda keep pace with her, should I take half that time and, you know get to know the students some, I was gonna give a five minute bio on me like hey, whatever and just monologue, but then how would you recommend to approach that (Jacob, 01142011, small group lines 160-165)

*I had frequently discussed the importance of taking time in the first lesson in placement to get to know students and share expectations. Jacob’s initial concerns showed the pressure he was under to keep up with his mentor’s curriculum pace. I suggested talking with his mentor about leniency on the day-to-day curriculum. Later in his reflective blog, before starting his teaching experiences for the quarter Jacob shared his thoughts and fears about teaching in a new classroom. He provided some insight into his lack of confidence when he was in front of a classroom full of students. He admitted his nervousness and need to really think through his actions and words when teaching which provided some reasoning for his trouble with flexibility (Jacob, 01172011 blog post, Figure J.17). The requirement of learning his students’ names helped him address his confidence issue during his first lesson.*

I was very happy, I think I found my system, or my groove, I don’t know, I found my happy place, first off, I went around and rattled off every kid’s name, first and last and I was absolutely thrilled, so I think that was a major confidence boost (Jacob, 01182011 pre-conference, lines 1343-1345)

*Knowing his students’ names helped him to feel more comfortable in the classroom, which was one of my concerns about getting him to use learner-responsive methods in his classroom.*

He reflected further on his first lesson taught in his winter placement in the formal critique following his viewing of the video from the lesson. Jacob noted his lack of wait time after asking a planned question to challenge students. He suggested that he could
have had students discuss their responses with a partner first and then used it as an opportunity to collect evidence of student learning (Jacob, 02022011 self-critique, Figure J.18). His suggestion for improvement to allow students to discuss their thoughts before asking for a response was consistent with suggestions I had given him in the past and modeled in the summer methods course. He followed this by providing several reasons why allowing students to discuss their thoughts would have been beneficial for him as well as his students. He then went on to use a student’s “partially correct answer as evidence of student learning (Jacob, 02022011 self-critique, Figure J.18). Jacob’s use of one student providing a “partially correct” answer as evidence of learning was extremely weak for many reasons and demonstrated his naïve approach to assessment. He went on to focus on a point when he was excited about the willingness of students to participate and his ability to facilitate the discussion (Jacob, 02022011 self-critique, Figure J.18). It is important to note his use of facilitate demonstrating a possible awareness about the difference between facilitation and teaching.

When I visited to discuss the lesson I was going to observe, Jacob shared some of his success with getting students to participate.

Jacob: they cruised through that in 5 minutes which was perfect, went right into a discussion about it, I had one kid come up to the smartboard which I was happy about for the first day, so tomorrow I’m kinda orienting them more about discussion, I want to try to preface it and be like

JH: right cause it’s just one big problem that they’re doing

Jacob: kinda yeah, the introductory ordeal is just basically like hey let’s feel this out, talk about what we’re using here, what different elements are and, so I’ll really try to refine like hey this is discussion, the floor’s open, be respectful, I’ll kinda give that little spiel hopefully, so that, I don’t know, we’ll see, but, yeah today I’d say all around went well, the timing was perfect because we were able to get everything we wanted to, so it was the best first day I could think of (01182011 pre-conference, lines 1365-1375)
Jacob was focused on trying to get students involved in a discussion and felt that his success with student participation from his first lesson should help the students feel comfortable with his plans for his next lesson. *It was promising to see him so excited. In addition, his increase in confidence allowed him to focus on learner-responsive methods such as encouraging student communication and facilitating discussion.*

*As we were discussing his plans I brought up some of the feedback I had provided on his lessons to get a read on how he was responding to my suggestions to pre-assess his students on specific concepts and address one of my goals for him.*

*JH: so that was something that I was suggesting when I was looking at your lessons, was if this is stuff that they’ve seen before, especially for Friday’s lesson, you know you’re talking about SOHCAHTOA, stuff like that, would you guess that they probably know that already*

Jacob: I’m trying to think what Friday is, I mean is that really it, just SOHCAHTOA stuff?

*JH: I don’t remember but, I think it’s part of the beginning and you’re gonna go over some examples with using SOHCAHTOA or something like that and I’m thinking, what I suggested and I don’t know if you’ve looked at the feedback yet or not*

Jacob: I haven’t

*JH: I’m pretty sure that they’ve seen this before, so I was almost thinking, maybe it would make sense on Thursday to give them an exit ticket or something that just asks one or two questions to see what they do remember about trying to solve for sides of triangles using those ratios or whatever, you know? Because then you might want to adjust part of your Friday lesson, maybe do some more difficult application problems or something cause you don’t want to spend 15 minutes on reviewing ratios of right triangles if they all ace the exit ticket*

Jacob: yeah definitely (01182011, lines 1456-1471)

*One of my goals for Jacob had been to continue to incorporate some type of assessment to get an idea about the students’ knowledge on a topic before teaching the lesson. I knew the curriculum in his placement and that the content he was planning to teach was not new for most of his students. One of the ideas we had discussed in the summer methods*
The issue was the re-teaching of the same content instead of approaching it at a deeper level when the students had already been exposed in a previous course. While Jacob agreed with what I suggested, he did not seem to be on top of his lessons at this point in his placement and was not familiar with what I was talking about.

I observed his lesson the following day and we discussed the issues that arose in a post-conference. After providing him with my notes from the observation he noticed a comment I had made about him seeming flustered during the lesson and referred to his difficulty with thinking on his toes in front of so many people (01192011 post-conference, lines 1506-1515). His struggle with this limited his ability to respond to student knowledge and questions in a productive, more learner-responsive way during his lesson. His struggle throughout the lesson with content also limited his ability to really get to deep conceptual understanding with his students.

JH: and there was one point where you’re like I need rotational speed are those the same thing, what are your thoughts, you asked them what the difference was and then you’re like, wait, there was no difference
Jacob: yeah, I put those on the same slide intentionally but then I was just running through them and I don’t know if it was lack of preparation, I mean running through the slides before hand would have hopefully made me more prepared to attack that, instead of stumble onto it, yeah I would hope that I cleared that up by my description you know, maybe not (01192011 post-conference, lines 1594-1600)

There were several examples of his surface level understanding of the mathematical concepts in this lesson. In this example he was asking students to compare rotational speed and angular speed and ended up presenting the ideas in a confusing light due to his own confusion. Whether it was his lack of deep understanding or nervousness, I tried to
point out areas where Jacob could have provided the students with more opportunity to think about the concepts instead of just providing them with the answers.

JH: and the fact that you asked you know how do I make it faster and they suggested shorter and then you essentially explained why it was longer
Jacob: yeah I wish I would’ve asked why’d you say shorter
JH: I was thinking we could just go back to that example, I know you were short on time but we could go back to that example and say okay, so let’s make it a shorter radius let’s see what happens (01192011 post-conference, lines 1628-1633)

In this instance I suggested that he facilitate an exploration of concepts with his students to help them see why their thinking was not accurate instead of just telling them it was not accurate. This post-conference discussion was conducted while his mentor was still in the room and she added her thoughts about his lesson throughout. At one point Jacob and I were discussing places where he could encourage more student participation and he suggested he wanted to get more students up to the board. His mentor cautioned him to not force students, especially if they do not volunteer (01192011 post-conference, lines 1685-1687). This demonstrated the pushback Jacob was getting in relation to methods to increase opportunities for students to participate in an environment where it was not a common method employed.

Undoing Progress

As the quarter progressed, Jacob seemed to have more problems than he did success. His experiences are best followed through his daily lesson reflections. The day after my observation he noted several areas in which he saw room for improvement with his lesson and his teaching ability. He noted his need to anticipate student questions that would take time to explain and his desire to have students discuss the problem. This was
followed by a back-up plan of him needing to be able to quickly explain the problem when there was little time. He also posed a question about how he could captivate his students using discussion in situations where he had little time. His last comment was to be able to decide to not use a pre-planned informal assessment when he needed to “press on with content” (Jacob, 01202011 lesson reflection, Figure J.19). It seemed that he began to realize with this lesson that he had to pay more attention to the time he was spending in the classroom on each topic. Even though this was his first week of teaching, this may have been the beginning of the end for Jacob this quarter as he realized he was getting behind in his mentor’s day-to-day plan for content coverage and would need to “fly through” explanations to problems. Jacob also noted his struggle with asking questions that would encourage student discussion but not take much time. His struggle in this area was inevitable since discussions are not likely to occur quickly in any setting so the time limit from his mentor discouraged any improvement in this area. Jacob had also incorporated the exit ticket I had suggested and decided the results would not be useful if the material was not addressed the next day. Jacob did not seem to see the value in learning any information about his students’ thinking and being able to plan more than a day in advance.

Jacob also admitted in a blog post his frustration with being placed with a mentor he did not feel he could learn anything from (Jacob, 01222011, blog post). I had a feeling Jacob would struggle to gain much from his observations winter quarter because I had worked with his mentor before and knew her perspective on classroom practice was not supported by the philosophy of the program. Generally I tried to motivate PSMTs in
Jacob’s situation to look for methods of organization that could be useful to note or try to think of how they would approach each lesson differently than the teacher they were observing. Besides the frustration with his mentor, Jacob’s struggles with different aspects of teaching continued. In one lesson reflection he noted his use of hooks, a post-assessment, encouraging student participation during boring notes through use of applause, and his overall feeling of students being engaged. However, he was still behind his mentor’s schedule (Jacob, 01242011 lesson reflection, Figure J.20). Despite having a lesson he felt better about, Jacob was struggling with covering the materials and was already behind by a couple days. He admitted the lesson was not engaging with a focus on notes but he was able to encourage some student participation and work on improving the classroom environment to be more accepting. The non-engaging approach of covering notes continued in his lessons despite his acknowledgement of low engagement.

Class was highly related to notes today and much of the notes were pretty low-level memorization issues, but I tried to connect the dots and show where they came from with the time I had. I gave a summative informal assessment asking them to create their own word problem, which will be used tomorrow in class to ask the other students. I thought it would be better to give them questions that will relate to them a little more than some of the book questions. (Jacob, 01252011 lesson reflection)

His lessons continued to focus more on notes and memorization, as Jacob seemed to be trying to catch up to his mentor’s schedule. He did attempt to include something more interesting for students by having them create their own application-type problems and had some success with piquing students’ interest the next day.

The students were excited to see their problems up on the board, but no one wanted to come up and solve any of them. Even the smart students that I know can do these problems stayed in their seats the entire time even after some prodding. This was disheartening because I envisioned this class as being like the
class that Boaler wrote about in the beginning of “What’s math got to do with it”. I guess this isn’t as easy as just telling the class to be interactive and openly discuss problems with each other. In the future, I need to look for opportunities to model openness with the class and question why they care so much about what other people think of them. (Jacob, 01262011 lesson reflection)

Despite getting students interested in the word problems, Jacob still struggled to encourage more participation in class by having students come up to the board. He commented on his frustration with his difficulty in encouraging this participation and reflecting on his need to go beyond just telling students he wanted the class to be a certain way and actually try to model openness. This is where Jacob began to demonstrate the conflict with his vision of a learner-responsive classroom and the reality of his experiences. He had been impacted by the discussions of engaging environments discussed in the summer methods course but did not really comprehend the work necessary to achieve those environments. His discussion with his mentor the next day helped him develop a better understanding of the obstacles he faced.

There is the issue of students not coming to the board. [my mentor] made the point that she usually stands up and just talks at them and I made the connection that this is what they how they’ve been trained to learn math so far this year. So the question now is how can I break this? (Jacob, 01272011 lesson reflection)

Jacob had finally realized that he was expecting his students to change from what they had been accustomed to doing. This was something I had continuously reiterated with the PSMTs and knew was going to be a struggle for them in trying to implement more learner-responsive methods. This was often a topic of discussion in small group with many suggestions for encouraging student participation being discussed. I even provided
Jacob with specific ideas in his lesson to encourage student participation. However, Jacob continued to struggle to get students to participate.

Today didn’t go very well. I wish I would have checked Jenny’s comments for my lesson today. She had some good advice on getting students up to the board. I think I will change Monday’s review day to make this more of a group activity instead of watching me write on the board. I’ve also noticed that the questions that I am asking the class are usually very low Bloom-leveled questions because this is the only type of question they tend to answer. I can attack this Monday by anticipating difficult problems they might struggle with having some thought-provoking questions to ask them. (Jacob, 01282011 lesson reflection)

This reflection demonstrated Jacob’s struggle to even get to my comments for improving his lessons and suggestions to get students to participate more willingly. He did plan to adjust his next lesson plan to try to work in my comments and experienced some success from his use of my suggestions. In his reflection on the lesson in which he incorporated my comments he commented on students’ willingness to get up to the front of the classroom and explain their thinking. He also noted that he was not initially prepared for their explanations to go so quickly but was eventually able to ask the groups some questions. He finished his reflection with optimism about his progress with encouraging student communication with an eye toward similar experiences in the future (Jacob, 01312011 lesson reflection, Figure J.21). Jacob was surprised and happy with his progress at getting students to participate and was actually able to recognize his need to improve his questioning strategies based on this experience. This demonstrated the importance of him having experiences that encouraged learner-responsive activities in order to be able to see areas where he needed to improve in other learner-responsive methods.
The next time I visited for an observation Jacob was back to difficulties with clear explanations and the encouragement of sharing thinking from his students. My comments throughout the notes included: “What was the student trying to say?”, “How could we involve more students?”, “Be careful with terminology”, “What about other students?”, “Ask students why this happens”, “Are you sure this works for every function?”, and “Make sure to address this confusion!” (02072011 observation notes). In the post-conference we discussed how the lesson went. Jacob commented on finding time to fix what he had “messed up” and his difficulty with actually finding the time to clearly address the content as he was already a day and a half behind his mentor’s schedule (Jacob, 02072011 post-conference, lines 1716-1723, Figure J.22). This discussion demonstrated Jacob’s continued lack of confidence with mathematical concepts and his struggle to implement his lessons as planned with this content deficiency. He also shared his concern about keeping up with his mentor’s planned curriculum coverage. I attempted to provide Jacob with some ideas to help him gain some ground on his content coverage while not sacrificing all hopes of using learner-responsive methods.

JH: In the homework you already are having them graph cosine and secant then you don’t really need to teach it, you’re gonna have them, they’re gonna be doing it anyways, so you’re gonna be going over it with the homework and you can talk about the different things you would’ve talked about anyways
Jacob: exactly, so yeah, so I’ll be able to polish up on that, cool
JH: I mean I wouldn’t be surprised if the homework didn’t take most of class tomorrow
Jacob: yeah
JH: but that’s okay because your plan is to go over sine, cosine, secant and cosecant anyways, so, so then your question is, how do I want to make sure I’m going over the homework in a way that’s beneficial to them, that they’re getting their questions answered, because they’re all gonna have different problems (02072011 post-conference, lines 1730-1740)
One of the many reasons I have seen teachers struggle to address the required curriculum is by taking the traditional textbook approach of certain sections on certain days without looking for connections among those concepts and possibly considering reorganizing the way the concepts could be addressed. This was why I tried to get Jacob to realize the relationships between the lessons he had planned and suggested that he try to consider addressing the connections among the topics. Jacob was still leaning on his mentor more than his own assessment options for information about his students.

Jacob: my mentor assured me that all of them, like she’s positive every single one of them has done it, if this was their first interaction with it I would’ve been a lot more hesitant to do what we did today but with that I was pretty assured and then I gave them a difficult, cosecant, and that was really my best formative assessment, was being able to go and walk around and yes it took more time, JH: they needed time to think through it on their own though so I think that was a good decision to let them try it out
Jacob: yeah and I walked around and I saw quite a few people, I saw at least two or three, I mean I was only really able to get a good loop because [one student] was sitting there doing nothing so I talked it out with him, they’re both bright and they both got it immediately, so we just kinda talked it through, made sure that they were clear, and then I pretty much continued around in that path and then walked straight up and, I wanna say I saw three or four had perfect graphs and then the other ones were drawing sine, hadn’t quite gotten there yet but they were in the right direction at least so, from what I scanned it looked like they’re at least on the right track, I mean tomorrow I might go around and check the homework as an indicator (02072011 post-conference, lines 1782-1789)

While his mentor’s comment was useful information to know that students had some experience with the concept, Jacob still knew very little about his students and their actual thinking on the concept of graphing. His knowledge of his students was superficial and not well informed at a time when students needed to have some guidance. Instead Jacob relied on the homework to inform him but by the time Jacob would have an opportunity to see student issues, they would have moved on to a different topic. He also
focused his time for formative assessment on chatting with two students he knew had a better understanding of the concepts and did not spend much time assessing the rest of the students. In thinking about using time in class to discuss homework, I suggested having students discuss their solutions with each other to try to tease out places where they were struggling. My goal was to help Jacob think about better ways to involve students in homework discussions and provide them with more opportunities to think about the concepts.

Jacob: I guess that could be, a process of getting them to think more metacognitively like okay, check your own work, are your numbers right, so are your calculations right, are your graphs, where is there an error, get them to think about that maybe

JH: if we just go through and show them, this is how you do each one, you ask a question, I’ll do it for you, then they’re not ever trying it on their own, they’re never trying to figure out what they did wrong

Jacob: where am I failing, yeah

JH: so I think it’s important to give them that opportunity to at least notice an error

Jacob: yeah, I like that (02072011 post-conference, lines 1815-1824)

Jacob demonstrated an interest in this method and seemed to see possible benefits so I focused on areas of the lesson where Jacob had intended to provide opportunities for student thinking to be shared and formatively assess student understanding.

JH: I was like he tries to say something, he’s confused, and you just say I’ll build off of that and you go off and explain it

Jacob: kinda yeah

JH: but then you got a student that said something and you weren’t sure what it was and didn’t want to use it so then you just explained it

Jacob: yeah and I don’t know if that’s just my cop out to try to you know, get him to stop, how do you, unless someone else jumps in and cuts him off, because if you just let him you know die out, you might be there for five minutes

JH: One thing you could do, if you do want to try to get a read from students is, say okay, I like where you’re going with that, I like some of the ideas you said, I wanna hear from, can anybody else add in something, and it just depends on what your purpose is with that moment in the class, if your purpose is to try to get a
read on the students, then you want to make sure to redirect it to other students and not just take it
Jacob: yeah, good point
JH: I mean I understand why you take it, it’s not like why would you do that, but we just want to think about what we’re trying to do and whether we’re getting that to happen or not (02072011 post-conference, lines 1944-1964)

In this case Jacob was attempting to avoid taking up time with a student talking about something he viewed as unrelated to the lesson so he just started explaining. While I understood his dilemma I tried to suggest ways he could have encouraged other students to add their thoughts and emphasize the importance of hearing more from students if that was his original objective. I also was trying to give Jacob more opportunities to learn about his students and their thinking and his tendency to avoid those planned opportunities made this difficult to achieve. Similarly I wanted to see improvement on the number of students he was hearing from.

JH: but I think originally when you started it you were asking good questions, the only thing I asked was how can we make sure we’re involving more students, cause it seemed most of the interactions you were having were from the two students in the back and maybe one or two students towards the front, so formative assessment wise, how many students are you really getting a read on?
Jacob: exactly yeah
JH: so how could we involve more students in that conversation?
Jacob: do you want to chew through that or just want me to think about that later
JH: I don’t know, what do you think
Jacob: um,
JH: I mean this is the same if we were in a classroom right and you were my student if I just told you what I thought then you’d be less likely to come up with it on your own next time, so if you can come up with it on your own this time then you’re more likely to use it
Jacob: yeah
JH: I don’t want to just tell you, not that I have the answers anyways
Jacob: yeah, man, I don’t know on this one
JH: I mean it’s not an easy question
Jacob: I know, I’m thinking through you know just getting them more familiar with the material, because I mean obviously giving them you know 10 seconds of wait time isn’t sufficient because they, I mean most of these problems you have to
actually work through to feel at least a little bit confident, and I mean even the more, the girl that was really confused, she’s usually quick to volunteer and quick to give information, but even with some of this stuff, you know like answering initially may completely lead everyone astray, so you’d think giving more, I’d like to test out having them work in groups, because that’s kinda the direction I’m going, have them work in groups to get a good feel for what they’re doing and then sharing it as a group, as a class, would that you know make the quiet kid that never speaks, speak I don’t know, today wasn’t gonna be the day to test that obviously but, I’m curious to see how that changes the dynamic because earlier I was able to get them into groups and then you know get up to the board and do each problem, that was the review day for the test and they took that pretty well, I mean everyone went up and at least stood there, a couple people, like one person would write, one person would explain it, so that worked out well, which I mean I don’t know, I guess that’s the highest level of interaction we’ve really dealt with so far (02072011 post-conference, lines 2001-2032)

My goal in this discussion was to get Jacob to think of ways to involve students on his own. I was taking the approach that I wanted him to take with his students, ask a question and give him the opportunity to think about it instead of just tell him what I would do. Jacob did eventually come up with something and it was actually what I had suggested he do to get students more involved in an earlier lesson and he had seen it work well with his students. This demonstrated the impact of actually having success with specific methods. Although he added that it was not a method that would have worked for this lesson “obviously,” which demonstrated his lack of persistence in trying to find a way to incorporate learner-responsive methods in any way possible. I followed his suggestion with another idea for him to consider for future lessons.

JH: this is something you might want to do in future classes, if you had whiteboards or something, just say, put up what your idea is in terms of what’s gonna happen if I do this or whatever, but I agree with you in terms of the dynamic of the class, I’m not saying you should call out different students or whatever and say what do you expect, what do you think’s gonna happen, I don’t know if that’s a good time to do something like this, but I mean in general I think the conversation was good and as long as the other students are following along and listening then it’s fine, but there’s just different things that you could do
where they don’t have to speak but they can interact and give you an idea of what they’re thinking, or give them a chance to just talk about them in their little pairs or whatever if that’s something that they’re good at doing, just say okay, we have these four sliders here, I want you guys to talk for five minutes no more, and try to think about what happens when I move the first one, the second one, the third one, and the fourth one

Jacob: yeah

JH: and then they’ve at least thought about it and they might be more willing to answer (02072011 post-conference, lines 2061-2074)

My goal was to give Jacob an arsenal of ideas, knowing that he struggled to come up with his own ideas and had actually had success implementing my suggestions. As our discussion continued Jacob threw in the issue of time as a reason why he may not be able to get students to participate.

JH: it’s just a simple question of why does this happen, and that’s one where you just want to sit there and go, I’m gonna make them answer this, you know, if you need to talk about it in pairs first go ahead, why would this happen, you know, I want you to think about this

Jacob: I feel like that’s a good, just being able to fall back on that if they’re not answering and you have time, talk about it with your table partner over there

JH: yeah, this is a question that I know you guys can answer but it takes a little bit to think about it

Jacob: I mean normally they’d anticipate me just moving on and having to cover material so having to move on, so being able to kind of put your foot down and you know talk about this (02072011 post-conference, lines 2100-2109)

While he demonstrated interest in the idea, he had to throw in the caveat of “if you have time” because that had been his biggest issue for the experience up to this point and he knew it was impacting the way he was teaching. Other than discussions about getting him to involve students more and incorporate more learner-responsive pedagogy, we discussed many different content areas where Jacob had struggled during the lesson. I brought up the different areas that he had glossed over and had him think more deeply
about the concept in order to help him understand so he could address the issues in future lessons.

At the end of our discussion Jacob brought up an idea he had for a project to get students to think about mathematics from a more abstract perspective.

I would like to make a concept chart and so I’m thinking about, I’m a big picture guy and that helps me so much to do that and I would love to be able to you know, give them that little nugget of information, to hopefully map this out, which I would love to do (Jacob, 02072011 post-conference, lines 2169-2172)

Jacob’s interest in concept maps stemmed from the way he felt he best learned. I encouraged him to move forward with the idea and work it into his lessons because I knew it would provide him with more opportunities to learn about student thinking. It demonstrated his ability to be creative and his interest in emphasizing mathematical concepts and connections despite his problems with demonstrating this interest in his actual lesson implementation. Jacob’s reflection for the day demonstrated a little of what he got out of our discussion.

The two main areas of confusion that I created today I had not realized were not always true until Jenny pointed it out to me. Jenny and I had a good discussion about a variety of methods of formative assessment and seeking out the best possible one for this specific class. She pointed out that around 25% of the class was participating in the class discussion. Increasing this percentage increases my ability to move with the class. (Jacob, 02072011 lesson reflection)

He was honest about his content issues and noted that our discussions about formative assessment and student participation were helpful. The next day’s lesson did not go well. He admitted that he felt he had “completely mislead” his students. Due to playing “catch up” with his mentor’s schedule he had taken the approach of explaining difficult concepts at the board for the lesson without taking the time to explain the ideas really well (Jacob,
At this point Jacob was really feeling pressure from not keeping up with the curriculum plan of his mentor’s. He was struggling to cover the material in a beneficial way in order to address the material in the way it was presented on his mentor’s assessments. The following day further demonstrated the pressure he was feeling from his mentor.

Today was a relief. I graded the quizzes they took today and the average was a 93% which is the same as [my mentor’s] other classes. This was a relief because of how much the students seemed confused about the material and complained a good amount to me the days before. (Jacob, 02092011 lesson reflection)

Jacob was extremely relieved to see similar scores on the assessment for his students in comparison to his mentor’s. The next day the pressure finally led him to give up on much use of learner-responsive pedagogy. He wrote “Today I conformed to some degree to [my mentor’s] teaching style in order to get through the content.” He admitted that he was struggling with his use of his mentor’s methods as it did not align with his vision of a “class full of students willing to share their ideas, misconceptions, and openly work through complex problems.” He resolved to try to encourage student participation using flash assessments within his mentor’s methods but admitted he could not envision the result. He also mentioned his desire to develop a project for his students to create concept maps but knew it would take him time to actually be able to implement it (Jacob, 02102011 lesson reflection, Figure, J.24). Despite his decision to copy his mentor’s method of delivering content to a silent classroom, Jacob still mentioned his desire to have a more learner-responsive classroom. He even provided several different ideas to try to encourage student participation in little ways taking the resistance from students he had received into account. Toward the end he demonstrated an interest in putting his
concept map project idea into his lesson plans but was struggling to balance the demand from his placement experience on top of work from his university courses.

Jacob provided a glimpse into his struggles throughout his placement at this point through his formal reflective paper. He had envisioned the classroom environment in his placement as initially being similar to the learner-responsive environment described in the readings during the summer methods course. After describing the environment he had expected in an ideal world he even suggested that he had been “immersed in a constructivist culture of teaching” (Jacob, 02102011 reflection on teaching, Figure J.25).

This vision of his was surprising to me because I had been fairly clear that it was unlikely to be something they would encounter in their placements. It was also surprising that he would suggest he had been immersed in learner-responsive methods since he had just completed a placement during fall quarter that he acknowledged as not aligning with the learner-responsive perspective. This suggested Jacob’s tendency to focus on the ideal and not pay attention to cautions about or observations of reality. He continued to describe the traditional methods his winter mentor employed and admitted that he had thought he could easily alter the classroom environment and did not expect the realistic complications of difficulty with curriculum pacing and student discomfort with learner-responsive pedagogy. He described these complications as a “necessity” pushing him to teaching traditionally even though he realized the focus on “getting through the material” and not “depth of understanding.” This was followed by his concerns about being able to implement the learner-responsive methods with the inevitable lack of support in any teaching position (Jacob, 02102011 reflection on teaching, Figure J.25). He had entered
placement with a dream that had slowly been squashed from the constant pressure from his mentor, the curriculum, and even from students. Even though he had been told by me to expect this, he had not really thought about the difficulty. At this point, he had concluded that the environment of the school and curriculum forced a more traditional approach to teaching. He acknowledged that he would probably take a more traditional approach in his first year of teaching and questioned whether he would be able to deviate from it in future years. Jacob initially ended his reflection at this point. Unfortunately, it looked like Jacob had given up trying to find ways to change the environment of the classroom he was working in and felt he had no choice but to capitulate to the traditional approach to teaching. While he did suggest that taking a learner-responsive approach was something he felt he could work toward as he gained experience I was concerned about the lack of concrete ideas of how he could achieve this so I asked him to expand his writing to address his options.

One problem is that there might not be a teacher in my immediate work place with this philosophy. This can be simply solved by staying networked with teachers that do. The question then is, “do I have this drive?” I think I can honestly answer this question, “yes”. (Jacob, 02102011 reflection on teaching)

Jacob acknowledged the importance of resources to support him in his endeavors but did not mention any specific approaches he would take to try to develop a more learner-responsive practice other than rely on others to help him.

In his lesson the next day he again commented on his struggle with time when he felt he had no choice but to say “I’m sorry” to a student who raised her hand and expressed complete confusion. He wrote about how he would have preferred to stop the lesson and probe the student about her confusion. He acknowledged that his teaching was
suffering due to his race to keep up with the curriculum. He even mentioned the need for more time to his mentor and she suggested students would always want more time spent on concepts (Jacob, 02112011 lesson reflection, Figure J.26). This demonstrated the perspective of content coverage being more important than considering the actual learning of students.

At the next small group meeting Jacob shared his goals for winter placement.

I have to use more open-ended, non-knowledge base questions that encourage critical thinking and just kind of creating that atmosphere of discussion where I feel like walking into my current placement there isn’t that, and so she just kind of has this lecture atmosphere currently (Jacob, 02112011 small group, lines 144-147)

Jacob: so better clarifying my objectives and then better tying my assessment to that cause right now that’s kind of nonexistent, and then better engage the extremes of the students, last week we talked a lot about hitting the highs and lows of the spectrum of students

JH: so do you feel like you have an action plan to attack these goals?

Jacob: not really, I wrote something down here, somewhat, I don’t know, it’s kind of on the drawing board right now, along with some other stuff (Jacob, 02112011 small group, lines 172-177)

Although Jacob had great ideas to work on for his classroom practice, he again could not provide concrete ideas for working toward those goals. A few days later Jacob decided to ask his students to share their thoughts on the methods I had suggested and he had successfully used for the review session.

I both despised and really enjoyed how class turned out today. Before we began our normal review session, I asked the students what they thought of the last one. A significant number of students gave highly negative opinions about it so I changed plans mid-class to accommodate. They wanted me to work through the problems for the entirety of the period, but there were a few times where I got stuck in the middle of a problem. At this point, I opened the floor to the students to see what their thoughts were. After a good amount of time, one student finally began explaining what he did and then got to where he got stuck. He sat down and then I asked the class again where to go from here. Shortly after, another student
came up and made a few great points and explained the problem further. From here, we were able to get to the solution. (Jacob, 02152011 lesson reflection)

Based on the student response against having to participate, Jacob decided to go with what the students were used to and go over problems at the front of the classroom. He struggled with the content in a few places and instead of trying to work through it on his own he used the strategy I had suggested and relied on the students to suggest ideas. He was able to have success with this method and worked around his content struggles at the same time as encouraging student participation.

A comment Jacob later made in a lesson reflection demonstrated more insight into his perspective on the purpose of education and his role as a teacher. “These students take their grades very seriously. This should be motivation to instruct them as best I can” (Jacob, 02162011 lesson reflection). This comment demonstrated his students’ perspective on grades as education as well as Jacob’s main concern in his winter placement on making sure his students’ grades were comparable to his mentor’s students, not necessarily whether his students were actually developing understanding of the material.

Considering Jacob’s struggle with learner-responsive pedagogy in an environment where it was not welcome I had him view and critique Derek’s video to see an example of learner-responsive pedagogy in an initially unwelcoming environment.

There are many small but significant things that you did to help the classroom environment. My favorite was when you told the students at the board that they were the teacher and that they had to explain what they were doing to the class. This is not only good for the person at the board retaining the knowledge of what they are explaining, but this gives the students a teacher that they relate with much more than you. I hope to embody this practice in my own teaching. Many other times you were encouraging to the student at the board. When one
struggled, you pointed out that if she was confused, 15 other students were probably also confused. I was surprised at how many students were willing to come to the board and how when one finished her work, the other students (seemingly authentic) clapped for her. She seemed excited and motivated as she walked away from the board. Everything that you did in terms of your explanations, your working with individual students, and the atmosphere you created was great. (Jacob, 02212011 critique of Derek)

Jacob noted Derek’s ability to encourage student participation and a safe environment for students to feel comfortable sharing their thinking. He pointed out many different ways Derek had been able to encourage student participation. The act of viewing Derek’s video seemed to have at least achieved my goal of him seeing ways to encourage student participation. It was not evident whether he had noted Derek’s role in creating that atmosphere.

A Little Improvement

As winter placement began to wind down Jacob began to see little areas of improvement in his students’ willingness to participate. He expressed frustration with the students’ willingness to sit in a silent classroom and copy notes from a teacher. However, he took note of his students “becoming more willing to say incorrect answers” (Jacob, 02232011 lesson reflection, Figure J.27). Jacob noted his frustration with students not being used to his method of teaching but was excited to observe a little area of built-up comfort with him so students were more willing to share their ideas without being concerned about correctness. He spoke more about his frustration with the student resistance in his blog. Jacob noted that he was enjoying teaching and reflected on the students’ resistance to his teaching methods because of their prior experience and success with more traditional methods of teaching. He acknowledged his belief in learner-
responsive pedagogy as well as his new understanding of the difficulty of putting it into practice (Jacob, 02272011 blog post, Figure J.28).

Toward the end of his placement, Jacob began to demonstrate more insight into ways to use his lack of deep understanding of content to his advantage.

As I finished teaching today, I noticed that what I was saying did not make sense. The class ended and I realized that I forgot to do one step that threw off the results completely. At first, I was mad at myself and frustrated, but I quickly realized how great this will actually be. This not only gives me a platform to further dive into the material, but it also gives me an opportunity to do a think aloud and demonstrate metacognition. (Jacob, 02282011 lesson reflection)

*Jacob decided to take the approach of using his content mistakes as opportunities to approach the content again using multiple representations. Unfortunately, he chose to use the opportunity to personally explain his thinking instead of providing his students with opportunities to use their own thinking.*

As Jacob transitioned out of teaching for the quarter he reflected on observing his mentor teach. He commented on the similarity in the flow of the class and made a goal to try different approaches in his next placement experience. He also took note of the presentation of material without any meaning leading to expectations for thoughtless memorization (Jacob, 03042011 lesson reflection, Figure J.29). *Once he sat back and was able to observe his mentor’s methods he realized again how her methods were not what he really wanted to use and made a goal to not follow his mentor’s methods so closely next quarter.* Jacob reflected further on observing his mentor in a blog post. He commented on the importance of attitude and motivation for students and a revised overarching goal for teachers to “get students to be learners that naturally desire to understand.” He argued for the importance of depth of understanding in education and
used his own difficulty with mathematics as an example of the results of a focus on breadth in education. (Jacob, 03082011 blog post, Figure J.30). **Jacob demonstrated his interest in motivating students to understand mathematics as well as his perspective on the importance of deeply understanding mathematics instead of addressing content at a surface level like he had approached it throughout his own educational career. Just as he had originally emphasized in the summer methods course, he was still concerned with encouraging student motivation to learn and did not necessarily demonstrate a perspective suggesting his role in providing students with those opportunities to deeply understand the mathematics.**

Toward the end of the quarter all of the PSMTs administered self-created surveys to their students for feedback and were required to analyze the results. Jacob brought the results to small group and shared his initial concern with the feedback he had received.

I haven’t really gotten to analyze it or anything but I flipped through them quickly and the last question on my likert scale one was, if you could have [the student teacher] in a class again would you take him, and a lot of them put no, and I was really surprised, and that kind of caught me off and then some of their short answers were pretty harsh in terms of, and all the students were pretty, I don’t know picky, I don’t know, and I prefaced it as, I wanted to make sure that, I had good feedback, so I was making sure, like be intentional, the more feedback you give the more I learn from this experience and I said I can take negative feedback, cause it seems like the way you preface it, really, puts a lot of emphasis

*JH: well I mean you want them to be truthful*

Jacob: and I do, I don’t know if I emphasized it too much or they just like think I suck or what, but just, I guess I don’t know how to deal with that in terms of the analysis now, because from what I’ve seen of the analysis you give bar graphs of how sweet you are

*JH: would have been nice to ask why, to have them say, please say why you picked what you did if you were on one extreme or the other because then you’re not just guessing* (03112011 small group, lines 222-241)
Jacob was hurt by the responses he received from his students. From what I had observed, read in his reflections, and heard from him, I was not surprised the students responded the way they had. Students are typically not very forgiving of teachers who make frequent content mistakes as Jacob had. In addition, I shared with Jacob and the rest of the group that it would not be surprising for their students to be irritated by the learner-responsive methods and not realize the usefulness of being challenged and pushed until years in the future.

In one of his final lesson reflections Jacob recorded a story he wanted to remember to share with his students in the future.

**Good first day pep talk** – “When I was in high school, one of my favorite classes (and the one I learned the most from that I still use to this day) was woodshop. For those that have taken woodshop, what do you do during class? [Build things] This class does NOT consist of the shop teacher building beautiful projects while we all sit back, watch, and take notes. I think this class was so beneficial because I actually got to work with the materials and tools. I was able to manipulate, create, and construct things for myself and this enabled me to be able to do this today still. What I learned from this (and verified it by doing some research and looking around this world) is that learning is best achieved when constructed by the individual. What this means for this class and for you is that you will play an active role in this classroom – not because I’m lazy, but because this is how you will learn best. (Jacob, 03072011 lesson reflection)

This story demonstrated Jacob’s interest in motivating students to become actively engaged in the classroom in order to more effectively learn mathematics. His description of constructing learning aligned well with learner-responsive perspectives.

Unfortunately, he had struggled to make much progress with learner-responsive methods throughout his winter quarter placement experience. Based on his lack of progress, my goals for him during spring placement were to continue to work on finding ways to help students adjust to learner-responsive methods and to continue to work on questioning
strategies (JH, 02272011 FEAG). One additional goal I had for Jacob was created during a discussion we had following a small group meeting. During my last observation, right before we met to discuss goals for the next experience, he had demonstrated even more reason for me to question his mathematical preparation and understanding by completely approaching a problem incorrectly for his students. I made it clear to Jacob that he needed to buckle down and prove to me that I should not be concerned about recommending him for a high school position in his next placement. Jacob’s goals for himself were:

- Evaluate and assess what is the best and most effective way of teaching and make a one page cheat sheet of practices to embody. Reflect on these frequently to see if I conform to this.
- Develop a pacing reflection system where it can be quickly and effectively maintained and referenced in order to get a more accurate view on how much time is needed for each topic.
- Work towards a more efficient form of pre and post assessment that is more accurate than discussion. (Jacob, 03012011 FEAG)

His goals continued to demonstrate a perspective that effective teaching consisted of a short list of skills to master and put into practice in the classroom. Jacob’s continued struggle to make much progress during his winter quarter placement experience and his continued struggle with mathematical content distracted from my ability to really emphasize learner-responsive experiences in his student teaching. I also was not familiar with his placement for spring and did not know to expect the intense pressure to stick to a thoroughly pre-planned, teacher-centered curriculum.

**Spring Placement – Focus on the Teacher**

Jacob’s spring placement was in another suburban high school teaching pre-calculus and algebra 2. He specifically requested the school and the mentor for personal
reasons. In this placement the day-to-day curriculum was painstakingly planned out and created by one teacher who took a traditional, teacher-centered approach. Jacob was encouraged to try to adapt the pre-planned worksheets and homework but was not really given much freedom to move and adjust the curriculum calendar. Despite having a peer from the program to collaborate with he did not resist and just went with the flow of the school he was in. He also struggled to keep up with all teacher responsibilities and admittedly did not focus on trying to develop engaging lessons for his algebra 2 class because he was not as interested in the material and did not feel a connection with those students (students who were overall less motivated academically).

*Getting into the Zone*

*Jacob entered the placement with low self-confidence on his understanding of content based on his difficulties in his winter placement and a conversation I had with him strongly encouraging him to spend enough time preparing for his lessons so that he would be better prepared mathematically.* “The content has been bothering me a good deal. After my last mix up at [winter placement] in completely screwing up the final problem I did, I think my confidence has been lowered in my ability in front of the class” (Jacob, 03202011 blog post). His admittance of his low confidence in his mathematical understanding had the possibility of bringing him back to his nervousness from fall placement. However, he observed his mentor handle her own content problem in front of the class of students only a day later and this observation helped him to see how to handle some weakness in mathematical understanding in the middle of class and realize that it is not uncommon to not know everything. His observations of his mentor at the beginning

145
of spring quarter also reinforced some of his perspectives on and experiences with teaching.

[My mentor] does a good job of being clear by letting students know how information fits into their existing schemas. She will touch on prior knowledge, give an anticipatory view for lessons ahead, or briefly describe the topic before she exhaustively addresses it in class. This is very helpful and requires thorough knowledge on the topic. The more I think about it, the more time I needed to put into the precalc class I taught last quarter. I need to do the homework that the students do along with other activities in order to understand literally anything that could come up during class. (Jacob, 03222011 lesson reflection)

Jacob noted the importance of keeping students informed of upcoming material and connections to past material but his mentor as a model reinforced the idea that the teacher needed to do the majority of the talking for students. While he did seem aware of the importance of helping students build connections, he did not seem to consider whether his mentor’s idea of the students’ prior knowledge was accurate or just assumed based on knowledge of the district curriculum. I was also surprised that Jacob seemed so influenced by his spring mentor yet critical of his mentor from winter placement when they had similar approaches to teaching through extensive explanation.

Jacob chose to begin his student teaching the day after returning from spring break. He was pleasantly surprised by his own ability and the ease with which he was able to adjust to teaching. He commented about his increase in comfort with the mathematical material based on the increased time he spent preparing and ability to take note of mistakes made by students to inform the type of assistance he provided them. He characterized this comfort as finally being able to find a “groove” for his teaching (Jacob, 04112011 blog post, Figure J.31). Jacob demonstrated the perspective on teaching again that it was just something to adjust to and there was some specific way that it was to be
done and he had gotten to the point where he felt comfortable with that method. This perspective does not seem to lead into a belief of adjusting your teaching approach and being flexible based on different students and different environments. As he had more experience in front of the classroom Jacob became more and more confident about his teaching methods and felt successful. These experiences unfortunately were reinforcing a confidence for traditional teaching methods. His self-critique for spring quarter demonstrated his development of confidence for traditional teaching methods. He described how he noticed he spent a long time describing examples at the board in his lesson and then provided students with time to work on problems and circulated the room. He focused his comments on his increased comfort in talking with students individually and increased confidence with the mathematical content. Jacob specifically chose to focus on his encouragement of multiple students sharing their solutions to demonstrate his learner-responsiveness (Jacob, 04132011 self-critique, Figure J.32).

Jacob’s comfort with the teacher-centered approach of delivering content to students for long periods of time at the front of the class had grown and his lack of comment about lecture being boring demonstrated a change in perspective. When he observed himself talking for long periods of time during fall placement he remarked how boring it was and that sentiment was not mentioned this time. He did demonstrate some interest in more learner-responsive pedagogy by asking for multiple solution approaches and encouraging student sharing but only because the problem lent itself easily to multiple approaches. Would Jacob think to ask for multiple approaches on other problems?
Jacob’s spring formal reflection provided insight into his struggles with developing learner-responsive pedagogy throughout the program. He started his reflection by emphasizing his main issue as “time.” He described how he was introduced to education, providing a summary of his experiences in the program. He mentioned the content taught in each university course and suggested that the summer methods course taught by me “was one of the few classes where teaching was actually modeled.” He also described his placement experiences as “trying to soak up” in fall, “get a taste of responsibility” in winter, and struggling with time in his spring student teaching. He described his approach to lesson planning as mainly adding his “flavor” to his mentor’s lessons instead of “searching for the most constructive, inquiry-based lesson.” Jacob was not satisfied with the approach he was taking but felt he did not have time to do what he wanted to do. He added that he viewed his first year of teaching as being similar and that it would only be over time that he would be able to get to “where he wanted to be as a teacher” (Jacob, 04172011 spring reflection, Figure, J.33). *His conclusion demonstrated the struggle that many PSMTs encounter with just not having the time to develop engaging lessons and feeling so overwhelmed that lessons are reduced to basic copying of a mentor’s teacher-centered approach. He was well aware that he was falling significantly short of the learner-responsive pedagogy he had seen modeled by me in the summer methods course but did not feel like he had much of a choice but to wait until he had more time to commit to improving his methods.*

Jacob’s experiences in his spring placement did provide him with the opportunity to work with students who struggled more with mathematics and had lower motivation.
Shortly after Jacob began teaching he began to reflect on trying to reach the students in his lower level classes. He struggled to relate to these students and reflected on different approaches he could take with these students based on his perception of their ability to process material. He suggested he needed to be “extremely intentional” and “make his explanations crystal clear” (Jacob, 04202011 lesson reflection, Figure J.34). He also struggled with keeping their attention. “[Algebra 2] was tough today. With it being Friday, students were focused on the weekend and did not want to sit through another boring math class” (Jacob, 04292011 lesson reflection). *He had not seemed to consider the possibility of making the “boring math class” more engaging and interesting to his students.*

Jacob also struggled with lessons dominated by him talking in his pre-calculus class. He commented on planning to incorporate methods such as collaborative work but found himself “ranting at the students for the entire period.” He did not like the methods he was using but was not able to get feedback from his mentor or a peer about different approaches to take and decided that his traditional approach was maybe the only option (Jacob, 05042011 lesson reflection, Figure J.35). Later he commented again on disliking his approach with his algebra 2 class.

I feel like I’m almost doing them a disservice by not challenging them. They seemed bored in class and have been especially talkative this week. Those that are taking the class are obviously not mathematically inclined. Many of them are seniors and they just need to pass the class to get through. This means that the curriculum is watered down to the point that they barely have to think in order to do well on the test. Math is reduced to having the correct formula, substituting in your variables carefully, and typing it in your calculator. Students walk out of this class seeing math as nuisance and they are only frustrated, still when they try to work things out. I guess them *walking out* is an accomplishment – meaning that they get through it… but that sets the bar pretty low. I do not have the naïve
assumption that I can personally get every student in my classroom to absolutely
love math, but I feel that I can at least make it fun to some degree. What I am
doing now is not fun for them… (Jacob, 05102011 lesson reflection)

Jacob recognized that his lessons were not presenting the students with a challenge that
would encourage them to learn. He acknowledged that his lessons were not fun and he
could at least work more toward that even if he could not achieve motivation for all
students. Jacob questioned the traditional use of worksheets from the textbook and
wondered whether the teachers in his placement had ever tried to make the mathematical
content “remotely interesting” to the students. He suggested that it was possible it had
been attempted and failed in the past or just never tried (Jacob, 05232022 lesson
reflection, Figure J.36). Jacob’s perspective seemed to be that the lessons could be
planned to be more engaging and motivating for students. His question of whether the
teachers had tried to make it more interesting and not had success suggested that he was
not convinced that it would make a difference for these students showing a little doubt
about the effectiveness of learner-responsive pedagogy.

I had the opportunity to observe Jacob’s last lesson in his placement and we
discussed the lesson a couple days later. He seemed distracted throughout the post-
conference discussion but I tried to address methods used that he seemed to have
developed more confidence in but were leaning toward a teacher-centered approach. I
brought up a specific instance in the lesson when a student demonstrated an interest in
only knowing enough to do well on the assessment and not caring about understanding
the concept.
Jacob: I was that student too that mind dump on the test and then forget everything and then I finally actually learned it in abstract algebra in college, so I mean I would like to battle that and confront that but how do you do it

JH: I don’t point that stuff out to say that I can’t believe that you haven’t addressed that here but knowing that that is something that students struggle with, how can we address it, and is it a goal of yours to by the end of the year to not hear as many of those things, that’s 9 months worth of work, so what are the things that you as a teacher want to try to do to try to make it so those aren’t the types of things that you hear by the end of the year

Jacob: yeah, which I think that’s a good way to say it, by the end of the year as opposed to you know right away completely oust that because it’s completely unrealistic, you’re not gonna get that with the typical students, because some students, I can think of a couple in particular, I mean they just don’t care and they don’t want to and you’re not gonna, I mean unless something crazy happens you’re not gonna give them the motivation to do that (05252011 post-conference, lines 2377-2389)

Jacob acknowledged the student’s perspective and admitted that it was similar to his own approach as a student. My goal with bringing this issue up was to try to encourage Jacob to pay attention to his students’ perspectives and see if he could have an impact on their perspectives once he had his own classroom. Unfortunately Jacob seemed to have developed a pessimistic view on his ability to impact student motivation, which was initially his main interest throughout summer, fall, and winter. I had also observed Jacob’s increased confidence with explaining difficult solutions and ideas but cautioned him on taking over the conversation in the classroom.

Jacob: yeah I’m curious to see, like you have in terms of confidence, was there anything that I did that stood out?

JH: you were just running through explanations fairly quickly actually, I mean there wasn’t much hesitation compared to what I’d seen in the past, it was obvious that you had spent time on the material making sure that you understood it, it just was obvious

Jacob: good, awesome

JH: so now we know that you have the content down, now you want to work on not breezing through it to the point where it’s look at how awesome I am at explaining this, cause I think that sometimes we think that really good teachers can just explain things really well, while that is important it is also important to
give students opportunities, so you want to balance those two things and not just take it over with explanations of your own
Jacob: yeah
JH: I mean there were just a couple times when I was sitting there just paying attention, you had a couple girls in the back you were having a conversation with back and forth, they seemed to understand what was going on and the guys in the front were just lost
Jacob: yeah those four, there’s a set up there that was like, and I’m looking at the class and then these guys and it’s funny that they’re immediately in front of me because if they were right here I’d be on them, but I mean they’re always screwing around they’re always on their ipods they’re always, just doing everything, and they’re always harassing each other, they’re completely apathetic, I don’t know, they’re just checked out, I don’t know if they’re all seniors but JH: it just made me think of the balance of students who really get it, the students who don’t, and the student in between, how do I reach all of them at once
Jacob: yeah, and that’s the question
JH: well I think it’s a matter of you trying to spend time with them now outside of the class or having them come in and talk to you, try to find ways to help them not necessarily during class but it’s something you’re gonna always struggle with, so I just think, I think everyone should, just put something like this, I don’t know somewhere where you’re always gonna remember, it’s just something to keep in mind
Jacob: yeah I need to brush up on that
JH: cause I think that as people who want to be teachers, we want, we feel like explaining things to students and saying things is how we are good teachers but then remembering that it’s not necessarily the case, I think it’s a really hard thing to do
Jacob: no but I mean there are I mean even the majority of my students, not the majority, some of my students now, just stop talking, I learn more when I do it, and I’m like, I’m glad you know that, but, what you were saying, setting them up and that’s the balance, I don’t know, there’s so many different things that require that perfect balance of error on either side is messed up so JH: I just feel like at this point, okay, next year I’m not gonna be here to constantly say don’t forget, so I want to try to find ways to get you to remember Jacob: you should give like a bulleted list of Jo Boaler quotes or different things from that or don’t forget these things (05252011 post-conference, lines 2398-2441)
JH: when you’re going through and doing explanations you wanna find some method of checking whether students are following you, I mean sometimes we just sometimes will do the sort of thing where you’re working through the problem and you just ask them to fill in the blank or whatever and that doesn’t necessarily tell you that they as a class are following, it just means that at least one is following so trying to find some method that works for you for you to be able to say yes I know, a certain percentage of the class is with me, you know I’m not just
talking to myself or talking to one or two students (05252011 post-conference, lines 2450-2456)

Jacob seemed excited about my note of his improvement with content but I wanted to make sure he was aware of the consequences of his domination of the conversation and his lack of formative assessment to see if his students were following his explanations or even able to think about the content in a meaningful way. Unfortunately Jacob seemed to have concluded that the students who were struggling did not care and he had given up on having any impact or trying to help them. My main goal with this final discussion with Jacob was to try to reinforce some of the methods and perspectives that I felt had been overridden by his experiences in his placements. My goals for Jacob in his first year of teaching were to remember to “never say anything a kid can say” and to keep his lessons interesting and break from the “traditional” routine (JH, 05232011 FEAG). I knew Jacob had developed confidence in teaching in a traditional, teacher-centered way and that was most likely how he would approach teaching in his first year if not longer. Therefore I was focused on the overarching goal of trying to keep the benefits of learner-responsive pedagogy in mind. Jacob’s goals were all focused on methods of grading and organization to make his life as a teacher more streamlined. There was no mention of focusing on student learning at all. Jacob’s third experience with a teacher-centered mentor and placement environment seemed to have solidified the separation between the reality of school context and the dream of a learner-responsive classroom environment. Without consistent support from me to try learner-responsive methods, Jacob “went with the flow” of the models around him.
Final Interview & Synthesis

The final interview began with a focus on getting an idea of where Jacob was in his thinking about teaching and learning in mathematics.

I see math as a way of thinking, I mean it’s a way of thinking that obviously entails many easily tangible process skills but, you’re teaching the processes and that can be done relatively easily, I mean I feel like we play school and we’re just like, if you do this, this and this, then you get to the answer and then you’re done, but part of the process, part of math, part of this whole thing is knowing what this, this, and this is, knowing those steps, knowing how to create those and how to get to that point, so teaching math is getting them to the point where they can think that way, so, I mean of course there’s small steps, I mean it can be broken down into small steps, I mean it’s continually going back from big picture to small picture, big picture to small picture, where you have to step back and be like, okay here’s where we are, and I love that about it and I love that you can, I don’t know, the complexity of it that it requires that, but I feel like so few people do that, and that was one of the biggest challenges with me in my learning process, and once I realize that, that’s kinda really what I’ve thought of as my benchmark of teaching is I want to really be able to nail that home and be able to model that and then teach that to students (Jacob, final interview, lines 2476-2593)

Jacob was quick to characterize mathematics as a way of thinking. His description seemed to focus on procedures and knowing why procedures work but lacked details to demonstrate his understanding of mathematics conceptually. He even admitted that he did not approach learning mathematics in the way he wanted to encourage students to learn. When I asked Jacob to share what had impacted his perspective he went back to his original issue of not having any experience with education and lost his train of thought so I posed the question again. He talked for a while about the value of seeing models in the summer methods class and his placements and actually getting to teach as being influential.

Jacob: I would say summer quarter, seeing it modeled by you was exceptional, just being able to get a good vivid picture of what that looks like, was extremely beneficial, and then, so having those kinda schemas established summer quarter,
but I mean I would say just, to building up my knowledge and then seeing models and then kind of just taking all that in, I’m very organized in terms of I’ll take notes of something and then I’ll put it back into my system of notes

\textit{JH: so you’re like a computer}

Jacob: kind of, but I mean I have a teaching document and I have a resources document and so pulling all that in and then building my own, textbook on teaching I don’t know, it’s not nearly a textbook at this point but

\textit{JH: it’s like a pamphlet}

Jacob: yeah it’s like a small pamphlet, two pages, so just that process but throughout that whole of me putting that and taking my notes and putting it into that, that was mainly reflection (Jacob, final interview, lines 2507-2529)

Jacob leaned heavily on his inexperience allowing him to just build understandings and adhere readily to the theories presented in the program. He also mentioned being able to see me model methods in the summer methods course as being helpful. His reference to the teaching document he was creating demonstrated more evidence of his perspective that there are specific skills and methods that must be used. It is interesting to note that his list was not very long after a full year in the program. I followed that question with an inquiry into his thoughts on his beliefs being challenged throughout the program.

it’s tough because I, hmm, kind of in-between answering that because I wanna say, I knew what teaching was because I sat through class after class after class, but I mean my focus while in those classes was focus on the content, whereas now when I see a class I absorb the content and I also critique the actual teaching process with you know, what I’ve been exposed to, so I wouldn’t say I really had beliefs established but I would say that any beliefs that I had were completely obliterated and changed and I mean everything was challenged, in terms of what I actually, because I mean I’ve helped with tutoring and that’s really the only front that I’ve seen with teaching, outside of that I’ve been doing manual labor my entire life, so it’s not like I was really exposed to it heavily, so I mean outside of that, I would say yeah, everything was challenged and I mean I feel like I came into this program fresh more or less and we’re all bias in our own ways but I feel like, yeah I mean I didn’t have any preconceived notions and I didn’t have any predispositions that would set me back or forward so I feel like I came in as a blank slate (Jacob, final interview, lines 2537-2549)
Jacob was still focused on approaching his perspective of education as being completely formed within the teacher preparation program. His comment about being a blank slate demonstrated to me a possible belief in learning as being something that replaces existing knowledge instead of building off of existing knowledge. So I dug more into his beliefs about learning from the perspective of his students.

_JH: now thinking about that, do you think your students come into your classrooms as blank slates_

Jacob: as math students no, definitely not, no I don’t think they all have been, I mean especially any place that I’m going to be teaching they all have been exposed to math up to that point and they all have you know either been trained poorly or very well, on that issue and they do have some concept of what’s going on

_JH: so then from my perspective, I don’t see teachers coming in, you know you guys coming into the program as blank slates because you have seen teaching but you maybe haven’t thought about it kind of like how those students you said maybe haven’t thought about_

Jacob: and that’s a good point because, I mean I’ve been exposed to teachers that I’ve liked and I’ve been exposed to teachers that I didn’t like but I never, it was always I don’t like that teacher or I do like that teacher it was never, I wonder why I don’t like that teacher, well, I guess because his worksheets are actually pointless, and I would like to have a more, I don’t think I’ve ever

_JH: I mean you were asked to think about that once you got into this program but maybe not before that so you were blank along the lines of reflecting on it maybe_

Jacob: yeah, hmm, I need to reflect on that (final interview, lines 2550-2582)

Jacob had become accustomed to thinking about his own development as completely beginning within his experiences in the program. My suggestions gave him food for thought but his reluctance demonstrated the strength of his belief. I then asked him to consider his response about how he thought mathematics was learned and whether he saw his teaching reflecting his perspective. Jacob was very honest about his own teaching not meeting his overall vision of himself as a teacher. He spoke at length about the difficulty of teaching within an environment where those methods were not prevalent or
encouraged and even discouraged at times. He also spoke about the difficulty of developing learner-responsive pedagogy in most environments and his plan to begin to work toward more learner-responsive teaching after his first year (Jacob, final Interview, lines 2583-2609, Figure J.37).

I followed with a question about his perception of constructivism and he struggled to provide a coherent explanation of his understanding demonstrating a lack of understanding on the concept. This was surprising to me in consideration of the shop class metaphor he had written about in his reflective writing demonstrating a strong connection to the constructivist perspective. His perspective on student-centered teaching was easier to follow and hinted at some of his beliefs about constructivism.

\textit{JH: so what would student-centered look like? What would be some characteristics of a student-centered teacher?}

Jacob: I mean, let the student do the work and let the kids go up to the board and you know explain their reasoning, and they take the time to, I mean they value student opinions and they value student mistakes, they have an air of openness where, students can do that and they you know make this environment such that kids feel comfortable doing that so, I don’t know, open and, yeah, allowing student mistakes, I mean for the benefit of the class being able to, build from those even though it takes more time to do that because often times, it does I mean it’s so much easier to just be like this is how you do it, now do it (Final interview, lines 2638-2646)

Jacob’s perspective of student-centered teaching was focused around providing opportunities for students to share their thinking. However, it demonstrated a surface level view without mentioning the importance of adjusting to students’ conceptions. He also acknowledged the difficulty of setting up that type of classroom due to time and how much easier it would be to not try to do it.

\textit{JH: so do you think a constructivist teacher would have those same characteristics or would they be different?}
Jacob: I think you can have all those characteristics, I guess the problem is that I don’t know anything other than constructivism

*JH: you mean other learning theories*

Jacob: yeah I can’t think of anything, I just feel like that’s a good thing and it makes perfect sense to me, why challenge it, so I think a constructivist teacher can be student-centered, I think a constructivist teacher can be teacher-centered, so yes I do feel like a constructivist teacher can be 100% student-centered

*JH: so do you see yourself as a student-centered teacher?*

Jacob: myself being, student-teacher myself or like my three year out ideal or five year out

*JH: I guess your three year out ideal because I’m assuming that yourself right now would be the opposite of that or*

Jacob: not the opposite, I mean I feel like I’ve had fun and been able to do what I’ve liked to do in my student teaching and in my placements, but no I definitely don’t feel like what I’ve been doing is my ideal, so I would consider myself a student-centered teacher because I feel like those activities that I would be implementing five each year or whatever, those activities themselves would be student-centered and they would get them involved, they would get them in the mix in getting, making them more aware of their thoughts and ideas and concepts

(Final interview, lines 2647-2671)

Jacob’s comment about not knowing anything other than constructivism was interesting but probably fairly accurate along the lines of him not being aware of how to talk about the educational theories underlying other types of teaching that he had observed. His belief that a constructivist teacher could be teacher-centered or student-centered was indicative of his lack of understanding of the theory of constructivism. He also reiterated his goal of working toward more learner-responsive pedagogy after becoming acquainted with his school environment and less overwhelmed as a beginning teacher.

After this discussion we looked at his description of his classroom before and after the summer methods course.

Jacob: I went back to the moment where summer quarter I haven’t taught anything at all and you’re just completely, I was completely naïve to the whole situation, and so, it was, kind of cool, I mean it’s all, hopefully, it’s all conjectures and I have no clue
JH: so what do you think about those things that you wrote and do you see any
changes between one to the next or?
Jacob: hmm, the first, the fourth bullet, if under pressure I’d probably start, take
off and go over their heads, I’m trying to think if under pressure, a lot of times I
just clenched up and didn’t know what to do or I would just turn it back to the
students and I’m thinking more of winter quarter where I actually ran into those
walls, but that’s funny that I thought that I would just rant about higher level
math, I would have a much better idea of how to run it, what?
JH: I think at that point you’re thinking I think I know what a class looks like now
and how I would go about doing it
Jacob: yeah, have a much better plan, so I think I have this intention of hopefully I
can get my students to think for themselves and I have this intention of getting
them to be, I mean of being student-centered but I think I have this, I might lock
up and just start teaching, me go up and start lecturing, so I think I mean at this
point of view I’m kind of anticipating a desire to do that but not being able to at
this point
JH: which at this point now you think, what?
Jacob: at this point now, I feel like I’m ready to jump to that next level and I feel
like I can, maybe take some time in the intermediate where I’m maybe not, but
heading in that direction but I feel comfortable at any place, I mean from where I
am now to where I will end up, I feel fine with that process (final interview, lines
2743-2764)

Jacob found reading his response to be nostalgic and realized how much he had learned
and experienced since that point. Jacob acknowledged his complete naïveté because his
actual experience with content struggles did not play out the way he thought it would. He
also noted that he had been realistic in the struggle to implement learner-responsive
pedagogy and had anticipated his reliance on lecture. He also demonstrated confidence in
being able to eventually achieve incorporating learner-responsive pedagogy after
becoming comfortable with traditional teaching in his placements.

When we discussed the change in his responses to the surveys over the year he
was flustered by his dramatic fluctuation in answering due to his desire to be consistent.

JH: best way to teach problem solving is to show children how to solve one kind
of problem at a time
Jacob: hmm, okay so I think I saw, slightly disagree to strongly disagree, I saw that as, I think initially being very problematic in that there’s a million types of problems and you can’t hit all of them, and then I’d say disagree and then I saw strongly disagree as going through this class and being like you should teach process, or teach the concept behind it and they’ll figure it out themselves, but then I think I went through student teaching and kids don’t get it sometimes, and they need to be taught the procedure and they need to I mean, you want to, and that’s where you have to be smart in how you teach and you wanna solidify the concept and you want to teach you know reasoning and abilities but then there are those, I mean you have to accommodate in some sense because there are those kids that will strictly learn off of your examples that you do so you have to provide some kind of examples, you have to provide, I mean at least a couple kinds of problems in order for them to get it or else they will just be clueless, so, I think that’s the reason why I went to slightly agree (final interview, lines 2823-2836)

JH: my class really drove the
Jacob: look at the process, look at the concept, (final interview, lines 2836-2860)

Jacob commented frequently on the impact of the summer methods course and then what he actually observed and encountered in his field experiences demonstrating the impact of those concrete experiences on his beliefs. When considering his discussion about children problem solving it was apparent that he had not had opportunities to see what students were capable of doing without guidance.

My final question was to directly share my research question and ask how he thought he could answer it from his perspective.

Hmmm, so specific instances, I feel like if I were to rank it on you know a scale of what was most influential and what was least, I would say just, for that whole first half of a quarter, seeing your class being able to model that and being able to see the positive effects of that, because how else, I mean, I’m such a model driven person where, you show me how to do it and I’ll be able to do it forever, that makes so much sense to me and I guess I would say that’s pretty unanimous, I would say that that’s very much how we work, and so I would say that’s really it, I mean if you can get that into the curriculum I would say definitely try it, cause that was contradictory, where the class that we just did now, where first class, we’re gonna do a pre-assessment, you know doing that and being able to model that by the staff themselves, because we all picked up on that when whoever gets up there and it’s a completely teacher-centered, yeah, but I mean yeah I guess just
modeling it and you showing it and demonstrating it even throughout I mean underlying principles of the staff doing it themselves when they’re teaching about teaching (Jacob, final interview, lines 3010-3023) I feel like that’s spot on of being able to experience it yourself, because I mean we can see it in textbooks and we can be told about it but that’s not gonna do anything (Jacob, final interview, lines 3049-3051)

Jacob’s top influence was having learner-responsive pedagogy modeled during summer methods. He had frequently mentioned throughout the year how he learned by watching and then doing. His suggestions were to have more examples of models for him to observe in order to help him develop more learner-responsive pedagogy. Overall, this seemed to be a good characterization of what was influential for him as he had developed many teacher-centered approaches in his style of teaching. He even acknowledged that he had and all of his mentors and observations had been of teacher-centered teachers. While Jacob was adamant about eventually including learner-responsive methods, I was doubtful about whether this would occur without frequent pushing and support. And this support was not likely to be there in his new position. The summary of his MBS scores (Table 7) throughout the program supported his demonstrated development. Jacob demonstrated initially low beliefs on all three factors (factor 1: how children learn; factor 2: teacher’s role in deciding curriculum sequence; and factor 3: the relationship between procedural and problem solving mathematical abilities), followed by a large increase after the summer methods course demonstrating the influence of his experiences in that course on his espoused beliefs about how children learn mathematics, the sequence of teaching for procedures versus applications, and the relationship between procedural skills and problem solving skills. Following his dominantly teacher-centered experiences in his
field placements, his beliefs dropped significantly to demonstrate less alignment with learner-responsive perspectives.

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Table 7: Jacob's MBS score summary

Aubrey’s Journey

Aubrey was a female in her early-twenties. Like many of her peers she completed her B.S. in mathematics and continued without any time off at the same institution to pursue her M.Ed. in mathematics education. Her story about why she decided to be a mathematics teacher was emotional and brought on a hint of tears as she shared it with the small group. While her choice of the subject of mathematics was based on one teacher
she had as a freshmen who changed her dislike for mathematics by challenging her to think and praised her unique approaches, her impetus for teaching came from an experience of a teacher providing her support when she could not find it anywhere else.

I walked into her room and I just started crying, like I couldn’t even say words and then she just shut the door and I just talked to her for like an hour and she was like I don’t care, it’s fine, and like I don’t care if you don’t do anything with my class the rest of the year, you’re gonna get an A in my class and I know what kind of student you are and, like I’m always here for you, and then I worked harder in her class than any other class for the rest of the year and also she would like write me little notes occasionally and just like to cheer me up and leave them in the office for me and she’d call me in after class just to talk and like she had such a huge impact on my life it was like I don’t know if I would have made it through school without her (Aubrey, 10222010 small group, lines 176-184)

This experience impacted Aubrey’s decision to go into teaching and focused her interest on generally having an impact on students, not necessarily mathematically. *I saw this experience as framing the profession of teaching through a desire to have an impact on students’ lives. This perspective framed Aubrey’s impressions of her mentor teachers and impacted her approach to classroom practice throughout her experiences.*

*Summer Methods – Tentative Excitement*

*Thinking of teaching in the way that is discussed in this article gives me hope that even though it may not seem comfortable or natural at first, it still could given enough time. (Aubrey, 07122010 summer reflective writing)*

As a means of funding her education during her senior year as an undergraduate as well as her graduate studies she worked for the university mathematics department as a teaching assistant with responsibilities to plan and teach recitation for courses in algebra. This provided Aubrey with more classroom experience than most of her peers however; she was not provided with guidance from the mathematics or education department during this experience. *This extra classroom experience before taking any courses on*
teaching methods typically led to teacher-centered practices observed as a student being more ingrained into a teacher’s belief system as a result of implementing them for a full year before being exposed to the reflective, learner-responsive approach to teaching.

Aubrey’s response to the prompt to describe her mathematics classroom provided evidence of the impact of her experiences as a teaching assistant. She referred to a strategy she had implemented with success to inform her vision of her future mathematics classroom.

I found that when students were having difficulty with a concept or problem, I’d have another student or pairs of students come up and do it on the board, and I’d have them explain how they did it and their thought processes. Then I’d elaborate when I felt it necessary. (Aubrey, 06212010 initial writing prompt).

This response provided evidence of Aubrey’s interest and recognition of value for student participation. My initial reaction to this description was that Aubrey was on the right track in valuing student participation but I would want to explore how to facilitate this participation in meaningful and beneficial ways and make sure she was not devaluing student thinking by taking over explanations herself instead of probing students to expand their own thinking.

By the end of the five-week methods course Aubrey’s response was less dependent on her previous classroom experiences and included references to group work, one day a week devoted solely to problem solving as well as a perspective of herself as a facilitator. Through class readings she had the opportunity to see the depth of thinking of which students were capable:

This article just drove home for me the fact that we can’t dumb down concept for students. If I were the teacher, I would never expect this level of students to be able to come up with some of the things that they did. I was very impressed –
based on some of their comments, I found it hard to believe that they weren’t fabricated! Of course I’m not questioning the validity of the article, just expressing the level of astonishment I felt by their dialogue. If I were teaching, I probably would have been throwing hints and suggestions at them because I thought they’d never get it on their own. In fact, this is something that, in hindsight, I probably did too much of as a TA. (Aubrey, 06302010 summer reflective writing)

*Aubrey’s reflective comparison of her own teaching methods with what was presented in the reading demonstrated my objective to challenge her perspectives on teaching by providing a salient and believable model.* This reading experience may have informed her vision of her future mathematics classroom on the last day of class. “Hopefully I would be giving no answers and instead I’d be posing good questions” (Aubrey, 07212010 final writing prompt). Her tentativeness demonstrated evidence of a realization of the difficulty in implementing a new approach to teaching. *Knowing from my own experience and prior supervision work that learner-responsive pedagogy was difficult to implement I attempted to facilitate discussions in the course on the patience the PSMTs would need with themselves to develop the ability to implement methods discussed and modeled in my class.* Aubrey demonstrated getting some of this sentiment from an assigned reading. “Thinking of teaching in the way that is discussed in this article gives me hope that even though it may not seem comfortable or natural at first, it still could given enough time” (Aubrey, 07122010 summer reflective writing). The same reading also provided her with the perspective of why the transition may be difficult.

It’s still tough for me to break away from old thoughts and habits, because they’re just so embedded in my brain, since teaching and learning are such cultural activities. I’ve been brought up in one type of classroom, but want to teach in a different type, so it’s going to take a lot of practice to realize what I need to do differently. (Aubrey, 07122010 summer reflective writing)
Her acknowledgement of the obstacles she would be encountering provided her with a more realistic view of the types of experiences she would have in her field placements. *This was important for me to get across to the PSMTs as I had observed resentment in the past when they encountered obstacles and had not expected there to be any in the first place. I was very honest with them about the probability of learner-responsive methods not being welcomed in their placements in hopes of avoiding surprise.*

Aubrey continued to demonstrate interest in encouraging student participation and was a little more detailed in how she would facilitate that participation. “Students would be expected to provide suggestions and would be encouraged to ask questions (which would be answered by other students)” (Aubrey, 07212010, final writing prompt). *I appreciated seeing growth in Aubrey’s perspective on student participation and felt that she was showing signs of focus on meaningful student participation through the caveat that student questions would be directed to other students. This was a method I had modeled and encouraged throughout the methods course as a way to increase learner accountability and motivation in the classroom.*

Aubrey was impacted by the summer methods course in other critical ways and shared those perspectives in her reflective writings. She was inspired by the models of learner-responsive pedagogy in the readings and made note of the importance of flexibility and providing students with opportunities to think critically and creatively. The models of learner-responsive classrooms in the readings helped Aubrey to see the value in recognizing multiple representations, “since everyone learns best in a different way, it’s important to create an atmosphere conducive to the learning of all students, and not
just some” (Aubrey, 06302010 summer reflective writing). Aubrey also pickup on different perspectives of mathematics that students could have.

I thought Boaler’s point about low achievers not learning the same things more slowly but instead learning a different mathematics was very interesting. I never thought about it that way but it’s so true. From my experiences with students, I can see that, for many of them, what they see as math is completely different from what I see as math” (Aubrey, 07072010 summer reflective writing).

These reflective thoughts seemed to be opening the door for Aubrey to begin to develop a perspective of learning more aligned with constructivism by acknowledging the possibility of differing perspectives of the world and our surroundings.

She was also reminded of models of teacher-centered instruction she had experienced as a student.

Asking good questions, while it seems like a very simple and obvious tip, is vital. I have had high school teachers and lecturers in college who seem to have no clue how to form a good question. Recently, I had a psychology professor who would ask only the most obvious questions (always “product questions”), so much so that students felt too foolish to even answer them. He’d wait about ten seconds before answering the question himself, never encouraging us to think for ourselves with more probing, difficult questions. (Aubrey, 06232010 summer reflective writing)

Aubrey went beyond seeing the value of posing good questions and was able to reflect on the extrinsic and intrinsic issues of not taking this approach based on past experiences. Justifying the learner-responsive approach may have helped her to solidify this particular belief. Aubrey’s reflection of the value behind well-posed questions and wait time was encouraging for me to see; however, I did not assume this perspective would coincide with smooth implementation of questioning strategies and made a note to focus on her development in this area.
Aubrey continued this reflective approach throughout her reading in the course commenting on the importance of encouraging different forms of student communication and wishing that this had been emphasized by teachers she had. *Her interest in having the opportunity to experience learner-responsive pedagogy as a student showed me that she was seeing the educational benefits to these methods. I saw this as a necessary hurdle for PSMTs to truly believe in these methods as teachers have demonstrated drive to be more likely to incorporate methods they see as beneficial for students.*

Following Aubrey’s desire to experience more learner-responsive pedagogies as a student was a realization that without these experiences she may not have developed the deep mathematical knowledge necessary to teach as effectively as she could.

A comment that scared me a bit was the following: “Effective teachers of problem solving must themselves have the knowledge and dispositions of effective problem solvers.” As obvious as this seems, I had never really thought about it before. I am worried that since I was very rarely exposed to problem solving throughout my K-12 education, and it has always been difficult for me, I will not have what it takes to teach it well. (Aubrey, 06282010 summer reflective writing)

*While my goal was to get the PSMTs to reflect on their own mathematical knowledge and realize they still had room to learn and grow I knew this was delicate ground because it could lead to discouragement and drive them from the desire to enter the profession. The inevitable doubts and questioning of obstacles preventing learner-responsive pedagogies arose in her reflective writing as well.*

While I agree with Reinhart’s suggestion that sometimes “less is more,” I think that always spending an entire class period on a single problem could result in not covering all of the material necessary. It is difficult to understand all the facets of a topic with only one or two problems to refer to. In some cases, several examples are necessary for thorough understanding. (Aubrey, 06232010 summer reflective writing)
Aubrey’s concern was one I expected to see and always have the most difficulty addressing as a teacher educator who has not had the opportunity to observe the use of these methods over the course of an academic year or more. My main approach to address this disbelief was through considerations of rich problems addressing multiple standards and concepts at once and trying to move away from the view of teaching as covering disconnected textbook sections toward providing students with opportunities to work with multiple concepts at once and develop natural mathematical connections.

Overall, Aubrey’s MBS score was 111 on the first day of class and 155 on the last day of class, demonstrating the possibility of significant change in beliefs. I approached Aubrey’s large changes with a grain of salt in consideration of two things: the findings from research demonstrating large changes in beliefs but not necessarily connecting those with learner-responsive pedagogies being implemented in the classroom and the possible gap between explicit and implicit beliefs that had often been demonstrated in research. Aubrey had demonstrated vested interest in promoting student communication and learner-responsive questioning strategies so my goals for her going into fall placement were to emphasize strategies to help her improve in these areas. Successful implementation of strategies in both areas would provide her with opportunities to attend to, interpret, and decide how to respond to student thinking.

Fall Placement – Mixed Messages and Stunted Progress

Yeah she thought the program was hilarious. (Aubrey, 03112011 small group, comment about her fall mentor, line 59).

Aubrey’s fall placement was in a local urban high school with Algebra 1 classes. Overall she struggled in the placement with a mentor who did not respect program
expectations and perspectives and did not demonstrate a strong connection with students, which was Aubrey’s reason for wanting to be a teacher. Her mentor teacher frequently laughed at and put down the program as well as my suggestions. This left Aubrey to feel like she could not try the variety of learner-responsive methods she had originally planned. During an observation visit, I even observed her mentor teacher actively telling Aubrey not to do a pre-planned exit ticket because it was not worth the effort. Aubrey was respected by her fall mentor teacher for her work and was asked to return in the spring for her student teaching. Aubrey declined based on the lack of freedom to teach in her own way and the amount of stress her mentor teacher put on her throughout the experience. The following excerpts and discussion provide insight into Aubrey’s experiences and the impact on her development of beliefs and classroom practice.

First Lesson – Opportunities for Student Thinking & Communication

My first visit to observe Aubrey teach was also her first experience with teaching in a high school classroom. The pre-conference conversation focused around Aubrey’s lesson visualization. The lesson visualization was something I incorporated in many pre-conference meetings in order to get an idea of the PSMT’s thinking as well as help them relax by thinking through their plan. Aubrey brought up a concern about her students’ knowledge for the lesson she had planned. “I’m worried that they won’t remember doing the expressions, it’s old, I don’t know exactly when they did it” (Aubrey, 10062010 pre-conference, lines 198-199). This comment demonstrated Aubrey’s lack of knowledge about her students and doubt in their abilities. I was not surprised that she was unsure of her students’ knowledge since she had not necessarily had an opportunity to assess the
students and the previous lessons she had observed did not deal with the same content she was addressing. As we continued to chat I noticed Aubrey seemed to have low expectations for her students based on discussions she had with her mentor joking about their lack of understanding. I was also not surprised to hear this perspective as I had commonly observed low expectations for students that had been characterized as low achievers. I took this opportunity to remind Aubrey about the importance of having high expectations and challenging her students despite what she had heard.

During the observation I made note of opportunities where Aubrey could have learned more about student thinking. For example, when Aubrey explained how to come up with an algebraic sentence to model a word problem and asked if it made sense, the students responded with “no.” She then provided an example and when one student responded that it had made sense to him she moved on. My comment was “so why did they have difficulty understanding before” (JH, 10062010 Aubrey observation notes), with the goal of getting Aubrey to reflect on her understanding of her students’ thinking. I also pointed out areas where student thinking was being overshadowed by her thinking in her use of a step-by-step approach to solve the problems and finishing student thoughts with her own thoughts. The other comments I provided were suggestions for encouraging accountability with student participation through asking other students to repeat student thinking and involving other students in the sharing of methods.

Immediately following the lesson, Aubrey brought up her initial doubt about her students in reflecting on their demonstrated ability throughout her lesson. She felt bad
about showing doubt in her students’ abilities before the lesson and even considered
whether she had managed to challenge them at all with her lesson.

A part of me does wonder if they learned or if they already know how to do it,
because they just seemed a lot more advanced on the topic than I thought they’d be (Aubrey, 10062010 post-conference, lines 378-380)

Even though Aubrey demonstrated guilt about her originally low expectations, she still
did not seem willing to admit that the students could have learned and developed
understanding in her class. Instead she suggested that the students had already been
exposed to the material and were just more familiar with the concepts than she had
expected. *I saw this doubt as coming from Aubrey’s inexperience and made a note to
work on addressing the issue of assessment and designing a lesson in a way that provided
evidence of student learning in order to avoid the second guessing Aubrey was
experiencing. This was not necessarily an issue to address in this particular conversation
though as I knew Aubrey had many other concerns and areas to focus on first.*

*During my observation I had noted Aubrey’s dominant use of a procedural
method for setting up algebraic equations. I was curious about her thinking behind the
decision to break up each word problem into a series of steps designed to help students
through the critical parts she wanted to emphasize. I was cautious to not probe her on
this issue prior to the lesson because I knew it was not something that she could easily
change in a short amount of time and I did not want to increase her nervousness. After
the lesson I decided to try to get more of an idea into why she chose this approach.*

*JH: why do you have it set up this way so that they have steps that they have to
work through*
Aubrey: because they had, that’s what it was in their book and she actually
wanted me to do a procedure, but I didn’t like the one they had in the book really,
it was pretty much the same but, well and they also have them solving the equation because it’s a later chapter and she didn’t want me to go that far, so, they didn’t have “define a variable” but they had “write a math sentence” “set up your equation” “solve the equation” so I added define the variable and got rid of solve the equation and I said what’s the answer if you can get to it and I think that again also would have come out of me not being confident enough in their abilities to be willing to try that and then have it fail (10062010 post-conference, lines 449-460)

Aubrey adapted the approach in the textbook and focused on a procedure based on her mentor teacher’s desire and a reluctance to challenge her students due to doubt in and lack of knowledge of their abilities. My goal at this point in Aubrey’s development was just to begin to challenge her tendencies and get her to think about the implications of her methods.

I wrote off to the side with the step-by-step, are students getting the opportunity to think? So in creating the steps for them, I’m not saying the situation was horrible, but you want to try to make sure that you’re not taking them away from thinking about what they’re doing with the problem, I think in that instance it was good because it was a complicated problem trying to think about the pieces and parts, but, in general, try to think of, by taking this approach am I giving them the opportunity to think about this at a deeper level than just what’s the answer, so just in general, when you’re planning, that’s the question you want to keep asking yourself. (JH, 10062010 post-conference, lines 558-564)

Keeping the focus of our discussion on student thinking I brought up specific instances in the lesson where there were missed opportunities to use student thinking. At one point during the lesson a student suggested a method for thinking about the work problem by using a chart. Aubrey had dismissed the students’ idea, “when I heard him say x, y, the first thing that popped in my head was, okay, this is someone who already took algebra, cause we have a lot of students who already took algebra and I didn’t want to confuse other students with y so I just like threw it out immediately” (Aubrey, 10062010 post-conference, lines 571-574). In this instance she knew some students had been exposed to
advanced concepts and ideas and did not want to acknowledge those ideas for fear that it would cause problems with other students. *She actively chose to ignore student thinking based on a split-second assumption about the student’s idea without trying to see or consider whether his idea may actually be helpful.*

> that would probably help them to make more sense of that equation, but ... so that’s just the same concept of, can we work with what the students are suggesting, but he says can we make a chart you say, well what would you do, how would you set it up if you want to make a chart. (JH, 10062010 post-conference, lines 577-580)

My response worked toward focusing Aubrey on the missed opportunity and providing her with a method to take advantage of a similar situation in the future.

Overall her biggest struggle in the first lesson was a lack of confidence in her ability to successfully do anything in the classroom. Her focus was mainly on little aspects of her lesson where she felt she failed and she had difficulty looking past those moments to consider what she did well and how she could improve in her next lesson.

One issue in particular that Aubrey struggled with was trying to think about mathematical concepts from the perspective of a novice instead of an expert.

Aubrey: I had trouble explaining the math of, like why is it 24 times 2 and a half at the end, saying that in any other way, because it’s just something that I don’t feel like I have a reason in my head, it just is

*JH: how do you do 24 times 2 and a half*

Aubrey: no, not even the method, well, I do it, I would do 24 times 2 and 24 times a half

*JH: why couldn’t that be a way you could explain it?*

Aubrey: I could of, and I probably would have if I had more time to do it a different way, cause I could tell they were having trouble, but I know this is the way they learned so I thought I’ll do that and then you know but the kid that sits in the front left came up to me after class and was like, why didn’t you do it the easy way, and I said what’s the easy way and he told me that, so I was like well that’s kind of interesting that he said that, so I probably could have done that, but I mean more even setting up the equation, so why is it 24 times 2 and a half, I had
so much trouble, and I didn’t realize I would have so much trouble with that, and when the kids wouldn’t understand why I set up an equation in a certain way, it seems like its, you can’t explain it at a lower level than what it is, it seems basic, which, I know is not the case, that’s how it seems in my head I can’t find another way to explain, so I’ll say does everyone understand and I can still see that there are a couple students that are like I don’t know but I don’t know how to say it another way, so I was just like okay, I don’t know why I asked that question cause there’s nothing I could do about it. So, do you see what I’m saying, that happened multiple times today.

JH: I understand exactly what you’re saying and that’s definitely an issue that is a big issue in terms of not just you, but everyone, we already understand the math and they’re trying to learn it, so how can we sort of deconstruct our own knowledge and try to think about how did I learn this, what was the way that I thought before I knew that this is the way it worked, and that’s really hard to do, and so the question is, how can you sort of build that knowledge, is it something we expect you to have in your first lesson, no, but it’s something where you would want to actively think, okay, I don’t know this, how can I help myself learn it?

Aubrey: it seems, it just seems so broad because it’s so many different, it’s just

JH: well let’s just focus on one lesson at a time, so one topic, for instance today, you don’t know how to explain why we set up equations the way we do, so what would help you, do you think, learn how students think about it

Aubrey: actually one, this might sound stupid, but this is what I would do if I was trying to figure that out, maybe go online and look for some sort of tutorial on how to set up equations and see how they explain it and maybe I wouldn’t use the same way but get ideas from things like that, because that’s trying to explain it to a student, so just to get ideas I guess

JH: you’re trying to figure out how students think about it, right? Why not talk to a student, so if you have an opportunity and I don’t know how it works during the days that you’re here, but do you have times when she says oh can you work with this student one-on-one, or do you have opportunities to do anything like that

Aubrey: not really, I mean I’m gonna have to interview a student for a couple different things so I could throw something in there like that

In this discussion Aubrey struggled with trying to break down mathematical ideas in ways that helped students to make sense of them. When I probed her to see if she would come up with considering talking to students to start to figure out what makes sense to them, she automatically thought about using the Internet as a resource instead. Even after suggesting that she should talk to students, Aubrey struggled with thinking about
when she would have an opportunity for that and it was obviously not in the forefront of
her thinking. I was running into the same problem she had encountered but at a different
level. I saw the obvious response to my question about to learn about how students think
as to just talk to students. It seemed that while my thinking was focused on increasing her
face-to-face time with students, her thinking was still on her own lack of ability and how
she could personally improve that.

When it came to her thinking about students, Aubrey’s tendency was to think
about her students as if they had similar motivation and interests to her. In the post-
conference she expressed her belief that it was important to have an example for students
to refer to even if they did not understand the concept (Aubrey, 10062010 post-
conference, lines 407-413, Figure K.1). This seemed to encourage memorization over
learning with understanding. She was also concerned with writing out details for setting
up equations in a specific way because she knew it was necessary for her (Aubrey,
10062010 post-conference, lines 407-413, Figure K.1). So her learning preferences were
automatically attributed to her students without thought about any possible differences.
This was more reason for me to try to find ways for Aubrey to learn more about how her
students were thinking as her own thinking was what she tended to reference when
thinking about teaching methods.

Aubrey continued to demonstrate concern with encouraging student participation
though and she indicated this through several comments about methods she planned or
wanted to implement in this first lesson.

I was thinking since I want to have them do more of the problems but like actually
come up and do them but I just know it’s gonna be not that much time, so I’m
gonna do the writing but I’m gonna ask for student participation for everything hopefully. (Aubrey, 10062010 pre-conference, lines 63-65)

Aubrey wanted to involve her students but was concerned about giving them opportunities to get out of their seats to work on problems because of the amount of time it could take. I also saw this as an unwillingness to give up control of the symbolic representation of the mathematics discussed, as Aubrey would be making the decisions about what was written on the board. Following the lesson, Aubrey reflected on the methods she had intended to use to encourage student thinking and communication.

Aubrey: something that, I tried to tell myself to do this today but, then I just got, I couldn’t remember everything I wanted to remember but, just ask why more, when they give an answer, whether it’s right or wrong, say why did you do that JH: and you did do that, once

Aubrey: I know I did it with Ethan, I think I did it when I was going around to the groups, because it is easier with a smaller number of people like you were talking about, and I need to do that more and also I think having students explain to other students could be helpful too, so, that’s something I think would help me a lot, is if I just did that more and get an idea of how they are thinking

JH: yup, that’s the kind of stuff I wrote in here, it’s like at this point, when a student says this, we could have asked this question instead and it would’ve helped you to learn more about your students and struggle less with how do I explain it to them and how do I get them to think about how to explain it to each other (10062010 post-conference, lines 344-356)

Aubrey demonstrated interest in incorporating this methodology but was critical when she did not do it as often as she had intended. The approach of asking ‘why’ was highly encouraged by me during discussions in the summer methods course. It was encouraging to see her bring up interest in using the questioning strategy since questioning was an area she had frequently commented on in the summer methods course. She was concerned with using it to get a better idea of student thinking and I made sure to make
note of the places throughout the lesson where she could have put it into practice. I also suggested other ways she could increase student communication over her own talking.

JH: so you did ask why with a student and he explained it and then you re-explained it, would it have been useful to ask the students to try to explain what he, say okay, that was a good explanation, can somebody else explain sort of, repeat what he said or tell me what you’re thinking, because then you get an opportunity to see how other students are thinking about it, and also gives that students or the students in general, what they say, more value, because if they think, oh every time I say something she’s just gonna repeat it, the other students will think well I don’t have to listen because she’s just gonna repeat it
Aubrey: and I wouldn’t have repeated it if you could hear him, cause I really just said exactly what he said
JH: you could maybe say, I really liked what you said but I don’t know if everybody could hear it, could you say it again (10062010 post-conference, lines 581-591)

At this point in her development I really wanted to emphasize the importance of creating an environment where students felt comfortable and valued. I had observed many teachers devaluing student thinking unknowingly by doing something as simple as restating student explanations. Even though Aubrey pointed out that she did not change anything the student said I was still concerned about emphasizing the importance of encouraging more student communication and less teacher talk.

At small group that week Aubrey shared her excitement for teaching after her first lesson experience and I asked her to reflect on any difference in her approach to observation based on that experience. She shared a change in her focus from the characteristics of her mentor’s teaching she did not agree with to noticing aspects she saw as being helpful. She was able to appreciate her observations more and approached them with an eye toward finding areas she could improve in her own teaching (Aubrey, 10082010 small group, lines 96-102, Figure K.2). Based on my past experiences as a
supervisor, I knew PSMTs tended to stop actively observing to reflect on pedagogical methods. I was excited to hear Aubrey’s ability to approach observation with a more open perspective after her own teaching experience. I also asked the group to come up with goals related to their field experiences and Aubrey focused on her desire to build confidence, “to be confident in myself and my abilities and always to remember that mistakes aren’t regrets, they are only room for improvement” (Aubrey, 10082010 small group, lines 164-166). I found this goal to be refreshing based on our post-conference conversation to not be so hard on herself. She also mentioned her feelings of guilt for not believing in her students’ abilities and shared excitement about what she did observe. “I felt so guilty afterwards cause I went in there and they were like coming up with awesome ideas and I was like ‘oh, you guys are so smart!’” (Aubrey, 10082010 small group, lines 769-771). I was encouraged to hear Aubrey’s excitement about her students’ abilities as one of my goals with getting them to encourage and observe student thinking in their lessons was for them to realize the amazing knowledge students possess, which could hypothetically lead to them valuing student thinking more.

Aubrey brought up an interesting point about the approach of meeting with her to discuss her lesson right after she taught it. “I realized that all my thoughts were just what you said to me (laughing) and I was like trying to think of what I thought and so I’d rather have time to think about it myself and then talk to you about it” (Aubrey, 10082010 small group, lines 903-905). I appreciated her honesty and used her idea to explain why I took the approach in post-conferences of asking them to share their thoughts before I shared mine. While my goal was definitely not to take away their
opportunities to reflect, it was interesting to hear that my suggestions were memorable for her. Aubrey also shared her disappointment in her mentor’s decision to not use the methods in the lesson she had planned that were more learner-responsive. This turned out to be the beginning of Aubrey’s frustration with her mentor during fall placement.

Moving on in Fall

In her next two lessons Aubrey taught the same lesson two periods in a row and demonstrated growth in her observations and excitement about her experience in her formal reflection. She credited herself with encouraging “rich thought and questioning from students about their work” (Aubrey, 10122010 self-critique 1) and felt she had contributed to an environment where students were comfortable communicating their thinking. As mentioned previously, my goal for strongly suggesting the use of methods to encourage student communication and sharing of solutions was for the PSMTs to have the opportunity to observe the amazing things students can come up with if given the opportunity. Aubrey’s excitement from her experiences with students was evident in her formal reflection on the lessons. She commented on the four different interesting ways her students had shared to solve a problem and how “awesome” it was to be able to talk about the different methods with her students (Aubrey, 10122010 vertical 2 reflection, Figure K.3). She was able to see multiple advantages to encouraging multiple solutions from her students and was excited about what she was able to achieve with her students.

In her self-critique on the same lesson she was critical of her use of wait time. “After I told them the answer and explained it, I said “Does that make sense,” and then I don’t even wait! I want to be careful to always provide enough wait time” (Aubrey,
10122010 self critique 1). Aubrey consistently demonstrated an ability to notice areas where she could improve through use of learner-responsive methods and I encouraged her to continue to make efforts toward making those concrete changes. Aubrey also commented on her difficulties with getting students to work on warm-up problems. She considered the possibility of this difficulty as being related to her lack of use of a hook to engage students in the lesson for the day. (Aubrey, 10122010 vertical 2 reflection, Figure K.4). This reflective thought demonstrated Aubrey’s consideration of learner-responsive pedagogies modeled and suggested by me. These comments indicated to me that she was actually thinking about the methods we had discussed and was concerned about giving students more opportunities and reasons to be engaged.

Aubrey also noticed instances where student participation and communication were present in her lesson as well as how she had contributed to that throughout. She specifically singled out one conversation she observed between two female students. I was happy to see Aubrey making note of good conversations and wanted to get her to reflect more deeply on what she had observed. My comment to her was, “What made the conversation good? How could you encourage this type of conversation in other groups?” (JH, 10252010 self-critique feedback). She also commented on noticing a student who typically struggles doing well with the responsibility of explaining his thinking to another student and concluded, “So I suppose that the pairing technique is a great thing to use when you have a classroom full of learners of various abilities and strengths” (Aubrey, 10122010 self-critique 1). It was good to see her reflecting on the
benefits of students working and communicating with each other and reaffirmed the benefit of students communicating rather than just listening to a teacher explain.

Viewing a Video Together

As the quarter progressed Aubrey continued to demonstrate an ability to notice critical features about her observations and I continued to challenge her to reflect on her choices and actions when we viewed a video of her teaching together. In the summer methods class one of the methods we discussed for encouraging student communication and accountability was to choose specific students to present from groups based on the teachers’ knowledge of that group’s work. Aubrey purposefully attempted to enact this method in a lesson during her fall placement.

\[ JH: \text{so you specifically picked the girl who didn’t do the problem but was in the group} \]

Aubrey: yeah, cause I wanted to make sure that she had gotten, like actually, cause I went over to them and I said make sure you’re explaining to each other what you were thinking and and they do talk about it, but I think I don’t know if I made her nervous being put on the spot or that sort of thing, I don’t know. (10222010 individual meeting, lines 816-821)

In this discussion Aubrey shared her intentions with choosing a specific student from this group based on her desire to encourage the expectation to explain their thinking to each other. Aubrey was lacking in confidence in her use of the method though and unsure about it’s usefulness based on the student’s reaction. Her lack of confidence in her ability to enact different methods encouraged by me continued with her discussion and frustration with attempting to ask good questions.

Aubrey: yea it’s really hard for me to do that, I have an idea in mind of what I’m trying to get at but I never communicate it right and I can never think of a way to communicate it so that everyone’s gonna understand what I’m asking, sometimes, in this class I even noticed, I remember asking a question and it was in second
period and that’s why I think I was nervous this period, asking a question about, I
can’t remember, a couple students understood what I was talking about and
answer and the rest of the class was like wait what are you talking about and then
I tried to explain it and no one got it and it was just a disaster so then it made me
nervous

JH: I understand why that would make you nervous, I wonder if one of those
students who answered could’ve explained it
Aubrey: yeah and they might be able to explain it better than me if
JH: yeah and that’s not a horrible thing I think sometimes we think that if we
don’t do everything then we’re bad teachers and, I think that the whole idea of
asking questions is a really difficult thing and it’s not an easy thing to do, that’s
why I’m always looking for the questions in the lesson plans is to have them
planned ahead time, obviously there’s gonna be instances where you’re like I
didn’t know that this was gonna be an issue and I have to come up with a question
on the spot, but typically just saying why or how, and trying not to make it very
complicated is usually the best if you can’t think of anything else
Aubrey: I just I feel like I try to ask why did you do this, why do you think this
person did it this way, why is this number here, and I’m never am able to get
answers out of them that like, it’s always just, cause they’re so in their heads it’s
ingrained that this is the process, so they’re like it’s 2 times this plus this
JH: it’s like asking someone why do you multiply, and they’re like cause that’s
what you’re supposed to do
Aubrey: that’s the hardest thing

JH: I think the thing that you have to remember, I mean it seems that you are
thinking about it, the students aren’t used to doing this and so you have to be
patient with them and just keep trying to get more and more out of them, can you
go a little further with that, try a little bit more (10222010 individual meeting,
lines 900-927)

At first Aubrey was frustrated with what she saw as an inability to explain ideas or
communicate them in a way that made sense to her students. I automatically thought of
the tendency for some teachers to think that in order to be a good teacher you just have to
be able to explain things well. I personally see this as a perspective that does not take
into account the importance of emphasizing student communication and student ability to
explain mathematical ideas. Therefore, I tried to get Aubrey to think about this idea by
suggesting giving students an opportunity to explain the idea and explained why this did
not mean that she was not a good teacher. This led Aubrey to the issue of students who
have not adapted to this expectation and do not have experience with communicating their thinking. After encouraging Aubrey about her ability to think about these ideas and methods I cautioned her to be patient yet persistent with the students.

As the video viewing continued, I found opportunities to help Aubrey reflect on her interest in student participation and communication and methods of achieving that while developing an environment encouraging student talk.

*JH: here’s a question, just something random I was thinking, are they explaining their thinking to you?*

Aubrey: yeah

*JH: who do you want them to explain their thinking to?*

Aubrey: class, no, I mean I want the, I just thought this cause you said it, but I mean I wonder how much the students are even listening to what they’re saying, you know what I mean? I don’t know, I’m curious

*JH: so how could we make it more apparent that they’re not just talking to you, they’re talking to the class*

Aubrey: I mean the best thing I think would be to have them come up and talk about their own solution maybe

*JH: but even then they’re still probably just talking to you, so is it something that we need to say to the class or*

Aubrey: what do you mean?

*JH: like, don’t just tell me, you know I already know how to solve this problem, I’m interested in how you’re thinking about it but I want everybody else to think about it, but then also we want to try to make them somewhat accountable for what they’re saying, so how could we do that*

Aubrey: I mean, have them repeat you know the method that the person used and the reasoning behind it

*JH: yeah I think that’s good, or maybe you could say you’re responsible for asking a question about it*

Aubrey: I could say does anyone have any questions for this student for how he did his problem but then I wonder if anybody will say anything

*JH: I’m just trying to think of ways of trying to make sure the students are more accountable for what’s going on in the class, because just watching that, he told you and you’re like, alright and then you go on, you know and it’s like, well what about the rest of the students, is this for you? I mean it is partly for you you’re trying to figure out something about the student*

Aubrey: but it’s mostly for the class because like you said, I already know it and I want to see how that student’s thinking but I really want to make sure that all the students are
JH: so how do we get the students to value this whole process? That we’re not just putting stuff on the board for the teacher, we’re putting stuff on the board so that everyone gets to see these different methods and try to understand them, because it’s not just the teacher and the students it’s a classroom, and we’re all in this together, and I’m not just saying that this is something that you can all of a sudden change in this class but that’s something that you want to try to create an environment for the class that you’re teaching, so try to think about the types of things that you could say to students to get them to start, sort of change their viewpoint about what the point of the class is (10222010 individual meeting, lines 742-782)

While Aubrey was definitely concerned with getting students to communicate, I wanted to make sure they were communicating in a beneficial way. This was a difficult concept for Aubrey to understand at first because she almost wanted it to happen implicitly through just inviting students to talk. I suggested she make it more explicit and share her intentions and expectations for student accountability with the class instead of just hoping that the students would eventually care about what other students had to say.

In the same video viewing Aubrey noted her excess talking that she did not realize until she watched the video. “I feel like I’m just talking the whole time, and I don’t want to do that and I don’t feel like that’s happening when I’m teaching and then watching it I realize that it is happening big time” (Aubrey, 10222010 individual meeting, lines 871-872). It was encouraging to see Aubrey noticing this in her viewing of her video and I pushed her to take it a step further and try to think about methods to reduce the amount of teacher talk in her lessons. I tried to acknowledge that what Aubrey noticed was no different from what I expected to see. Aubrey struggled to think about any way to change her lessons or implementation to decrease the amount of her talking so I tried to get Aubrey to begin to work on her questioning capabilities more and finding more ways to encourage student communication. I knew Aubrey was concerned about asking students
to participate at the board in her classroom if they were shy so I tried to suggest a method that would help students feel more support and less stress in front of their peers.

JH: could you have maybe someone who’s responsible for saying, this is what I did, like this guy, and then you say could somebody go up and write it on the board for him as he tells you what to do, then that student’s explaining and they’re not worrying about writing or anything like that and the person at the board is not embarrassed to be up there writing because it’s not their thinking right, so that’s one thing that you could try to do so there’s not this wasted time Aubrey: you know what I see happening if they do that, so either he would just give the numbers and the person would write it and it wouldn’t be very productive or he would actually explain his thinking and the person at the board would have no idea JH: so maybe it’s something where you want like, okay, if you guys are working together right, one of you has to go up and write it for him as he’s explaining it Aubrey: oh yeah, I like that (10222010 individual meeting, lines 680-690)

Initially Aubrey had an excuse for why she did not think the method would be useful in her class but I suggested an added detail that could take care of her concern. Aubrey continued to be discouraged throughout our discussion though as she shared her lack of confidence in her ability to think about methods for encouraging student reflection and thinking during her lessons.

Aubrey: I don’t really know, I’m so bad at thinking of things, especially on the spot, if I, this makes me sound nervous, in hindsight I can’t think of things so how am I ever gonna think of something, afterwards I will think I wish I could’ve done this differently but then I can’t think of how I would do it JH: well I think the problem is that you might be looking for a right way to do it, there isn’t, there’s just things that you can try, I mean I don’t know the answers to things, I know things that have worked, and I have examples of things but I don’t know what’s going to work in every situation because every classroom is different and every student is different, so what’s something that you could have possibly tried? Aubrey: I mean, when I was typing my reflection I was thinking I would have a student show me how it fits the problem, come up and show me how it fits the problem, but I don’t even know if they would understand what I was talking about JH: okay, so essentially you are saying, does this answer make sense? Aubrey: yeah, but, and I wanted to say, reread the problem and see if these numbers fit the question, but I guess, I mean, I was thinking I could ask the
specific student who wrote it on the board or another student that raised their hand for this to be right, but I don’t know, I just, I don’t know (10222010 individual meeting, lines 786-802)

Aubrey’s frustration with herself reminded me of a common perspective about education, that there is one ‘right’ way to teach and one ‘right’ answer to deal with every difficulty encountered in the classroom. This was definitely a misconception I had as a new educator several years prior and I tried to express this to Aubrey and help her to think about just trying different approaches with the objective in mind and making note of what works for her and her students. She wrote more about her frustrations in her blog. She started with the statement, “Honestly, at this point, I just want to make it through the program without breaking down.” She continued to explain how she had received feedback from students convincing her she would be a “great teacher” but questioned whether her lack of creativity would hold her back. She mentioned my comment about the importance of recognizing the areas where she could improve and suggested it was not useful without having ideas of what to actually do in the classroom (Aubrey, 10222010 blog post, Figure K.5). This blog post demonstrated Aubrey’s stress and struggle to deal with the different complicated facets of learning to teach. She was greatly impacted by her belief in her inability to think of ways to engage and challenge students. Hearing so many success stories from another intern in our group who had qualities of confidence and creativity that she felt she lacked impacted her. Although she remembered my encouragement about her obvious progress in a direction that could lead to effective teaching, she still saw her inadequacies as preventing her from her goal of having a positive impact on students.
Making Progress

As the quarter progressed, Aubrey began to run into different obstacles in focusing on her own development of practice because of her mentor teacher’s approach to teaching. Jacob shared his approach to lesson planning by searching for good problems on the Internet and Aubrey felt that her mentor’s unwillingness to stray from her planned curriculum of a section a day made it difficult for her to feel she had that freedom (Aubrey, 10292010 small group, lines 769-772, Figure K.6). *I saw that Aubrey was beginning to feel restricted by her mentor teacher’s planned curriculum. Her difficulty was not uncommon in placements with mentors who held themselves to a particular schedule of content. I made a note to explicitly discuss the issue of the curriculum calendar with mentor teachers during winter placement. My hope was to try to help the PSMTs see if there would be flexibility and take advantage of the opportunity.*

As the quarter progressed and Aubrey continued to gain experience teaching and she continued to increase her confidence in front of the classroom. This allowed her to make progress in her use of learner-responsive methods and notice other areas for improvement. She felt good about one of her horizontal two lessons and commented on how much she liked giving her students an opportunity to “discover the relationship between points and their inverses without just telling them.” She admitted that she was initially concerned that her students would not make the connection between the concepts and was encouraged when they actually did (Aubrey, 11062010 horizontal 2 reflection, Figure K.8). *It was good to see Aubrey’s excitement stemming from success at implementing a lesson that incorporated more learner-responsive pedagogical methods.*
In the same reflection she was also critical about her lack of closure. She mentioned her own difficulty in gaining student attention after collaborative work and the difficulty in implementing a method that the students were not accustomed to (Aubrey, 11062010 horizontal 2 reflection, Figure K.7). Aubrey’s difficulty with implementing learner-responsive methods in an established environment where those methods were not commonly used was a frequent obstacle for the PSMTs. She did demonstrate a consistent perspective on the importance of closure in her peer critique comments on Jacob’s lack of closure in one of his lessons. “For the last few minutes, the students seemed kind of rowdy. Having a good closing and working to the bell is probably the hardest thing for me to do, and it seems you may have a similar problem” (Aubrey, 10312010, peer critique of Jacob). Her consistent concern with the importance of closure from her own critique of her teaching to a critique of a peer’s teaching demonstrated the possibility of a strong belief about the effectiveness of this method.

In the same reflection Aubrey also noted a problem with student communication being limited to only a few students. Aubrey was not happy with the implications of only a few students communicating their ideas and planned to address this issue in her next teaching experience by having students wait to be called on instead of shouting answers (Aubrey, 11062010 horizontal 2 reflection, Figure K.9). This reflective excerpt demonstrated Aubrey’s emerging concern about formative assessment opportunities. I noted Aubrey’s demonstration of being able to go beyond observing an issue in her lesson to coming up with an idea to address that issue as her beginning to feel more comfortable with her ability. In her critique of peers Aubrey also focused on issues of
student communication and access to their thinking. She focused on Jacob’s use of high-level questions in his lesson and his ability to access student thinking in order to adjust his lesson based on student responses (Aubrey, 10312010 peer critique of Jacob, Figure K.10). This was the first concrete evidence of Aubrey mentioning the importance of student thinking to inform instructional decisions. Aubrey was also interested in encouraging student discussion and multiple solutions and gave the same suggestions to Jacob that I had given to her.

In her second video critique Aubrey was satisfied with the student communication as well as her use of methods I suggested. “I liked my use of having students repeat and explain their ideas to others” (Aubrey, 11042010 self critique 2). Again Aubrey demonstrated excitement about her observations of the benefits of encouraging learner-responsive pedagogy despite her struggle to include other methods such as exit tickets and closure. Her peer reviewer also pointed out Aubrey’s successful use of learner-responsive pedagogy by encouraging student communication through the use of a “think-pair-share” (10232010 peer critique of Aubrey, Figure K.11). The acknowledgement of successful use of these pedagogies from a peer was helpful for providing Aubrey with more support when she was not getting that from her mentor.

Stressed and Overwhelmed

Despite the progress she was making, Aubrey’s feeling of discouragement began to dominate her fall placement experience in different ways. In a blog post she commented on her lack of confidence about her ability to develop and implement “good” lessons. She also questioned whether teaching was right for her as she was so used to
succeeding and had not seen her own success up to this point (Aubrey, 11142010 blog post, Figure K.12). Aubrey seemed to be struggling to view her growth in the classroom as successful and our final pre-/post-conference meeting provided a glimpse into what may have been causing this self-doubt. Aubrey struggled as her fall placement wound down as a result of the stress of the program assignments paired with the stress from her mentor pushing her in a direction counter to the program philosophies. Her frustration with her mentor was evident when she expressed the limitations of what she could address in her lesson during the pre-conference meeting at my last observation visit for the quarter.

Aubrey: okay, I wanted to cross more into the conceptual why or just based on my equation why would this make this happen, I didn’t know how much room I had to do that, cause she was, I mean if you could have heard her say it the way she was saying it was don’t do that, stick with graph it, see what happens, don’t talk about how the equations, cause she’s like I just feel like, for the students who have already had this material, that’s gonna be unfair to the students who haven’t had the material because they’re not gonna know what’s going on, but I’m like they can figure out what’s going on if I say you plug in this number for x then it’s

JH: it’s like we’re trying to protect the students from knowledge
Aubrey: yeah, exactly
JH: don’t expose them to something if they might not know what it is, okay then how are they supposed to learn
Aubrey: yeah cause she’s like, we’ll do it in two weeks so you don’t have to do it, they’re gonna see it eventually so she’s like just steer clear from that, which I didn’t think about it in that moment, could I have said that, but I was considering I want to talk about why does the slope change it in this way, I feel that’s the only way they’re really gonna remember that, is that they actually understand why, I don’t want them to memorize a list of when it’s negative it does this, when it’s positive it does this (11162010 post-conference, lines 1252-1270)

This excerpt demonstrated the push and pull Aubrey experienced during her fall placement with wanting to try to address conceptual understanding through her lessons but feeling she was being held back by her mentor. *Her difficulties were stemming from
her mentor’s desire to present concepts in the same order as they were presented in the curriculum. This conflicted directly with what I had been trying to express to Aubrey and the other PSMTs: break away from the order of presentation of concepts in the curriculum in order to help students make connections and build stronger understanding. Work with what the students bring to the classroom. Despite Aubrey’s inability to be able to do what she wanted to, her frustration demonstrated her belief in the importance of trying to help her students think more deeply about the concepts.

After observing the lesson I commented to Aubrey that she seemed worn down and that she was, “kind of fighting just to try to please people” (JH, 11162010 post-conference, line 1107). Aubrey then shared how her mentor had responded to the lesson plan she had taught today.

She goes, I looked at your lesson last night and I saw the homework that I gave you but then there was something on the end with some graphs and I was like, ‘yeah, I was gonna do an exit ticket’ and she was like ‘ha’ just laughed at me and I was like ‘I need to try something new and it’s something Jenny recommended and I just want to try it out’ and she was like ‘okay, you can try it but I’m not doing that in my classes.’ (Aubrey, 11162010 post-conference, lines 1120-1125)

I was not surprised to hear this as I had observed Aubrey talking to her mentor before the lesson started and her mentor pushing her to not actually use the exit ticket that I had suggested because she would not have time. Of course, Aubrey did not use the exit ticket she had planned and I have no doubt her mentor played a large role in that decision. By the time she was in the last few weeks of the quarter, this push and pull had worn her down and her enthusiasm for teaching had dissipated. With the last lesson I observed during fall placement, Aubrey began to feel the pressure of time constraints with the curriculum and her lesson activities. She began to second-guess her learner-responsive
methods and ideas as a result of issues with time management. She struggled to balance her goal of wanting students to truly understand the mathematical concepts while addressing large material coverage expectations from her mentor at the same time (Aubrey, 11162010 post-conference, lines 1238-1240, Figure K.13). Unfortunately her idea to deal with the problem was to take over the student task of discovering connections and just tell the students what they were originally looking for, “but maybe I should’ve quit sooner so that I could actually write for each thing what it does” (Aubrey, 11162010 post-conference, lines 1076-1077).

During this lesson Aubrey also noticed something she was doing that discouraged student communication.

Aubrey: I noticed myself doing this, I think I’m getting it from my mentor, I think she’ll have an idea in mind of what she wants them to say so then she’ll ask them a question and no matter what they say she just makes it into what she wants it to be and I always notice that and I’m like I don’t want to do that and then I see myself doing it every time I ask a question

JH: it’s not just your mentor, all teachers do it, it’s kind of a thing that we just, it’s like we’re born with it and then we have to stop ourselves from doing it

Aubrey: I tell myself don’t do that, it’s like it just happens, and then in hindsight I’ll be like maybe that’s not really what they meant, I think I can see what they’re trying to communicate so I just go off of it

JH: and I think what you did was you said what about \( y = x + 3 \) and the student said increase and you said, what do you mean and so I mean you don’t do that every time, you do it sometimes which is good, it’s better than none (11162010 post-conference, lines 1154-1166)

She felt bad about assuming what students were saying and then repeating it but struggled with convincing herself not to do it in the moment of teaching. I made sure to point out the instances where she did not do it and encouraged her to continue paying attention and working at it. I knew that habits were difficult to break and tried to remind Aubrey of this. I was still concerned with my original objective of her working toward holding
students accountable during class discussions in order to encourage more meaningful student communication.

JH: I was thinking about how can we hold all the students accountable? Aubrey: yeah
JH: because your discussion, it was a good discussion you were asking some good questions getting them to think about the different things that were happening and some of them were looking in their calendars and not paying attention and I think you knew that, how can we involve them more, maybe if you did something like, you know if we’re gonna have a discussion like this, and all of you are expected to have done this, can I just call students at random Aubrey: which I think I put that in my lesson plan to do on Thursday so I can make sure that they’re all working, so I think I’m gonna try that, draw names or something like that (11162010 post-conference, lines 1357-1366)

Following my suggestion for randomly selecting students to encourage student accountability Aubrey mentioned her plan to do that for the next day’s lesson, however she did not have a set plan to achieve this goal, just an overall idea.

Bringing the Quarter to a Close

At the point in the quarter when the PSMTs had taught all of their lessons, we focused our small group discussions around some more philosophical perspectives on the purpose of school. One topic that came up was the issue of grades and whether they should depend on completion of homework or demonstration of understanding. Aubrey demonstrated confusion as she acknowledged the importance of learning over anything else followed by a comment that the current education system did not allow that to necessarily be the focus (Aubrey, 12032010 small group, lines 572-582, 631-641, Figure K.14). She seemed content to just work within the system and saw the complexity of trying to make substantive changes as a result of the impact of methods used in higher education on the types of assessments used in high school.
At the end of her fall placement experience, Aubrey’s goals for herself included an interest in improving her classroom management, use of technology, and “closure of lessons, implementing some sort of exit ticket or routine for wrapping up class” (Aubrey, 11142010 FEAG). For her fall placement experience I saw Aubrey as making progress in areas of implementing learner-responsive pedagogy however I felt her progress was stunted as a result of the stress and restriction inherent in her placement environment. My goals for Aubrey’s next placement experience were focused around areas she had demonstrated some interest in but had struggled to implement or had room to continue improving.

Include more informal assessments such as pre-/post-tests and exit tickets and continue working to find ways to challenge your students and get them to feel more comfortable sharing their thinking in your classroom (especially higher levels of thinking). (JH, 11232010 FEAG)

I was not familiar with the mentor she was placed with for winter but felt good about Aubrey’s continued demonstration of belief in the effectiveness of some learner-responsive approaches. As a result, I focused on finding ways for her to continue to have opportunities to notice student thinking through formative and informal assessment.

Winter Placement – Promising Experiences

For winter placement Aubrey was in a suburban high school observing and teaching a class designed to help remediate struggling students between taking Geometry and Algebra 2. Aubrey had a positive start in her winter placement with a mentor who demonstrated instant interest in preparing her to interact well with students and develop a strong rapport – a lacking characteristic of her fall mentor. Her winter mentor required her to learn the students’ names within the first week and consistently encouraged her to
get to know the students beyond the mathematics classroom by asking them about other aspects of their life and attending after school functions. During my second observation, her mentor commented to me that Aubrey was only being observed during lessons where she was not teaching because students were doing group work activities. He suggested that I should make sure to come for a third observation when Aubrey was actually teaching suggesting a view of teaching as explaining, not necessarily facilitating learning opportunities. Toward the end of the placement, Aubrey commented how she felt like she had to sneak in activities that were not just guided notes everyday demonstrating her perception of feeling restrained in her choice of teaching methods.

Renewed Interest and Progress

The issue of the purpose of school and assessing students came up during a small group discussion again early in the quarter. Aubrey demonstrated a change from her comment toward the end of fall quarter.

well this is probably gonna sound really bad but, if they really know it so well then they don’t have to do the homework and they can still, I mean, why waste the time doing 20 of the same type of problem when you’re like I already know this, especially the class that I’m doing, it’s like a bridge class for students that didn’t do well in, geometry so they didn’t go onto algebra 2 right away and, so a lot of them know topics so well and you can tell they’re kind of bored (Aubrey, 01142011 small group, lines 347-353)

Her experiences and observations within a different context gave her reason to consider a different perspective on the purpose of homework. *While she acknowledged the lack of interest she observed in her students there was no mention of why the students were bored and whether she, as the teacher, had control over the student perception and motivation.*
In her winter reflective writing, Aubrey reflected and commented on the difference in environment in her fall versus winter placement. She noticed increased engagement in her winter placement classroom and attributed it to her mentor’s focus on building a rapport with his students (Aubrey, 01262011 experience reflection, Figure K.15). She seemed impacted by this difference in student behavior and attitude based on the teacher’s interest and encouragement. She mainly took note of the power the teacher has to impact the environment of the classroom. I saw this as a possibly powerful perspective as many of the struggles she encountered fall quarter were in an environment where learner-responsive pedagogy was not commonly implemented and she struggled within that environment. With this perspective she had more possibility of realizing she could impact the classroom environment on her own but it would have to be within the six weeks she would be teaching.

With winter placement focused around the PSMTs teaching one of their mentor’s classes for a minimum of six weeks, I did not observe for the first few lessons in order to allow them to establish a rapport with students. A couple of days before I met with Aubrey for her first observation of the quarter she began to notice and reflect on her methods and how they were involving students or not. She commented that her perception of students understanding the material led her to increase the pace of her lesson (Aubrey, 01252011 lesson reflection, Figure K.16). The lack of obvious student confusion unfortunately commonly led to this reaction, increasing my desire to get PSMTs to have more opportunities to notice thinking and the possible lack of understanding instead of assuming silence meant understanding. While she did
acknowledge involving students at the board, she was concerned about making sure she increased student involvement and participation (Aubrey, 01252011 lesson reflection, Figure K.16). This concern demonstrated Aubrey’s continued interest in encouraging student communication. I was hopeful that her interest would allow her to see that her students were possibly not “catching on” as well as she had perceived. However, she struggled to balance her ideas for learner-responsive methods and her mentor’s methods and pace for working through the material with the other classes he was teaching. She commented that she was conflicted between her mentor’s idea to “instruct” more and her own interest in giving students more time to think about the problems using a “think-pair-share” strategy. She saw her approach as providing her with the opportunity to see how her students were doing and provide more guidance if necessary but also noticed her mentor’s ability to “get through” more examples (Aubrey, 01262011 lesson reflection, Figure K.17). Her conflict seemed to be that her methods took more time and she felt that she had to stay on pace with her mentor’s other classes in order to be validated as a teacher. However, Aubrey frequently commented on the importance of student communication when we met on the day of her first lesson observation. “I like the idea of them pairing up with someone because I think that could be really helpful for them to explain” (Aubrey, 01272011 post-conference, lines 1573-1574). She demonstrated a desire to encourage student communication but a struggle to make sure to include it with other aspects of her lessons because of the time it required. The juxtaposition of a novice implementing complex learner-responsive methods with an expert implementing
straightforward instruction was a difficult competition for me to continue to push PSMTs on the path of learner-responsive pedagogy.

As Aubrey attempted to encourage more student communication in her classroom she reflected on some difficulties and sought help from me during my first observation visit.

Aubrey: And I’ll say you know, let’s be respectful and listen as they explain it and, ask questions if you have them. One thing is, I want them to get more comfortable with talking about the math, which is a big reason that I want them to pair up and also explain what they’re doing. But they don’t seem to do very well with that at all, so I try to get them to do it the last two days when I had someone do problems and they’re like what do you mean. I just did this and this. I wrote it down, why do I have to say what I did. So that’s kind of a fear I have is that that won’t go well at all.

JH: Well, and just thinking about, so if you were to explain maybe this problem and how you would do it. And you were gonna say, well I just plugged in -5 and I simplified and this is what I got, this is what x equals. And then well, I already know what y equals, so I’m done. So then is that, what are you looking for? What would you like them to say?

Aubrey: if that’s what they said then I’d say, well why did you choose to plug 5 in, because yesterday some of them wanted to just solve the first one for the first variable. You know what I mean, no matter what. And so talk about well we already have one solved for y, so why don’t we just plug that in. And just ask why’d you do this, why’d you do this, and then I’m just gonna kind of drill them. Cause another thing [my mentor] said they do a lot is plug back into the same equations once they solve it for the variable. And so, why’d you choose, which equation do you want to plug it in to or why’d you choose that or that kind of thing. (01272011 pre-conference, lines 1446-1465)

Aubrey demonstrated frustration with the students not responding well to her expectations for deeper explanations of their thinking. I tried to get her to think about the types of responses she would like to get from students and she focused mainly on the reasons behind the students’ actions. She demonstrated interest in getting her students to think about what they were doing mathematically but did not share any thoughts about why her students had difficulty expressing their thinking. I kept this in mind throughout
my observation and during the post-conference I pointed out to Aubrey that she may want
to pay attention to her own method for explaining content.

JH: The other thing I was thinking, is for you to watch the video and pay attention
to what you do when you’re explaining how you’re doing a problem. Because
you’re modeling for them what you want them to do. Right? So are you giving
explanations beyond just the procedure?
Aubrey: Yeah, that’s true. Probably not.
JH: I mean, it’s hard not to, I think, cause I mean that’s kind of what math is to
most people, that’s how we’ve paid attention to it, so that’s the other thing to look
at in your video, is how are you giving explanations and how can you expect
students to do much beyond that. (01272011 post-conference, lines 1663-1669)

I tried to get Aubrey to think about herself as a model for her students and if she wanted
her students to be able to meet some expectation, demonstrating what that looked like
could only help students work in that direction

On a similar note Aubrey commented about the lack of usefulness of her
questions planned ahead of time.

Aubrey: I know, exactly, and I always think that, for the lesson plans, I used to
always put those discussion questions in there, which I think are good to think
about, but then I feel like it just never works out how you think it’s gonna work
out. It’s not like it’s this step-by-step, it’s gonna be perfect, so I feel like most of
the questioning is just the natural, what comes up and so that’s hard
JH: The best questions to ask, how did you do that, why did you do that, those
work every time, but then the questions, there’s gonna be specific questions that
are good to ask, if you know you’re doing substitution and graphing, or you know,
at the beginning you talked about the problem that you saw on the homework,
most of them just solved for one solution, so I was thinking, perfect question to
ask, what’s the point, why are we doing this? You know? Why would I not be
happy with just seeing one number (01272011 post-conference, lines 1628-1638)

Aubrey was suggesting that most of the facilitating done by a teacher during a lesson has
to be spontaneous. I tried to clarify the difference between those spontaneous probing
questions and the pre-planned questions to help to get students to think about specific
aspects of mathematical content. While I considered her acknowledgement about the
importance of those spontaneous questions, I also viewed it as important for her to think about the content as she was planning the lesson in a way that would allow her to develop meaningful questions to challenge the thinking of her students.

Similarly to fall placement, Aubrey noticed her tendency to restate students’ explanations.

Aubrey: Oh something else I noticed I do that annoys me that I do it but it’s so natural and I can’t help it. I’ll ask a student to explain it and then they do and then I’m like, well I could explain it better so I’m gonna go off of that and explain it my way. Or what he said was, what he meant was, you know? Oh my gosh and everytime I do it I’m just like, right afterwards I’m like what was I doing it’s just totally putting down the student’s comment and saying well I can explain it better so why even have you do it. So it’s not like I’m just awful. I know that, I always feel bad when I do it, cause, my goal is to not, but it’s just so natural and sometimes there’s just something I want to say so bad that I can add onto that that I think is important. And I don’t know

JH: So I think it’s just a matter of trusting that the students can understand or that the students are gonna come up with it, or that the students can say it. So I wonder if it’s more, if you could look at your video tape and say okay, these are the places where I think that I did that and these are things that I could do instead. And that’s what you could focus your critique on.

Aubrey: Yeah, and something that I think, and I’ve thought this before but I never do it so I need to actually, but when I want, when I have the urge to do that, make it a question, whatever I’m gonna say, make it a question to them or to the class so that way I can still have that thing in there and they can get it but I don’t have to be the one saying it

JH: or you could ask the class, do you guys have anything to add to that, do you think that there’s anything else that you were thinking, or anything like that, but yeah, I think that’s a good idea. (01272011 post-conference, lines 1603-1624)

She continued to be frustrated by this habit and noted the possible discouragement of student communication as a result of her continuing to do it. I tried to suggest some ways for her to reflect further on this issue and make note of the instances where she had a tendency to do it. She then shared an idea to try to help herself improve by always responding to student comments with a question. This was a noted improvement from her
lack of confidence in her ability to come up with learner-responsive methods to try during fall quarter.

Additionally Aubrey struggled to carry out her plans to provide students with opportunities to be challenged by and then communicate mathematical ideas.

**JH:** So I was thinking, let them work together, you know, that’s the point, that’s the reason why you designed it this way, they don’t have to have it completely done, they don’t have to have it completely right, and so I was trying to pay attention to the amount of time it took before they were ready to move on and they started moving on on their own, the first time I didn’t catch it, but it was only a couple minutes, and they started asking each other, especially with, I don’t know if it was the second or third one, maybe it was the second one, the guy in front of me and the girl next to me, he was just like, I’m getting something funky, because it was infinite solutions, and so they were quick to try to figure it out with each other, so it was natural for them to do it, so I think that it’s a good thing for them to do, you just have to let them do it

Aubrey: I know

**JH:** you are doing too much work

Aubrey: I just can’t help it, I see them struggling with it and I’m like oh I got to tell them

**JH:** yeah, you need to stop, just say, I need to relax, I need to sit back and let them do the work, you’re just working too hard, give yourself a break, cause I mean you’re running around, you’re going crazy cause you feel like this student’s struggling, and that student’s having, and these students’ are done and I don’t know what to do, just let them do what you planned to do (01272011 post-conference, lines 1722-1738)

Aubrey demonstrated within this discussion her innate desire to help struggling students. I tried to suggest that her plan to let them communicate and work it out was great. She needed to give it a chance to work instead of overstepping her own plans and ideas with an approach that overstretched her capabilities as a single teacher in a classroom of 30 students while also taking away student opportunities to think. In the same discussion I continued with more suggestions about why it would be beneficial to allow students to work together instead of approach it like she is the only one who can help the students
learn, especially when her telling her students how to think and work through problems was not necessarily helping.

Aubrey: I know, it really is time is my huge thing, I don’t know, but, because the first lesson I taught, I got done and he gave me notes and we talked about it, and he’s like, the only really negative thing that I could say is that you flew through it, or he’s like it was a little too fast, he’s like, I mean it was okay but some students were totally lost and you just kind of went through it too fast, so then I had this fear of, okay, I feel like, it’s hard for me to get a general, with this group of students, where they’re so different, it’s like, do I just go with the middle of the road student and that’s the speed I’m gonna take the lesson.

JH: I think you do it different every day, you don’t have to do it the same everyday, but for the lesson that you had today, I think that it would of, like the girl that you were helping a lot, she was working with the girl behind her anyways, and she could’ve, like you said, she was just confidence, right, so, she could’ve seen that she was doing fine or bounce some ideas off of another, why does it have to be you, cause you’re building this relationship with her right now that you’re the only one that can help her, and she needs to be able to help herself and she needs to be able to ask other people questions, cause you’re not gonna be there all the time, you’re not gonna be in her head, it would be nice, I always thought when I was tutoring and stuff, if I say something enough, and I repeat it enough, it will repeat in their head and it will be like I’m there helping them through the quiz and the test. That doesn’t work. But I mean I know exactly what you’re thinking, I mean I’ve done the same thing myself, so it’s not like it’s unnatural, it’s not like it’s horrible, it’s just kind of what we’ve been taught to do and what we’ve experienced and it’s us wanting to help people, that’s why we’re teaching, right? (01272011 post-conference, lines 1760-1780)

I found it important to share with Aubrey my own struggles with breaking myself of methods that were not beneficial to students in order to help her understand the difficulty as well as the importance of continuing to work toward the goal.

While Aubrey demonstrated the ability to incorporate methods to challenge student thinking she admitted to her differentiated approach to interacting with and challenging low versus high achievers.

Aubrey: Plus I didn’t feel like I needed to tell her. I mean she’s definitely one of the brightest in the class I didn’t feel like I needed to tell her anything, you know what I mean?
JH: But no matter who asks that question it’s good to respond with what do you think. So it was a conditional what do you think?
Aubrey: it was, but I feel like if a student who was, like if a weaker student said that, I’d be like, yes you said that and I’d be like, yeah, you can, good job, you know, which isn’t good but I mean (01272011 post-conference, lines 1790-1795)

In this discussion, I wanted to share that I had noticed her use of a good questioning strategy and did not anticipate her use of questioning as conditional dependent on her perceived ability level for the student. She did demonstrate an awareness of this not being a good approach to take, however, she also indicated that it might be difficult for her not respond differently because of her excitement in a low achieving student doing something right. While I understood her excitement, from my experience I knew learner-responsive methods had been successful when used with low achieving students. This gave me more reason to try to help Aubrey to understand how her approach was not really helping that struggling student.

An issue that surfaced during winter placement and was a frequent topic of discussion during the small group meetings was that of encouraging student participation, even with reluctant students. This issue came up during my conversation with Aubrey at my first observation visit.

Aubrey: I think I just always have a, I mean, I don’t know how I feel about it, but I know when I was in school, I never wanted to come up and do anything, ever, and it’s not like I was shy, I mean I would always answer things but I never wanted to come up and do a problem on the board, and so I always have this idea like if someone doesn’t want to do it, I’m not gonna make them, but I don’t know if that’s good, that’s just letting you off the hook
JH: right, the question is, what is your objective, are you having them come up there, for why, what’s the point
Aubrey: to learn
JH: I mean, you can learn about what they know, but why’s it good for them?
Aubrey: cause they get practice with talking about math
JH: so by not, I mean
Aubrey: that’s taking that away from them

JH: as long as you think, I mean research has shown that it is useful for students to communicate math and try to explain things, but you have to believe it in order to do it and feel like you know, you’re gonna throw yourself behind it, so I mean, yes I agree, I was the same student, I didn’t ever want to talk, I always knew the answers, I’d say them under my breath, I’d be the person who whispered them every time, and I think that it would have been better for me to have been forced to do that, forced to talk more often, cause I’m still really shy, I’m still nervous about going in front of people and doing things and I think that that would’ve helped me to be, I don’t know, maybe it’s just who I am, but, so I don’t know, yeah some students could respond negatively to it and it could end up being, but for some students it could be helpful

Aubrey: and I don’t want to, this is another fear I have, I think it’s good when students come up and have the wrong the answer, I feel like that happened a couple times last quarter and it was the best lessons I had because that’s such a learning, a moment where everyone can chip in what do they think is going on and I think that person learns better because they’re hearing it, but also, if I call on an insecure student, like the girl who was having a lot of trouble, if I call on her, she comes up and does it on the board, has the wrong answer, I feel like that’s just gonna kill her confidence even more, that is the worst fear with that, and I don’t want to draw her name and then say, oh wait, I’m not gonna have her come up, that’s the worst thing, but yeah, I do think it’s still important to have it (01272011 post-conference, lines 1866-1915)

When Aubrey brought up the hesitation about “forcing” students to come up to the board and participate, I decided to try to get her to focus on her objectives and the reasons behind even encouraging participation in the first place. I figured if she could reflect on this purpose and realize the possible student benefits, she would not be as concerned about putting students on the spot. This topic came up a couple days later in a small group discussion and Aubrey contributed her perspective. She reiterated how she did not like the idea of making a student communicate verbally in front of the class but recognized how only taking volunteers limited her ability to assess student understanding. She also mentioned what I had shared with her about the importance of giving students experiences with communication (Aubrey, 01282011 small group, lines 106-117, K.18).
felt that Aubrey’s sharing this perspective with the whole small group showed her ability
to reflect on the conversation we had and ultimately consider what was best for her
students. Again I often tried to build interest in learner-responsive pedagogy by
reminding the PSMTs about the benefit for their students and typically that gave them
more reason to consider incorporating them into their practice.

In Aubrey’s winter placement, while her mentor was supportive in some ways, he
encouraged teaching methods that did not coincide with the learner-responsive
pedagogies I had modeled and continued to suggest. After my first observation I pointed
out how she could try to focus more on helping students to think about the ‘why’ she had
mentioned as being important to her during fall placement.

JH: the only other thing that I circled and we kind of talked about this, is this
focus on the procedure of doing it, like you said, you know if you’re having
trouble, go look at the steps or whatever, I mean I understand that, it’s hard not
to, but when a student asked, can we do number 16 on the board, you say, okay,
what’s your first step.
Aubrey: yeah
JH: and I’m thinking, our first idea should be, okay what are we doing with this
problem, you know, and I think I’ve already said something like that, and I just
wrote, let’s think about this idea of focusing on steps versus, what’s the point of
what we’re doing, and then get to the, so how do we do it (01272011 post-
conference, lines 1839-1847)

Aubrey had mentioned before about how she wanted students to be able to think about
mathematics conceptually so I made sure to make note of instances where her methods
may be contradicting this goal such as when the focus seemed to be more on just working
through procedures instead of making sure students were thinking about what the point
of solving the problem was in the first place. I also decided to renew my efforts to get
Aubrey to incorporate a hook into her lessons. Based on my observations she was not
engaging her students from the beginning of the lesson, which made it difficult for her to get them interested in her planned activities.

JH: I want you to try to do something other than a warm up problem that’s just a typical homework problem or something like that, do something like a hook
Aubrey: yeah, I know, I’m really bad at that,
JH: you just got in a bad habit of doing it last quarter because your mentor didn’t support it and so now you’re just like I’m just gonna keep doing it, I got away with it once (01272011 post-conference, lines 1801-1806)

Shortly after that Aubrey pointed out her plan to use a problem as a hook that I had suggested to a peer for use the previous quarter. The peer had incorporated the problem and shared his success at small group and Aubrey mentioned her plan to incorporate the problem as a fun way to get her students to think about applications of the concept before formally talking about applications the next week (Aubrey, 01272011 post-conference, lines 1819-1823, Figure K.19). Aubrey’s use of this problem turned out to be a meaningful experience and she shared her experience at small group the same day that she used it. She explained how her students had asked her about how to do the problem and she had responded with “you can do it a bunch of different ways.” She also shared how she noticed some students solving it in different ways and had encouraged her students to keep on working on it over the weekend instead of giving them the answer (Aubrey, 01282011 small group, lines 240-254, Figure K.20). When Aubrey mentioned her approach of not directly answering her students’ questions about how to do the problem her peer who had used the problem fall quarter said “You pulled a Jenny” (01282011 small group, lines 240-254). I saw this comment as demonstrating their connections of specific learner-responsive pedagogies to my model of those pedagogies in the summer methods course. This demonstrated the impact of their experiences in the
summer methods course. Aubrey continued to share with the small group what she observed while students were working on this problem. She explained how she had noticed a student’s solution method for the problem she would never have thought of and how she had observed her students coming up with ideas she did not think they would understand (Aubrey, 01282011 small group, lines 300-310, Figure K.21). Just as I had intended with the use of learner-responsive pedagogies such as providing students with rich problems, Aubrey had created an opportunity to observe the abilities of her students and learn more about the way they think. Not only did she have an experience that excited her, she actually focused on specific methods students used to solve the problem and was able to reflect on the mathematics involved as well as the benefit for her students.

Aubrey reflected further on her use and implementation of the problem as a hook in her self-critique after viewing the video of the lesson. She provided details about how her students were frustrated with her not telling them how to do the problem and how she was pleased with her decision to come back to the problem at the end of class. She commented that even though all of the students were not able to get a solution to the problem, she was positive that it got them thinking about the applications of the concept. She was also able to notice how the problem encouraged the students to communicate their understanding with each other (Aubrey, 01312011 self-critique, Figure K.22). This reflection showed how successful Aubrey was with the use of the engaging hook and how much she learned about her students and their abilities by trying this method. There were many aspects about the implementation of the problem that I had suggested to Aubrey.
such as not having to finish the problem at the beginning of class, being able to come back to it at the end of class if there was time or even a few days later if the students were really interested in the problem. Her ability to observe successful implementation of learner-responsive methods within her practice led to excitement and increased interest in those methods.

As winter quarter progressed she continued to reflect on her different experiences in relation to her beliefs and interests in learner-responsive pedagogy. In one lesson reflection she revealed her conflict with the idea of practice and repetition as she noticed her students lack of motivation to complete a “tedious and boring” assignment. She struggled with her belief in the importance of practice to learn mathematics and her students being forced to do 20 problems when they were already able to do the problems (Aubrey, 01312011 lesson reflection, Figure K.23). She was conflicted with her belief in ‘practice makes perfect’ and her belief that her students should be engaged and interested in the material. She observed that her students were not having difficulty working through the procedure but did not necessarily make note of whether they were understanding the underlying concepts or not.

At one point Aubrey came to small group with a question about using a learner-responsive pedagogy in a specific situation.

Aubrey: I feel like I’ve seen it in [the class I teach at the university] way more but it happens all the time that I’ll be doing a problem and I’m letting them tell me everything to do and then they’ll say something and it’s something I could do but it’s not gonna get me anywhere or it’s gonna make the problem take longer and to me if that was me in that class, I want you to show me the most efficient way, especially for the college course because that, I’m gonna look at my notes and that’s gonna be the example I go by, so for them to have it in their notes as an extended way that they’ll be like why did you do that, you know what I mean? So
I guess that’s a little different but, you know what to do when they, and I don’t want to shoot them down cause you know, okay we can do that, I don’t and I want to encourage their input, so like what would you do (02042011 small group, lines 259-268)

JH: could you say, okay, from this point, we could go this way and we’ll follow that in a second, are there any other ideas of what other ways you would have gone from here? And then just follow the different paths? it makes perfect sense to you why it’s not a good idea, and you think that by explaining it to them, they might get it, but they haven’t tried so if they haven’t done it themselves, it’s hard for them to see the same merits behind it as you do (02042011 small group, lines 303-309)

My thoughts automatically went to research on the use of learning progressions and the importance of not asking a student to move to a more sophisticated way of thinking before he/she is ready. I recognized Aubrey’s concern here and tried to get her to think about the implications of not valuing a student’s thinking and a practical way of incorporating their thinking while also showing a different solution method.

During a small group meeting early in the quarter I asked everyone to write their goals for teaching for the quarter and share them with the group. Aubrey’s focus was on pacing for her lessons, “coming up with higher order questions to ask students” (Aubrey, 02042011 small group, line 330) at critical points in her lessons, like when students are at the board, and her last goal was “to not have a mental breakdown” (Aubrey, 02042011 small group, line 338). In comparison to her goals from fall quarter, she was still focusing on general comfort and ability with teaching, was focused on a specific learner-responsive pedagogy, and her last goal demonstrated the level of stress on her and other PSMTs at this point in the program.

During my second observation visit, Aubrey shared little aspects of learner-responsive pedagogy she wanted to focus on improving. She shared her struggle with
coming up with “thought-provoking” questions “on the fly” and her feeling that by
getting to know her students better in this placement they seemed more comfortable with
communicating, even if they could be wrong. She also commented on her interest in not
just responding directly to her students’ questions when they are working in cooperative
groups, but trying to encourage them to communicate with each other (Aubrey, 02092011
pre-conference, lines 2054-2084, Figure K.24). Aubrey demonstrated concern with her
questioning ability again and then specifically wanted to focus on her ability to
encourage students to work in groups and communicate their thinking to each other. She
was more satisfied with her progress in winter placement due to the rapport she was able
to build with her students allowing her to focus more on implementing learner-responsive
methods. She even mentioned her students’ frustration with her for using my modeled
approach of responding to student questions with questions or redirecting them to peers.
Aubrey also struggled with implementing successful cooperative grouping strategies
during her winter placement.

JH: is there some sort of accountability for working in class today
Aubrey: no
JH: other than it’s just, this is your opportunity to practice and so that’s another
reason that you’re not gonna get some students working, so I work on it if I need
to and if I don’t want to then it’s not a big deal (02092011 post-conference, lines
2543-2548)

She struggled with this during her fall placement as well and I had mentioned needing to
hold students accountable in different ways. This time I tried to help her understand why
students would not necessarily work well for her if they did not see any consequences to
not participating.
In this same meeting the issue about what a learner-responsive classroom looks like and how it can be interpreted came up.

Aubrey: I feel like my favorite thing to see on a video or when [my mentor’s] teaching and I’m watching them do stuff, I love when they just, just listening to them talk about math, or when they just start on a problem or they’re debating it with each other or something, I’m always like, this is awesome, and then I realize that I can’t use that as my clip because I didn’t do anything, they’re being awesome

JH: but would they not be doing it if you hadn’t given them the problem
Aubrey: yeah that’s true but

JH: I mean cause really, what we’re trying to do is talk about the teacher’s job and this whole perception of what the teacher’s job is, is the teacher’s job to sit up there and talk the whole time or is the teacher’s job to create lessons that almost run themselves with you just sort of facilitating
Aubrey: yeah

JH: So more of a facilitator and less of a lecturer, where the job you’re doing is more behind the scenes than anything else
Aubrey: and I agree but I just feel like if we have to have video of us it’s like, I don’t know (02092011 pre-conference, lines 2117-2131)

Aubrey commented about how encouraging and exciting it was for her to observe students having a great conversation about mathematical topics. However, she struggled with the way this is portrayed on a video because she felt it did not demonstrate anything about her teaching and her abilities. This made me think about the perception of a teacher’s job and how that perception of “all-knowing explainer” needs to change to “facilitator” and that comes along with the realization that a lot of the work of teaching is done outside of the classroom in preparation from assessment results. This was a perspective that seemed to be critical for PSMTs as well as those evaluating their teaching.

During my last observation visit Aubrey continued to demonstrate her growth in interest in the remedial students she was working with.
Aubrey: I feel like they’re way smarter than they get credit for, since they’re in that class, oh they’re dumb kids, but they’re not, I honestly feel like, the students in this class, I mean if you told me these were honors students I would believe it, not based on their grades which sucks but when you hear them participate in class they know what’s going on, so I feel like they could do a lot

JH: so you just want to give them the opportunity to try something

Aubrey: which is why, I like doing the brain teasers, I feel like that’s at least doing something, but a lot of them think that, they don’t even participate, they’re like this is stupid, they’re like are we getting graded on this, do we have to turn it in

JH: so it’s not an issue of intelligence it’s an issue with motivation

Aubrey: yes, definitely, that’s how I feel

JH: so finding ways to motivate them

Aubrey: I feel like most of them and that’s why they’re in this class cause they never did their homework before, so there are a few that fit that profile that I think is put on the whole class like you know what they’re expected to be and so, and like I said that’s what makes it hard is that they’re on such different levels

(02162011 pre-conference, lines 2752-2767)

These statements demonstrated Aubrey’s concern for the perception of students and the belief in their abilities. I also saw it as evidence of her ability to notice student thinking and knowledge throughout her experience in this placement. She had incorporated many opportunities for students to share their thinking and as a result learned more about their abilities than she would have initially assumed based on the remedial class they were in.

Her interest in student thinking was demonstrated in a comment about outspoken students in one of her lesson reflections. She shared her preference for the students who were willing to communicate openly because “it makes it a lot easier for me to figure out what I need to focus on and spend more time on, and how they’re best going to learn (Aubrey, 02162011 lesson reflection, Figure K.25). This comment demonstrated Aubrey’s focus on student communication for the purpose of informing her instruction. This was a noted development from her initial focus on general student communication without recognition of impact on her instructional decisions.
**Putting Models into Practice**

Aubrey’s progress and development throughout the quarter were apparent in many ways. In her last lesson conference with me, Aubrey seemed much more relaxed about being flexible. She spoke about how she was able to “play it by ear” based on her perception of student understanding and how she would switch between discussion with her students or letting them work on problems while she circulated (Aubrey, 02162011 pre-conference, lines 2677-2681, Figure K.26). *I saw Aubrey as finally beginning to feel comfortable in viewing herself as having control of the classroom environment. She had developed comfort in using questioning strategies to facilitate discussions and adjusting her lesson based on assessment of her students’ understanding.* Aubrey’s ability to be flexible and feel more comfortable gave her room to incorporate more methods to encourage student communication. She shared how she had been trying to have her students answer other students’ questions instead of just answering the questions herself. She shared how she believed the students communicating get the opportunity to think more and her students sometimes understood each other better than her (Aubrey, 02152011 lesson reflection, Figure K.27). Aubrey began to notice the value in students hearing the thinking of their peers. *She had acknowledged her lack of confidence in her ability to explain mathematical content in ways students understood during fall placement and I had suggested letting the students do more explaining. This was a way for me to encourage Aubrey to have increased opportunities to attend to student thinking with the goal of her learning more about how her students think while also providing students with opportunities to communicate and develop understanding.* She shared that
through her frequent emphasis on having her students share their thinking she had noticed that by only hearing from a few students she had no idea how her other students were doing with the material. She suggested implementing a form of formative assessment that would allow her students to quickly and safely provide her feedback with their understanding (Aubrey, 02162011 lesson reflection, Figure K.28). Her emphasis on encouraging student communication provided her with the opportunity to reflect on her assessment of student understanding as well. *In conversations with the PSMTs about their lessons I would always ask them about whether they had evidence of student learning. This emphasis may have impacted Aubrey’s concern about not hearing from all of her students and trying to think of a way to assess more than those willing to volunteer.* Aubrey also had some great experiences with implementing the method of students sharing different solution methods with the class. She shared a specific experience of a student sharing a method for factoring that she found to be easy to understand. She had asked that student to share her method with the rest of the class and was excited about how well the student had explained her method and how the other students were involved by asking questions and discussing which method was better (Aubrey, 02162011 lesson reflection, Figure K.29). Aubrey’s excitement and enthusiasm about the success of this method during her lesson demonstrated the impact of this experience on her perspectives. *At the beginning of the quarter, Aubrey took note of her tendency to fly through the lesson and wanted to try to focus more on student participation. As the quarter progressed and Aubrey tried new methods for encouraging student communication she began to see success in methods, particularly some that I had suggested such as having*
other students answer students’ questions and encouraging alternative solution methods. I saw her ability to use these methods and experience success as providing her with reasons to continue implementing learner-responsive pedagogies and build stronger beliefs in the effectiveness of those methods.

She elaborated on her perspective of her progress on teaching goals in her second reflection paper for the quarter. She shared her focus on improving her questioning ability and her difficulty with pre-planning questions when she did not know how the class would “naturally flow” (Aubrey, 02182011 goals reflection, Figure K.30). While I respected her point about adjusting to what students were bringing to the lesson, I still believed that there was a place for pre-planning questions based on objectives and knowledge of intricacies of the mathematical concepts to get students to think about. However, it seemed that as novices in teaching specific content the PSMTs struggled to think about what to emphasize in their questioning prior to teaching the lesson.

Aubrey also commented on her successful implementation of strategies suggested by me to get more student communication in the classroom. She mentioned her incorporation of some method to engage her students in the end of class through use of a brainteaser or foreshadowing the next lesson (Aubrey, 02182011 goals reflection, Figure K.31). Aubrey had struggled to include a closure in her lessons fall quarter partially due to her mentor’s negative support. Knowing that this was a goal of Aubrey’s and other PSMTs, I consistently suggested the importance of keeping students engaged until the end of class in some way and provided methods to achieve this similar to those she had used. Aubrey continued to comment on her use of an accountability strategy I had suggested as
well. She also brought up her attempt to respond to student questions by asking other students to think about it. She reflected on the positive impact of providing her students with an explanation other than her own and allowing them to see different perspectives. She mentioned how she had originally thought her inability to provide the perfectly clear explanation meant she was a “bad teacher” and how she still felt that way but saw positives in encouraging other explanations (Aubrey, 02182011 goals reflection, Figure K.32). She admitted that she did not completely believe my idea that it does not make her less of a teacher but she did seem to agree that it is good for students to hear ideas from their peers as well as her though. I commented on her remark about being a bad teacher in my feedback.

I would say that most people (including myself) initially think about teaching as being able to explain things really well ... I have come to see it a little differently though. While it is important to be able to explain things well, I see it as more important to provide students with opportunities to construct their own understanding and I think that happens more when they get a wide variety of perspectives and communication of perspectives is valued in the classroom. (JH, 02192011 reflection feedback)

I attempted to direct Aubrey’s focus more toward the benefit for the students and away from her negative view of her abilities. In the last section of her reflection she shared her continued struggle with posing questions. She struggled with finding a good balance between vagueness and too much detail to really get the students to think deeply about mathematical ideas (Aubrey, 02182011 goals reflection, Figure K.33). I provided some feedback and support.

I think this is definitely something that comes with experience and getting to know your students over a longer period of time. At this point, you are still trying to figure out what they have been exposed to, so I think that makes this more complicated. Either way, maybe the next time this happens, ask them if they...
understand your question or ask if they could explain what you are asking. If they can’t, then you need to reword or add on. (JH, 02192011 reflection feedback)

In my feedback I attempted to provide Aubrey with support by admitting the complexity of achieving her goal but finding ways to make progress. In her peer critiques, Aubrey was consistent with her focus on encouraging student communication by commenting on similar aspects of her peers’ lessons.

I just think that the pairing up with another group could be really beneficial rather than you going over it at the front of the class. Having students explain their thinking to each other is something I think is really helpful for all students involved. (Aubrey, 02202011 peer critique)

Her suggestion of the value of student communication demonstrated a consistency in her perspectives about the types of experiences contributing to student learning.

The Algebra Tile Experience

Toward the end of her winter placement experience, Aubrey decided to try to incorporate manipulatives into a unit she was teaching. She specifically chose to use the manipulatives based on her experience and growth of understanding from personally experimenting with them. Her use of them was also an attempt to “sneak” in more learner-responsive pedagogy in order to break from the pressure of using the collaborative materials produced by the teachers in her placement.

Aubrey: yeah, what’s my new goal, I mean, I’m in a struggle with, I’ve been trying to do different stuff but, I don’t want to do the same, I mean this doesn’t have to do with today cause I already have this made out and I understand, [my mentor] likes me to have this because he’s like, they need the structure otherwise they’re, if they don’t have the guided notes in their hands they’re just not gonna pay attention they’re not gonna know what’s going on, which I get but I just hate doing that everyday, it gets kind of, I don’t know JH: so you’re essentially saying that you don’t wanna get in this rut of doing this everyday?
Aubrey: yeah
**JH:** have you not had other days where you do other things?
Aubrey: the only days we do other things, which are a lot, we have a lot of review days so I’m able to do other stuff, but
**JH:** it’s almost like you want like a discovery lesson day
Aubrey: yeah! Which I’m kind of trying to sneak in with the algebra tiles cause I’m having them do that first and then talk about how does this relate to what you know about FOIL (02162011 pre-conference, lines 2737-2751)

Aubrey demonstrated her feeling that she had to provide structure based on her mentor’s expectations for his students but suggested that the same method every day got boring.

She also mentioned her attempt to bring in learner-responsive pedagogy through use of manipulatives. However, she experienced many ups and downs in incorporating the manipulatives into her lessons as the students reacted to her choice. She discussed her experience with me and wrote about it in her lesson reflections several times.

Aubrey: do we have to use algebra tiles, we already know how to FOIL, but then what I’m gonna tell them, I didn’t really know what to say at the time but then I thought about it, and I’ve always known how to FOIL for a long time, and I never really thought about why it worked, I just did it, cause you know, I knew it was right and then once, the reason I want to use algebra tiles is because I think they’re so cool, cause once I used them I was like, oh, I get it, and, I just think it’s so cool, and another thing, it’s the same picture in my head for mental math that I would use, you know what I mean? And so those more advanced students that are like, this is stupid, I can talk to them on that level and say, hey I didn’t know how to use algebra tiles, I knew FOIL first, and I think it’s really cool and it helps me to understand

**JH:** and it makes more sense to me, it’s easier for me
Aubrey: I don’t know if they’ll go for it, I think they’ll just be like it’s still stupid, but at least I have something to say if they say it to me again, so, I don’t know, we’ll see (02162011 pre-conference, lines 2699-2711)

Aubrey demonstrated awareness of the deepening of her mathematical understanding and was excited about how helpful the algebra tiles were for her but doubted whether her students would be open to using them. Her lesson reflection from the next day told the story of how the students handled it. She started her reflection by stating how terrible the
lesson went partially resulting from shortened class periods. Overall, her students had resisted using the manipulatives and she questioned whether they actually helped them to think about factoring. She suggested abandoning the use of the algebra tiles but was conflicted because of her belief in their usefulness (Aubrey, 02172011 lesson reflection, Figure K.34). Aubrey’s students responded exactly the way that she feared and did not want to use the manipulatives. *Aubrey’s experience demonstrated part of the reason why PSMTs struggle to implement learner-responsive pedagogy with students not used to the methods and tools. The students resisted using the manipulatives probably based on unfamiliarity as well as Aubrey’s lack of experience with classroom management strategies. This is just an additional struggle for PSMTs developing learner-responsive classroom practice.*

Despite the negative experience Aubrey had with using algebra tiles at first, she decided to continue with her plan because of her strong belief in the usefulness of the manipulatives. She shared her anticipation for the lesson based on her mentor’s decision to stop using the manipulatives but was resolved to use them. She incorporated several strategies to encourage student participation and accountability and was pleased with the outcome of the lesson (Aubrey, 02282011 lesson reflection, Figure K.35). *Her persistence paid off and she was able to see some promising results from her use of the algebra tiles paired with implementation of methods for collaborative work and accountability I had suggested. Even though she had experienced expected resistance from students about the use of manipulatives, the fact that she was able to gain some*
success from their use may have provided her with a reason to not completely abandon the use of manipulatives in the future.

Bringing the Quarter to a Close

By the end of winter quarter, Aubrey was able to reflect back on her experiences and what she had learned by reading through some of her reflective writings. She noticed how her attitude about teaching had changed from dread before every lesson to loving every experience by the end of winter placement. She also acknowledged an understanding of how she could not start off as a great teacher but would have to continuously work at it (Aubrey, 03182011 blog post, Figure K.36). Aubrey had become more confident and comfortable with herself as a developing professional. Without the pressure and conflicting ideas coming so strongly from her mentor Aubrey was able to grow into her own style of teaching. She was also able to make more progress in her use of learner-responsive pedagogies and reflected on her progress, came up with ways to try to improve, and incorporated many of my suggestions successfully throughout the quarter. Aubrey’s personal goals focused on a continued interest in improving her questioning with an eye toward assessment as well as general organization while teaching and use of technology (Aubrey, 03042011, FEAG). My suggestions for goals for her next experience emphasized my acknowledgment of her progress from winter quarter by suggesting her to “continue” working on areas of pre-assessment and encouragement of student communication in positive yet challenging ways (JH, 03082011 FEAG). Aubrey had demonstrated noticeable progress in the use of learner-responsive methods and the strength of her beliefs in the effectiveness of encouraging student communication. She
was also demonstrating an increased interest in assessment and I wanted her to be able to reflect on the type of information she could get from different forms of assessment to inform her instruction.

_Spring Placement – Solidifying Pedagogy_

In her spring placement Aubrey was in a suburban middle school teaching Pre-Algebra and Algebra I. She struggled with the lack of guidance and amount of freedom provided by her mentor. She loved working with the age group of middle school students and developed a great rapport with most of the students. She ran into minor issues with a couple students in one class period rebelling from her style of trying to ask more questions and tell/instruct on procedures less but generally was able to continue to gain experience with the learner-responsive methods she had focused on during her winter placement experience.

In spring placement Aubrey enjoyed the excitement and willingness to participate the middle school students brought to the classroom. (Aubrey, 0408/2011 first reflection, Figure K.37). Aubrey had been interested in encouraging student communication from the beginning of the program and her mention of using student communication for assessment at this point demonstrated her growth in perspective as she had a concrete reason for her interest in communication. She also continued to comment on her use of different methods for encouraging communication and accountability that had been discussed in the past. She had students rephrase the thinking of other students, encouraged discussion among her students, and continued to redirect student questions back to the rest of her students (Aubrey, 0405/0408/04132011 self-critique, lesson
reflection, Figure K.38). Aubrey’s comments on her use of the different learner-responsive methods demonstrated her interest in finding ways to incorporate them into her classroom practice. *It was promising to not only see Aubrey commenting on her use of the methods but also seeming to have success with the methods. I was initially concerned about her initial surface-level interest in student communication in the summer methods course and was glad to see her seeking to encourage meaningful and accountable student communication by this point in the program.*

*Early in her spring student teaching experience Aubrey turned in a lesson plan that I was surprised to see. She had taken an approach that emphasized rote memorization and I had not seen anything like this from her up to this point in the program. I let her know in my feedback that “I expected more from her” (04092011, phone conversation). I knew my comment was taken seriously when Aubrey called me the next day to discuss ways she could adjust the lesson. She shared her difficulty with not using materials provided by her mentor, even if he said she could use something else. She felt that if she chose to use something else he would perceive it as her putting down his methods of teaching. This demonstrated the conflict she faced throughout her placement experiences as she tried to be respectful to her mentors while still finding ways to incorporate learner-responsive methods. We discussed different ways the lesson could be adjusted to challenge her students to think deeply about the concepts in an engaging way and she was excited about the idea but was concerned about using it with the “low-level” students in one of her classes. I expressed my perspective that “it would be a detriment to*
her students to not consider to challenge them or provide them with an opportunity to think about the concept deeply” (04092011, phone conversation).

In a critique of a peer submitted during spring placement she continued to show the strength in her belief in learner-responsive methods when she went as far as to suggest that the peer could have been more learner-responsive in his approach to the lesson implementation. She also made specific suggestions for improving her peer’s ability to encourage student participation and feedback about their understanding. She questioned the lack of “discovery” approach used by her peer and the weak “check for understanding” through asking questions such as “Got it?” She acknowledged her own struggle with finding meaningful ways to really assess student understanding and suggested trying to call on specific students (Aubrey, 04292011 peer critique, Figure K.39). Aubrey’s initial feedback about making the lesson more “discovery” oriented demonstrated her critical eye when observing other lessons. While this indicated to me that she was acknowledging the lesson was not learner-responsive I did not interpret it as her necessarily knowing how to make the lesson more constructive. The second part of the feedback demonstrated her continued interest in formative assessment. At this point it seemed that Aubrey had noticed she was not receiving meaningful information from students and was trying new ways of getting feedback than the ways she had been used to using. It was significant to me again that she had acknowledged the flaw in her own methods.

A fellow supervisor visited Aubrey toward the end of the placement experience for an observation. The supervisor commented on Aubrey’s use of questioning to
encourage student participation and thinking about the concepts. He also noted Aubrey’s use of student prediction for the lesson as a method for leading the students to build understanding about the mathematical concepts. He praised Aubrey’s use of wait time and ability to encourage her students to develop their own ways of thinking about the concepts (05242011, supervisor feedback). *The supervisor’s comments demonstrated Aubrey’s improved use of learner-responsive methods to engage students in developing deeper mathematical understandings.*

Aubrey’s personal goals for her future classroom practice continued to focus on her use of questioning with an eye toward assessment as well as attention to the typical classroom management skills and communication with parents (Aubrey, 05302011 FEAG). *I continued to take the approach of acknowledging her progress with learner-responsive pedagogies by starting my goals with the word “continue.”* I emphasized the article titled “Never Say Anything a Kid Can Say” (Reinhart, 2000) as a way to remind Aubrey of the reason for encouraging student communication and accountability. I also encouraged her use of collaborative grouping and novel learner-responsive methods to keep her and her students on their toes. My final goal was for her to be proactive in finding ways to reflect on her teaching as I knew this was something that first year teachers struggled to do without support from university coursework and supervisors (JH, 06012011 FEAG).

**Final Interview & Synthesis**

Before the final interview took place I had Aubrey complete the initial surveys she had taken in the summer methods course. *I approached the survey results with the*
perspective of them not being fully indicative of her current perspectives but providing a place to start thinking about her development and perspectives at the conclusion of her field experiences. Aubrey’s MBS score had remained the same from when she finished the summer methods course, 155. Out of the eight respondents to the survey, hers had stayed the same while five had decreased and two had increased.

In her final interview, Aubrey expressed many interesting ideas about her beliefs about how students learn mathematics and what her role was in helping them to develop that understanding.

Not saying that this can always be done, especially in the classroom if there’s not the time or the resources or whatever, but I think the best way that you can learn math is to construct it yourself, the knowledge, because, I think of some math concepts that maybe I knew procedurally how to do them but I didn’t remember them later, and I’m teaching them in the math lab now, but once I build the conceptual knowledge, even if that has to come after, that’s when I’ve really learned the subject (Aubrey, final interview, lines 12-18)

In this statement she shared her belief about the importance of developing conceptual knowledge about mathematical ideas. This belief could be seen throughout her development in her frequent interest in helping students to understand ‘why’ (e.g. her use of algebra tiles in winter) and her frustration with her placements in seeming to keep her from addressing this aspect through focus on curriculum pacing or disconnected organization. Following that response I asked how she saw that perspective playing out in her classroom practice.

I do try to use activities where kids will sort of create their own understanding, the thing that scares me is, that usually takes longer and also kids want to resist that more, I think cause they’re not used to it, so anytime I try to use something that they’re like “why are we doing this, we don’t get, what is” you know, they just want you to tell them, but I still think it’s important, even though they don’t
realize now that it’s important, because then later they’re gonna understand better and remember it better I guess. (Aubrey, final interview, lines 21-27)

This response demonstrated that her placement experiences helped her to be realistic about what to expect from students when asking them to participate in a learner-responsive environment that may be foreign to them. However, she shared her belief in the importance of learner-responsive characteristics even if students resist because they just do not know what is good for them.

When asked what she saw as impacting her perspective her response focused on the summer methods course experience as the beginning.

Well the thing that first got me thinking about it was your class, and I didn’t really know if I bought it, I was like, I don’t know if that’s true, but then from there I started seeing it in everything, and I mean, in my teaching, and the thing that I saw the most is in my own understanding of topics because those things that I really conceptually understood, I still remember and I think will always remember, and if I don’t remember the procedure I can go back and relearn because I understand why it’s that way, whereas there’s still things that I learned in my math major that I did not understand, and if you asked me about it I would have absolutely no idea, cause I memorized them, you know. (Aubrey, final interview, lines 31-38)

This statement demonstrated that Aubrey saw the summer methods class as beginning the process of opening her eyes to a different perspective, but she did not completely buy into those ideas until she was able to observe and experience some of the results herself.

These enactive mastery experiences were throughout her development in her observation of student engagement and learning through encouragement of student communication, use of questioning strategies, and use of hooks and brainteasers. The follow-up question was whether she viewed her beliefs about teaching and learning in mathematics as changing.
I definitely think they’ve changed, because, it’s hard for me to remember how I’ve thought about these before, but, I remember when you started talking to us about building the conceptual understanding and letting kids just work on problems even if they don’t necessarily have the procedures down that they would use to do them or whatever and I just thought that was crazy and I was like that would never ever work you know, but, I completely, I feel so differently now, because I think that’s what’s, first of all that’s what’s fun about math I think, if you’re just given a procedure and told to do it, it’s so boring, so it’s fun to try to do problem solving and stuff, and also I mean it’s just, I think it’s just good for you in general to try to expand your brain and really think about stuff, but also, I’ve said a million times but, that’s how you build the understanding is figuring it out on your own (Aubrey, final interview, lines 76-88)

This response provided a more detailed glimpse into Aubrey’s altered perspective. She initially held disbelief and questioned the ideas I was suggesting but eventually was able to see the positive possibilities in taking a learner-responsive approach. The possibility of focusing more on just getting students to think about problems instead of only practicing procedures was also tied into a perspective on the nature of mathematics as not being about boring procedures but about engaging in problem solving.

In the final interview, Aubrey brought up her experience with algebra tiles during winter placement and how useful they were for her.

Aubrey: yeah, the one thing that keeps popping into my head is, I never knew any other way to multiply besides just you know the algorithm for multiplying and using algebra tiles, I learned how to multiply, I can multiply multi-digit numbers in my head now

JH: you’re talking about planning for that lesson that you taught in winter?

Aubrey: yeah, yeah, and, now I can multiply bigger numbers in my head that I never would have been able to do before. I would literally in my head be like, multiply those, get rid of the number, but now I see it a completely different way and I never knew why that worked either, I mean that’s so sad to say but even the place value, I could’ve figured it out but I didn’t actually think about it, I just took it, I was like it works, okay, so then now that I know that it’s awesome cause I see it a different way and I understand why it works and it’s quicker

JH: you said something about maybe wanting to use algebra tiles in the future, do you see yourself using them in your classroom
Aubrey: well, I don’t really know, I, it went, kind of terrible but I love them, I feel like, I love them personally, I want the kids to love them (final interview, lines 41-59)

Despite her belief in their usefulness, she was still unsure about whether she could get them to work with students or not because of her lackluster experience with them during winter placement. This demonstrated the powerfulness of having a positive experience with learner-responsive pedagogies. Her own experience with the algebra tiles seemed to possibly be powerful enough for her to consider using them again though. She also commented on the issue of time and trying to incorporate activities that are more engaging and learner-responsive.

That’s what I find hard about doing activities, is you don’t have the time and even if you make it a two day lesson, you have to spend the first ten minutes reminding them what we’re doing, getting set up, you know (Aubrey, final interview, lines 66-69)

In her experiences she had difficulty incorporating learner-responsive activities and encountered the problem of splitting them over a couple days resulting in the activities taking longer. In her new teaching position, she had remedial students for a block period, which she commented as making it more possible to consider those activities. This demonstrated the impact of the context of the school environment on PSMTs ability to incorporate learner-responsive methods.

Aubrey also talked about her own growth and development with issues she struggled with over the year, such as not feeling confident in her ability to explain concepts to students clearly, when she looked at her different responses to the prompt about her vision of her mathematics classroom.
Aubrey: I try to and I can tell they’re not getting it and I’m like, okay, I give up, someone else tell them

JH: I mean I think that’s the biggest misconception about teachers, is that you have to be really good at explaining things, I think, I don’t think that’s necessarily the case

Aubrey: and I think I’ll get better, there are some topics that I just, I saw one of my mentors teach and then I would say, I would have never thought to say it like that or something like that so I think it’s the kind of stuff you pick up as you go, like how do students learn, cause what I really know right now is how I learn which isn’t necessarily the same, you know, so, I just have to get used to it, I don’t know if I could really do that, one day a week of problem solving, I think what I’d do, I mean actually I’m almost positive I would never do that unless I have, it just would, I just feel like there wouldn’t be time, maybe I’m wrong, but, I still want to keep doing what I sort of did in the winter, which was, most days I just gave them a problem at the beginning of class that wasn’t really related, so that’s problem solving and they get it every day but it’s just, it’s also a hook and it’s also a good warm up while I’m doing checking homework or doing whatever I have to do, so I think that’s ideal, because you’re using time, you’re not wasting time cause you need that time anyway to check homework or do attendance or whatever, and it gets them, you know gets their attention and they still get to do problem solving, so I kind of disagree with what I wrote there, unless I would just have an ideal situation (final interview, lines 180-201)

Aubrey noted her belief on learning about student thinking through just being around students and noticing their thinking. While she was talking she noticed her comment about having a problem-solving day in her final prompt response from the summer methods course and was considering how realistic that idea would be after having experienced typical classroom periods throughout her field placement. She spoke about how she had found ways to work in her interest in having students experience problems solving through her use of hooks. It is interesting to note her perspective on using a hook as being a good use of time to allow her to check homework and mark attendance. So she had found a way to justify the use of it since it did not cut into the typical class time devoted to new material. This was actually my suggestion throughout the year to the
PSMTs because I found it as one of the few ways I could get them to try it without having issues with them getting behind their mentor’s curriculum calendar.

In the final interview, Aubrey reiterated how student communication was something she had always considered critical for the classroom.

I like what I wrote here too, I mean to start off with, and that’s something that hasn’t changed about me at all, is that I really like to ask a lot of questions and I really like to have students explain what they’re thinking, because I think it helps other students a lot, and part of that is just because sometimes, I mean this makes me a bad teacher, but I just don’t know how to explain things, I try to and I can tell they’re not getting it and I’m like, okay, I give up, someone else tell them (Aubrey, final interview, lines 176-181)

Aubrey demonstrated her interest in student communication that had been present from the beginning of her experience in the program. She also demonstrated her continued issue with struggling to explain mathematical concepts to students but her acceptance, based on my suggestions, that it did not mean she was a bad teacher and she had ways to work around this weakness that were actually more beneficial for students anyway.

Even in discussing her experiences during the final interview, Aubrey brought up her use of her first engaging hook problem during winter placement and recalled her excitement about the solution a student was able to come up with and how students can solve challenging problems without knowing exact procedures for how to think about the problem in the most efficient way.

I don’t know if you remember it but, I had a student who was like, he did not like, we were doing solving systems of equations, he did not use another problem and he couldn’t figure out how to do it in class, you know what I mean, and he ended up getting it which was awesome but by this point he hadn’t and he still solved the problem, and that’s just an example, I saw it all the time, students who, didn’t necessarily have those tools that they needed to solve it but they still were able to do it (Aubrey, final interview, lines 242-247)
Aubrey had the opportunity to observe a student solving a rich problem in a unique way. Aubrey’s memory of this experience and continued excitement demonstrated the impact it had on her perspective and continued interest in using specific learner-responsive pedagogies in her classroom.

When asked whether Aubrey thought she would be able to use learner-responsive pedagogy in her classroom she was a little unsure.

I would like it to be but I am also kind of scared that it will be really hard, I’d like to think that I’ll be a constructivist teacher all the time and, I think it takes more time, so I think you have to pick and choose which topics would they really benefit more from doing it in that way and spending a little bit more time on (Aubrey, Final interview, lines 108-111)

Aubrey still demonstrated a feeling of intimidation about the difficulties of incorporating learner-responsive pedagogy in her own classroom practice. She was realistic about maybe only being able to take a full learner-responsive approach with specific content topics and later in the discussion described her vision of incorporating learner-responsive pedagogies into her classroom over time.

I feel like my first year, I’m gonna try a few things that I think are really important, you know what I mean, or choose a few topics that I think I can try doing some sort of constructivist activity or lesson or unit whatever, try it, if it doesn’t work, I’ll try something different next year and if it does I can add new things in every year, which kind of sucks, I want to go in and be you know great, but I just think your first year is already hard enough, it’s gonna be really, and I don’t want to get in a rut where I’m taking the easy way out and just, oh you guys already have lessons for this, okay, one teacher’s already like, I have a whole year of geometry lessons, I’ll just give them to you, and it’s like, well that would be the easy way out, I already have all of my lessons done for the whole year (Aubrey, final interview, lines 343-357)

Aubrey’s plan to slowly incorporate lessons focused around learner-responsive pedagogy was a suggestion I had given several times throughout the year and it was good for her to
take a realistic approach to her own classroom practice development. Her comment about taking the easy way out acknowledged her knowledge of a different approach to teaching she could take but was unwilling to do so. This demonstrated her belief in learner-responsive methods based on her commitment to using them. She continued to talk about her teaching position and her hope for the possibility of collaboration and support from her colleagues.

I mean I’m hoping that I have support from other teachers, that would help me, that would give me all the, that’s the main thing I want, if I don’t have that, I mean the way they made it sound, is we have freedom to do stuff it’s just that I want to collaborate with other teachers, you know, we have a couple, they said they have a couple math teachers who don’t really work with the department that much, kind of do their own thing, so if I have to do that, I would do that somewhat, you know what I mean, so I think what will help me is having that remedial class, cause the way they were all talking about it was like, oh, you’re taking it and we don’t want anything to do with it, which kind of like, now, they’re like do what you need to do pretty much, cause we didn’t have luck with these kids so you know figure something out, so to me that would be a way that I can use that, hopefully (Aubrey, final interview, lines 132-141)

Aubrey acknowledged the possible difficulties she could face with her colleagues not supporting her in her new position however, she was positive about the possibility of a little freedom with her remedial class since her colleagues seemed to have given up on the students. Her statement demonstrated her belief in the importance of continued support in her development of learner-responsive pedagogy.

Overall, Aubrey demonstrated impact on her beliefs resulting from the introduction of perspectives supporting learner-responsive methods in the summer and the reinforcement of those perspectives through enactive mastery experiences throughout her field placement. A summary of her responses to the MBS (Table 8) throughout the program demonstrated a snapshot of her beliefs development consistent with her

233
espoused beliefs. Aubrey’s beliefs on factor 1, how children learn, were initially low in comparison to her beliefs on factor 2, teacher’s role in deciding the curriculum sequence, and factor 3, the relationship between procedural and problem solving mathematical abilities.

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Table 8: Aubrey's MBS score summary

She demonstrated movement toward more learner-responsive beliefs after the summer methods course and maintained that level of alignment after her field placement experiences. Her development of beliefs and practice demonstrated the importance of consistency in support for implementing learner-responsive methods throughout her
experiences. Whether she will continue to have some form of support in her new teaching position is not known, however, Aubrey demonstrated interest and planned to continue her development of methods she believed and had observed to be effective.

**Derek’s Journey**

Derek was a male in his early-twenties. Like many of his peers he completed his B.S. in mathematics and continued without any time off at the same institution to pursue his M.Ed. in mathematics education. Derek shared his purpose for teaching similarly to how he discussed most topics: with seemingly little emotion and a lot of practicality.

Mine didn’t really have anything to do with the teachers that I had. My dad’s a teacher so I think just as I was brought up he taught me stuff like he taught students and I think that’s where I get a lot of my teaching instincts from. I guess I chose the teaching path just because the impact you can have on the students if you’re gonna see or you’re gonna get to know thousands of students and in my letter to get in this program I said that was my main reason is I think I have a knack for teaching, I’ve had lots of people in tutor rooms and stuff say that you’ll make a really good teacher and that all just kept promoting it but the main reason is you can be such an impact, like Aubrey said, in so many different student’s lives, just by doing little things for them (Derek, 10222010 small group, lines 191-199)

Derek was driven by his interest in having an impact on students’ lives. Teaching was something he was familiar with from his father and he was encouraged by the success he already had from working with students. I was able to find out more about his father’s impact in our final interview. I knew Derek was coming from a family where his father was a teacher so I inquired what influence he saw his father having on his teaching perspective.

I got it first hand you know, I knew before I started this program that a lot of people, including myself, learn best by doing, making mistakes, correct your mistake, move on, and my dad was very good at you know, you need to do this and you need to mess up a couple times with anything, you know, just, I’ll get out
He admitted that his approach with teaching was built on the perspective and personal experience of his father taking a step back and providing him with opportunities to actively engage in his own learning. This belief was prevalent throughout Derek’s development of beliefs and practice in his teacher education program experiences.

_Summer Methods_

Derek’s admittance of interest in having students “learn by doing” was faintly evident in his initial response to the prompt to describe his mathematics classroom. Derek’s first description addressed having the students grouped with four to three to a table and continued with,

I would lecture for the first 20 minutes of class starting with key words, then using some examples. Then I would ask some kids to do examples on the board. Last fifteen minutes of class would be used for them to work on homework individually or as a group. Group work would be a key as I think sometimes peers explain concepts better to one another than teachers do at times (Derek, 06212010 initial prompt response)

Derek’s initial vision of his mathematics classroom contained many characteristics of the traditional teacher-centered classroom with an initial lecture for the first third of class and the last third of class being devoted to time for homework. _I was not surprised to see Derek’s initial description and but I was interested in the aspects that were not traditional such as his interest in having students communicate through examples at the board or his consideration of collaborative work._

Throughout the summer methods course Derek’s interests were piqued but there continued to be a hint of doubt in some of his writings as well as the results from his
beliefs surveys. Derek demonstrated interest in challenging students with difficult problems. “No matter what the problem, as long as it is challenging, it forces the person to continue to work on it until he/she succeeds, even though it may be after a lot of frustration” (Derek, 06232010 summer reflective writing). His eyes also seemed to be opened to the idea of responding to students’ questions with questions.

In reading Never Say Anything a Kid Can Say, I was incredibly shocked by the mere idea of trying to ask a question whenever you know a student can give the answer. In my experience of teaching/tutoring it is very easy to just answer the student’s question or explain it better to them, but it makes perfect sense to have students do more talking and the teacher less. The student doing the explaining will understand better and the class will have the benefit of hearing the explanation from a peer’s mouth, something that is often beneficial. (Derek, 06232010 summer reflective writing)

This reading addressed Derek’s initial interest in encouraging students to communicate and provided him with a different perspective on helping students. I was not surprised to see Derek’s comment on how natural it felt to just answer students’ questions when tutoring as I had similar thoughts before being introduced to the theory of constructivism and learner-responsive pedagogy. His mention of the benefit of responding to students’ questions with a question was a significant method to note.

Derek also reflected on different pedagogical methods he wanted to incorporate in his own classroom. Most were focused around the encouragement of student communication in one form or another such as having students work on problems in groups and present their solution to the class. Derek commented on the benefit for several reasons including student communication, demonstration of multiple solution methods, and ability of the teacher to take note of student thinking. He also appreciated reading
about a teacher who had taken advantage of her students’ innate interest in fair sharing to initiate a mathematical discussion.

As long as you can have good discussion, I believe in her method and believe that kids will eventually work to get the right answer and can probably come up with an algorithm on their own. I will definitely try to use this technique in my classroom. (Derek, 06302010 summer reflective writing)

I found it interesting to note Derek’s slight caveat in the usefulness of the method as being dependent on the ability of the teacher and students to actually have a good discussion. Rightfully so, Derek was not completely convinced of the methods he was reading about because he had not actually observed them in action in an actual classroom with students. He also picked up on the importance of being intentional about discussion facilitation and not just expecting it to happen on its own. In his reflective writing Derek also commented on the importance of encouraging students to reason about mathematics and reflected on how he would have benefited if given the opportunity to do so in his own experiences as a student. “I would have been a lot better off if I had had more practice in my middle school years. I strongly encourage all middle school teachers to include this type of work in their lessons and if I teach a middle school class I will attempt to do the same” (Derek, 06292010 summer reflective writing).

Derek’s experience with developing his microteaching lesson on division of fractions was impactful as he reflected on that experience after reading an article about the same concept.

Also, in the Mathematics or Mathematizing article there is one statement that I agree one hundred percent with. The author says that teachers often mistake students having the right answer as meaning students understand. This is entirely true, and is severely overlooked today. I can honestly say that I never had a problem dividing fractions, but when I began making my lesson plan I realized
that I didn’t understand why “invert and multiply” works until I looked it up. This is proof that teachers do this. They saw that I was getting the right answers and never thought to ask me how or why I was getting the answers. (Derek, 06302010 summer reflective writing)

Derek was able to realize that his understanding of the concept was not deep and connected and realized that he was still able to succeed in his mathematics classes because his teachers had focused on his ability to get the right answers, not his true understanding of the concept. I saw this as a critical observation for Derek as the issue of assessment of students is typically carried out on a surface level in traditional, teacher-centered classrooms.

In his reading Derek also took note of the type of knowledge students could bring with them to the classroom.

In Racing to Understand Probability I was shocked at how much intuitive ability the students had of fairness in the games. I always thought that fairness was something that was taught rather than learned through experience. However, after reading the students’ journal entries I can tell that they have very deep intuitive ideas of how to tell if a game is fair. I was definitely shocked at how they took into consideration more than one factor to determine whether the games were fair. I just assumed kids looked at if each situation seems to be fair without considering other factors. (Derek, 07192010 summer reflective writing)

Derek’s ability to notice and reflect on this aspect from reading this article was important for his development. A critical component to a perspective supporting the use of learner-responsive pedagogy is believing that the knowledge students bring to the classroom is worth paying attention to.

Derek did question some of the models of learner-responsive teaching he saw, as he did not believe the methods could be used on a daily basis because of the time necessary to implement them. He specifically referenced the model of Cathy Humphreys
spending one whole class period exploring relationships within one problem. He noted that while he liked her method, he would want more information about how she taught the rest of the year because he could not imagine her spending the same kind of time on one problem in every lesson. *I saw Derek’s point as valid and agreed that it would be beneficial to see how learner-responsive teachers were able to work around curriculum requirements but unfortunately did not know of any examples to provide him with.*

By the end of the five-week methods course Derek’s response to the prompt about how his classroom would look incorporated many of the learner-responsive pedagogies that had been discussed and modeled in the course but the traditional lecture approach was still present.

I would sit kids at tables with groups of 4. I would start the class with some type of “cool” activity to engage the students. I would try to incorporate constructivist ideas in the beginning activities, as I let the kids explore the day’s lesson topics. As I go through the “meat” of the lesson I would probably have to incorporate more traditional teaching methods, but at the same time I hope to let the kids lead discussion. Most days I will give students a problem solving word problem to do for homework. (Derek, 07212010 final prompt response)

It was interesting to see Derek’s incorporation of the hook activity at the beginning of class to engage students, as that was not commonly mentioned in other final prompt responses. Derek’s interest in trying to get his students to begin to think about the mathematical concepts for that day’s lesson before going back to his “more traditional teaching methods” also demonstrated a critical change in his thoughts about teaching.

Overall, Derek’s MBS score was one of the lowest out of the respondents at the beginning with a 99. His final score was also the lowest out of all of the respondents as well as the smallest indication of belief change with a 110. Derek’s
lack of change was surprising to me based on his responses and reflections throughout the course. Noticing this lack of change in Derek that was inconsistent with the overall trend for the PSMTs in the course, I decided to ask him to join my research as a person who still seemed to align more with teacher-centered methods of classroom practice than learner-responsive pedagogy.

Fall Placement – Surrounded by Support

One of my biggest drawbacks to teaching constructively was I didn’t have confidence in the students. (Derek, 10082010 small group, lines 760-761)

Derek’s fall placement was in a suburban middle school observing and teaching an accelerated seventh grade class and a regular pace seventh grade class. He loved his placement classroom and mentor and determined early on that he wanted to return for spring quarter student teaching. He even mentioned that he had originally been only interested in teaching high school until he had this experience and liked that middle school students were more open to “silly” activities (Derek, 10122010 post-conference, lines 602-604). In his placement he was proactive in finding teachers to visit for meaningful observations. His mentor was very open and supportive and encouraged Derek to start teaching early and often. He agreed with this approach in order to be able to balance out the heavy end load of fall quarter class work. By the end of his placement experience Derek had taken the initiative to develop and teach for more than the eight required lessons.

Meaningful Models Galore

At the beginning of Derek’s fall placement he had the opportunity to observe his mentor as well as other teachers implementing many methods supporting a learner-
responsive philosophy. He recorded and reflected extensively about all of his observations. The following reflection is one example of what he experienced.

In every class we had 3 activities that were pre-assessment activities and acted as diagnostic assessments. This allowed us to figure out what prior knowledge all of the students have and what, if any, misconceptions they may have. I was shocked at the amount of knowledge the advanced math class had for being 7th graders. (Derek, 08262010 observation reflection)

In this reflection Derek commented on being able to pre-assess the students in his mentor’s classroom and his amazement at what his students actually knew. *Without this pre-assessment implemented by his mentor teacher Derek would have not have had this opportunity to recognize the value of a pre-assessment as well as the knowledge the students were entering the classroom with.* Derek continued to note and reflect upon the methods he observed from his mentor. He reflected on her use of students sharing answers at the board because the students love to do it and he believed it was good for the students to hear their peers’ explanations instead of his mentor’s all the time. He also commented on how he observed her add in a “mini lesson” on order of operations when she noticed her students struggling. He found this change interesting and attributed the choice as being related to her knowledge of the importance of order of operations (Derek, 09272010 observation reflection, Figure L.1). *Student communication was something he had mentioned as being important during the summer methods course and he was actually having the opportunity to observe it in practice and reflect on the benefits. He also noted the adjustment of the lesson based on assessment of student understanding and was able to observe the importance of flexibility in lesson implementation.*
In small group discussions Derek continued to demonstrate his proactive interest in his development as well as others. He frequently brought up his observations of learner-responsive methods as well as his use of and questions about learner-responsive methods. His openness led to many great discussions and opportunities for reflection for the whole group. At one of our initial small group meetings while discussing approaches to writing lesson plans, Derek shared what he had observed his mentor use with her own lesson planning.

In all of her lesson plans at the bottom she has like, if at this point in time there is less than 10 minutes left, do this and if at this point in time there is over 10 minutes, do this and she has extra problems, and it takes a lot of stress off because you know you can be way ahead or way behind and it doesn’t matter because you can always reference that (Derek, 10012010 small group, lines 577-580)

This suggestion for lesson planning was a great example for Derek to take note of and share. I knew many of the PSMTs would not actually be able to talk much about lesson planning with their mentors because few mentors wrote substantive lesson plans. Derek’s sharing of this method was only the beginning of my realization of what a good model his mentor was.

During fall placement Derek also had the opportunity to observe a teacher in his placement who used a project-based approach in her classroom. He spoke about it at a small group meeting and shared the teacher’s approach to switching from “bookwork” to major projects every couple weeks. He explained how the teacher reminded him of me because as the students were working she “never answered any of their questions” but redirected the questions back to the students. He went on to explain the next project the students would be doing in her class and said he was “just blown away by what they
could do” (Derek, 10012010 small group, lines 170-190, Figure L.2). Derek was excited to have the opportunity to observe this class. *He commented that the teacher he observed reminded him of the way I had taught the summer methods course and he was excited to see it in action in a middle school classroom. It is interesting to note his comment on calling it “half project-based learning” because the teacher interspersed “teaching” from the book with projects in order to meet the standards. This suggested Derek’s underlying perspective of project-based learning as possibly not being teaching and not necessarily meeting standards.* Derek also wrote extensively about this experience in his observation reflection as well as a formal reflection providing more evidence of the impact of the experience on him. He recorded the specific types of questions the teacher was asking as well as how she asked the questions and what types of responses she expected the students to engage in. He remarked that he found her approach interesting because “it was obvious she was just trying to start discussion” and he also noted that she was able to get an idea of her students’ understanding using this approach as well (Derek, 09302010 observation reflection, Figure L.3) *This detailed observation provided Derek with a concrete model to refer to and reflect upon. In my feedback I provided Derek with a perspective about the teacher’s questioning strategies he had not expressed: “I would also say that she takes this approach because it provides students with more opportunities to learn the material at a deeper level and build from their own understanding” (JH, 10092010 experience reflection feedback). Through my feedback I attempted to get Derek to think about the questioning strategy from a constructivist perspective.* He also commented on the perceptions of the students in the project-based
classroom. He noticed the engagement of the students and mentioned the lack of boredom in the class as well as the high motivation. He also made note of the lack of behavior problems as a result of the student engagement and shared that he would want to include similar projects in his own classroom in order to make his class “much more enjoyable for his students” (Derek, 10092010 experience reflection, Figure L.4). Other than Derek’s observation of learner-responsive methods similar to what I had modeled in the summer, Derek seemed impacted by the use of engaging activities to help manage student behavior. This was his first acknowledgement of proactive classroom management, which continued to inform his development of classroom practice throughout the program. Overall, Derek was excited and motivated by this observation and grew in his confidence and beliefs about the approach to teaching he had observed.

In all of his observations Derek seemed concerned with recording the different methods he observed as well as the effectiveness of those methods. One example was his observation of a substitute teacher. In his reflection Derek commented on the students’ restlessness while being lectured to and the resulting classroom management issues (Derek, 09232010 observation reflection, Figure L.5). This was Derek’s first recorded observation of the management difficulties related to methods that did not actively engage students. Juxtaposing this observation with the engagement he had noticed in the project-based learning class may have provided him with more reason to focus on piquing the interest of his students. While observing another teacher he focused on methods with which he agreed and disagreed. He made a point to emphasize the teacher’s use of a procedure and limiting her students to that procedure. He also noted the absence
of wait time, the majority of teacher talk, and how boring the lesson felt. The teacher’s use of bonus problems in the homework to get a better idea of student understanding was also noted as a useful method to challenge students (Derek, 09302010 observation reflection, Figure L.6). *Derek frequently brought up the issue of boredom with respect to his students or himself when discussing particular teaching methods, suggesting that he had a shallow interest in learner-responsive methods based on them being more interesting for him and the students, not necessarily more meaningful and effective for student learning.*

**Putting Models into Practice**

Derek’s mentor provided him with many opportunities to get in front of the classroom.

Just on random days she’ll come in and she’ll be like this is a great lesson for you to do because it’s whatever and then I’ll be like yeah I can try it you know and I’ll just wing it from her stuff (Derek, 10122010 post-conference, lines 591-593)

He would observe her lesson and then teach it in a subsequent class or plan and team teach a lesson with her occasionally. *These experiences provided Derek with opportunities to work and reflect on his classroom practice. He was even able to consistently incorporate learner-responsive methods into his teaching because his mentor frequently used those methods.* Once he started teaching he frequently reflected on many different aspects of his teaching as well as what he noticed about his students.

In first period I went over 4 problem-solving problems with the students that involved problems that needed simplified and then solved for x. This was the first time they had solved for x so I had many different students come to the smart board to demonstrate their techniques. I was really surprised with how many used a trial and error method. (Derek, 10042010 lesson reflection)
In this reflection Derek commented on his use of the method of having students demonstrate their solution approaches at the board and the method his students were using. *Derek was already demonstrating deeper noticing abilities by going beyond his ability to use a method to encourage student participation to actually note the methods his students were using.* Following another teaching experience Derek continued to comment on his experiences as well as the feedback he received from his mentor.

I thought the class had great discussion and really started to constructively create their own idea of what a proportion is. I am still shocked at the knowledge that the students have inside of them that just takes a little prying to pull out. [My mentor] told me she was really shocked because I got two kids to come and volunteer at the board who she can hardly even get to say a word in class. This made me feel like the students must feel really comfortable with me teaching. (Derek, 10062010 blog post)

He continued to show his interest in getting his students to construct their own ideas of mathematical concepts, which provided him with the opportunity to be amazed by the knowledge his students brought to the classroom. *This experience was exactly what I was hoping all PSMTs could experience since I knew just being able to see what thinking students were capable of could have a meaningful impact on their perspectives about learner-responsive pedagogy.*

*As Derek began to prepare for his formal fall placement teaching he took my suggestions for possible improvements and changes to his lesson plans seriously as is demonstrated in this comment from his reflective writing:* “Before school [my mentor] and I went over the comments that Jenny Harrison made on my lesson plan for next Wednesday. We made the appropriate adjustments according to her suggestions” (Derek,
Unlike other PSMTs, Derek worked directly with his mentor teacher to incorporate my feedback.

When I visited for the first observation and conference discussions before and after his lesson Derek continued to demonstrate interest in and use of many different learner-responsive methods. I began his first pre-conference discussion the same way as I did with all PSMTs, asking him to share a visualization of his lesson. He explained his plan to use a video from the Internet to initially engage his students and then provided a series of questions he planned to ask to get his students thinking about the content for the day (Derek, 10072010 pre-conference, lines 23-27, Figure L.7). In the first few minutes of his lesson Derek was already talking about incorporating multiple representations and solution methods and focusing on his use of student participation in his lesson. I probed Derek’s thoughts about his lesson asking about what the students would be doing at their desks while others were presenting at the board and where he planned to be. “I just like to ask questions from the back and then I really like to have another student explain what that student just did, because that seems to work really good” (Derek, 10072010 pre-conference, lines 39-41). I was pleasantly surprised to hear Derek’s quick responses to my probing with learner-responsive pedagogies I had modeled in the summer methods course. He had even already used them while teaching his mentor’s lesson plans. Derek also demonstrated insightful management strategies to encourage accountable participation through having students explain each other’s thinking. He continued his visualization by describing how he would introduce the main activity in the lesson. He wanted to have his students think about ways to predict the number of M&M’s in a large
package based on the use of proportions and small packages of M&M’s. He acknowledged his need to be flexible based on his students’ comments and shared that his objective for the lesson was to “make them think and see how [proportions] can be used” (Derek, 10072010 pre-conference, lines 100-107, Figure L.8). These comments demonstrated his interest in getting ideas from students, encouraging discussion through his facilitation, and not just telling them what to think.

Following his lesson I started the post-conference conversation by asking Derek what his thoughts were.

Overall if I had to do an overall, I’d say it was, I mean decent, I don’t know there’s always stuff that can be changed, I’m pretty hard on myself but, I don’t know, I thought I got pretty much every kid involved I don’t think I let any not volunteer. (Derek, 10072010 post-conference, lines 136-138)

His response demonstrated his perspective on his own improvement as well as his interest in student participation. I focused on getting Derek to reflect on specific methods he used and what he learned or observed from the experience.

JH: so when you first turned in the lesson there wasn’t a discussion about making a prediction ahead of time and that was a change you made, do you think that that was a useful discussion
Derek: yeah that was definitely a good change cause I didn’t have to explain nothing, yeah and I didn’t have to explain how to do it at all, I didn’t have to use the book, I didn’t have them even open their book because [one student], he had a really good explanation on the board and I knew I could answer the rest by just walking around and they could do it in their tables, I mean I didn’t have to show anybody how to really set it up, they all had it set up they just weren’t sure if it was correct, which I think’s good because I haven’t given them an exact like, this is how you have to do proportions (10072010 post-conference, lines 182-192)

This particular method was one I had suggested he try to incorporate in order to encourage more opportunities for student thinking to be observed by Derek and he was able to successfully incorporate it and take note of the subsequent thinking demonstrated
by his students. He reflected further on assumptions he was making with what he was hearing from his students. “I thought maybe they’d seen something like that before because they all used the words proportion and ratio a lot but they have no idea what it means” (Derek, 10072010 pre-conference, lines 47-48). Through these increased opportunities Derek took note of the danger of assuming student understanding. He also demonstrated interest in considering different avenues of student thinking and ways he could react before teaching the lesson. He shared that his thoughts about next steps if students struggled were not to just tell them the answer, but to find some way to encourage their thinking. (Derek, 10072010 pre-conference, lines 70-72, Figure L.9).

This demonstrated his commitment to encouraging his students to think and believing in their ability to think about the concepts with only a little guidance from him.

Despite Derek’s strong promise on noticing student thinking and encouraging accountability and participation, I continued to push him in areas where I saw room for improvement. Derek had invited a student to share his method at the board and following his explanation he encouraged the class to begin working on the activity. I wanted to get Derek to think about the possible consequences of only demonstrating one method and how most of the students ended up only using that method and maybe not thinking about why it worked. In his self-critique he mentioned how his excitement about the student’s method led him to not ask for other solution methods and he would have approached this part of the lesson differently (Derek, 10182010 self-critique 1, Figure L.10). While it was possible Derek mentioned this in his reflective writing because he knew I was reading it, it was written over a week later demonstrating the possible impact of the suggestion.
From the beginning Derek demonstrated flexibility and thoughtfulness in his approaches to lessons. Derek was concerned about being prepared but not attached to the exact order of his lesson plan. He emphasized knowledge of his main objectives and comfort with adapting his lesson on the spot to meet those objectives while being cognizant of his students’ knowledge and needs at the same time (Derek, 10072010 post-conference, lines 266-271, Figure L.11). This flexibility and confidence were critical in Derek’s ability to develop his learner-responsive classroom practice more quickly than other PSMTs.

He reflected further on this lesson I observed in a formal reflection paper and a self-critique where he watched a video of the lesson. He noted that the student participation he had received from his hooks was surprising and that he viewed a good hook as “essential” to the lesson (Derek, 10182010 self-critique 1, Figure L.12). Using a hook to grab students’ attention from the very beginning of class was a method I emphasized using in the summer methods course. Derek excitingly commented on the usefulness and benefits of incorporating a good hook for increasing student engagement in his lessons. He also commented on what he was able to learn about his students and their mathematical understanding while having students volunteer to show their solutions at the board.

I also really liked that the kids had questions and discussions with one another and the fact that many of them noted doing the problem in a different way to get the same answer. I felt that the kids were increasing their understanding of the material by debating about it. (Derek, 10182010 self-critique 1)

Derek demonstrated his value of being able to see and hear his students talk about mathematics and not only learned about his students’ abilities but also felt that his
students benefited from listening to each other. He continued to reflect on his original lesson being longer than what was implemented and how he was getting such good student discussion he would not want to speed up the lesson if given a chance to teach it again. He shared his interest in hearing and encouraging student thinking, discussion, and multiple solutions as well as his flexibility with his lesson in order to allow more student thinking and solution methods. Derek also set a goal to make sure to try to involve more students in future lessons. (Derek, 10112010 horizontal 2 reflection, Figure L.13). I provided feedback to suggest a way for him to involve more students.

*Maybe you could try some strategy for randomly calling on students so those students who are less willing to volunteer will be involved more often. This is not something you would need to do all of the time, just occasionally to involve more students.* (JH, 10182010 horizontal 2 reflection feedback)

When I noticed Derek had not come up with a way to encourage more student participation I decided to provide him with a start to thinking about how to do it. I took the approach of providing somewhat direct feedback to the PSMTS when it was an area they had not necessarily explored yet and especially toward the beginning of their field experience.

Derek also commented in his reflection on his classroom management during his first lesson. “Lastly, I will talk about classroom management for the first lesson. I think the students were busy most of the time which didn’t really allow them to talk” (Derek, 10112010 horizontal 2 reflection). *I commented that he was using proactive classroom management by engaging his students and not giving them many opportunities to get off task. This approach to classroom management was first noted in his observation of the project-based learning classroom and became a common point made throughout his*
observations and experiences. He developed a strong classroom management perspective based around the engagement in his lessons instead of only his ability to discipline. He went on to share how his objective was to “make the lesson fun” and see “how proportions can be useful.” He commented how he liked the “hands-on” aspect of the lesson and how his students could take “ownership” of their learning. He also noted that he was impressed with the discussion they had since his students had mentioned mathematical ideas from the first week of school (Derek, 10112010 horizontal 2 reflection, Figure L.14). Derek demonstrated his focus on making lessons “fun” and it almost seemed like making sure the lesson was meaningful came second although it could be that he related the two. Derek also commented on the interactive aspect of his lesson that possibly contributed to strong student understanding. In his self-critique he watched the video of his lesson and was able to notice more about the specifics of the discussion he facilitated with his students. He watched his video with the intent of finding a point where students were “actively learning” and focused on how students had built off of each other’s ideas as evidence. He also mentioned his “amazement” at what his students contributed to the discussion demonstrating their knowledge of concepts that had not been discussed in class for a couple months (Derek, 10182010 self-critique 1, Figure L.15). While Derek commented on evidence of student learning that was not very strong such as hearing students say they “got it,” he was able to notice other critical aspects that were more evident of student learning such as the ability of students to build off of each other’s ideas. Derek demonstrated excitement about his students having a deep and meaningful discussion about mathematical concepts and also commented on the benefit
of being flexible in his lesson and adjusting when connections to related concepts were brought up in conversation.

During a small group meeting Aubrey was sharing her experience with teaching her first lesson and how nervous she was. I asked everyone who had already had teaching experiences to share how the lessons went and how they dealt with nerves. Derek shared his experience with teaching his first lesson. He began by sharing that he was not a person who got nervous but that a good hook was crucial. Derek went on to share the specific hooks he had used and his students’ response to them (Derek, 10082010 small group, lines 66-86, Figure L.16). I almost felt like I had planted Derek’s comments because they were so important for the rest of the PSMTs to hear. It sounded like something I would have said and it was good for them to hear it from a credible peer. Derek was able to get firsthand experience with the benefit of incorporating a hook into his lessons to grab student interest from the very beginning. He went on to suggest posting his hooks and the reason he used them on a public discussion board for everyone in the group to see and use and then shared what he had learned about his students from his lesson experience. He shared how he had initially doubted his students’ knowledge and abilities and had since learned that “it is absolutely amazing what they have in their heads if you just give them time.” He suggested it had helped him to pre-plan “hints” to share with students to help jumpstart their thinking (Derek, 10082010 small group, lines 749-765, Figure L.17). Derek’s comment demonstrated the impact his lesson experience had on his perspective of his students. Again I could not have planned a better comment to be shared at small group. I was not surprised to hear what he was sharing because I
had actually brought his attention to what I had observed from his students and we talked about it during the post-conference. At small group Derek also shared his approaches to improving his own development and incorporating feedback. He explained how he made a short list of areas his mentor had suggested working on (e.g., “get away from the board” and “make sure you call on 3 or 4 students that hadn’t been volunteering”). He had then put that list in a place where he could easily see it while teaching to help remind him (Derek, 10082010 small group, lines 103-114, Figure L.18). This demonstrated Derek’s drive to make improvements and find creative ways to work on his use of learner-responsive methods. Derek continued by sharing his fall quarter goals to “be the most constructivist teacher I can be while maintaining classroom control” (Derek, 10082010, small group, lines 116-117). This demonstrated Derek’s interest in maintaining his learner-responsive approach while finding ways to effectively manage students at the same time.

Working Within the System

In the next lesson I observed, Derek again exhibited an emphasis on incorporating learner responsive pedagogy and was able to be realistic about the limits on some lessons.

I didn’t have as much opportunity for kids to explain stuff at the board as what I like but, I mean some lessons are gonna be that way I guess, I think the lesson overall was still very constructive (Derek, 10122010 post-conference, lines 385-387)

I think it was my best lesson so far because 90% of the discussion was all the students talking. I rarely had to talk and answer questions because they were doing such a good job of explaining the problems and showing multiple techniques while they were up at the board. (Derek, 10122010 lesson reflection)

Derek demonstrated an understanding that having students share their thinking at the board was not the only way for a lesson to focus on helping students develop meaningful
understanding. He also shared his approach to questioning his students as he walked around the room by just asking “why” (Derek, 10122010 post-conference, lines 390-392, Figure L.19). Derek was using a method I had demonstrated and discussed in the summer methods course. I emphasized the power of asking “why” instead of just telling students or directing them in order to encourage thinking. Derek also used his knowledge of his students to encourage discussion and introduce ideas, which was another method discussed and demonstrated in the summer methods course. He shared that he had specifically picked a student to share her thinking because he knew she could explain it well. He compared his use of student communication to a game, saying “you’re trying to get them to say it without you saying it and then as soon as they do you’re like I can use this” (Derek, 10122010 post-conference, lines 397-402, Figure L.20). Derek had obviously paid close attention to the different students in his classroom and noticed their strengths and weaknesses. He demonstrated an ability to use this knowledge of his students to encourage more ideas from students throughout his lesson.

One aspect I had taken note of about Derek’s perceptions of students was the way he talked about the students’ abilities. After his lesson I made a point to bring up this issue as something for Derek to reflect on.

JH: you keep saying these students aren’t that smart
Derek: well they aren’t as smart as first period, first period is geniuses, there’s a couple kids in there that just blow me away
JH: they’re advanced, because they’re smart they’re just not, they’re at a different level for their age
Derek: right, I mean they are smart, I mean, I just compare them to first period and first period is honors so there should be a difference but
JH: they’re just at a different point in their development in learning and understanding, you just want to be careful how you talk about them, because if you typically talk about that way either to me or small group or with your mentor,
whatever, it could come out in the way that you teach, not that I think that it did, just something to watch out for, because they were saying some really good things when you asked why, they were thinking that it would be wider or taller or whatever, I was pretty impressed with the things they were suggesting Derek: yeah they had a pretty good discussion (10122010 post-conference, lines 419-432)

My main concern was to get Derek to think about the possible implications in his teaching if he perceived students to not be as able or intelligent. I also focused on what the students were able to bring to the classroom and helped Derek to focus more on what knowledge they had instead of what they did not know.

In his vertical two reflection Derek continued to demonstrate his professional development. The first of the two lessons was a review lesson in which Derek used a clicker-response system to have students respond to different problems. At one point he reflected on how he responded to a poor student performance indicated on the response system. He explained how he focused on possible student misconceptions by asking a “brave” student to volunteer her thinking. He reflected on the benefit of the ensuing discussion and how he felt his students were able to make the connection better by thinking about the mistake than if he had just showed them “the correct way” (Derek, 11082010 self-critique 2, Figure L.21). Many PSMTs struggle to involve students at the level Derek did based on concern about embarrassing students. It seemed to be a combination of the classroom environment in his placement already set up to welcome this method and Derek’s belief in the benefit of the discussion for students. The second lesson he taught that day was focused around an activity where students had opportunities to predict and then reflect on results within different parts of the activity. He reflected on this lesson in two different formal reflection papers, one that was supplemented by his
viewing of the video of the particular lesson. He discussed his need to change his original plan to have students make predictions based on his students misunderstanding his instructions. He was able to adjust and incorporate student work using a document projector and felt his students were still able to have a discussion about the mathematical concept in the lesson. He also explained how he appreciated being able to walk around and ask his students questions as they were working in order to assess individual understanding (Derek, 10172010 vertical 2 reflection, Figure L.22). Derek continued to demonstrate his flexibility and ability to notice what students were doing and adapt his lesson accordingly to still allow his students to think about the main lesson objectives. *His description of the types of questions he was asking as he circulated the room gave me the opportunity to provide an idea to help him keep track of his observations of student thinking. “Would it help to carry around a seating chart and make marks next to names when you talk to them? You could even make indications of their understanding of the concepts”* (JH, 10182010 vertical 2 reflection feedback). When Derek viewed the video from this lesson he noticed another area where he could improve with encouraging student participation: calling a larger variety of students to share their thinking at the board. He suggested trying to draw student names randomly in a future lesson (Derek, 11082010 self-critique 2, Figure L.23). *I felt he demonstrated his maturity in observation by catching this area for improvement and noticed his suggestion for improvement was related to my comment about finding a way to randomly select students to participate.*

Derek continued to reflect on his viewing of the lesson and focused on a part of the lesson he saw as being an area where he was excited about the discussion students
were having. He focused on a specific point in his lesson where he was positive student learning took place. He noticed how his students had originally entered the discussion with confusion about the concepts and by the end they were commenting about wanting to change their original response. He also noticed his students “taking the previous ideas and manipulating them and adding to them to make their own answers better” (Derek, 11082010 self-critique 2, Figure L.24). Throughout Derek’s reflection on his second lesson he demonstrated his interest in continuing to focus on encouraging student thinking and discussion through questioning. He also demonstrated his ability to notice student thinking and adjust his lessons based on how students were responding and demonstrated an ability to notice concrete instances of student learning occurring during his lesson.

When Derek met with me to view a video of his first lesson he was open about the characteristics we observed that he had made efforts to improve upon as the quarter progressed. He demonstrated an awareness of the impact of his location in the room as well as his preferences for calling on specific students. He shared a method he had recently implemented to try to pay more attention to the students he was calling on during his lesson and make sure he was giving attention to all students. He also mentioned trying to incorporate different strategies I had suggested to help him involve more students.

During this meeting I also had the opportunity to discuss Derek’s resources and get an idea about what was influencing his lesson plans and approaches.

*jH: so a question I have for you is, a lot of the stuff that you’re doing this quarter, is it coming from that workbook, like half and half?*

Derek: yeah, I’d say 50/50, I try not to use the whole workbook cause it’s just a workbook
**JH:** well it has some good activities and questions in it
Derek: it does have a lot of good activities that I like but I like to change them, put my own twist

**JH:** which is perfectly fine, I mean, I think that sometimes, when we do teacher education classes, we’re too hard on textbooks, because there are good textbooks out there and it’s perfectly fine to use the textbooks
Derek: yeah, it’s a great one but at the same time I don’t want them to think we’re just following right along from the workbook because that’s still boring to them then you know, that’s why I threw the silent board game that’s not in the book at all, throwing in the point, that’s just something fun, the hooks I’ve all come up with on my own, except any of the YouTube videos obviously

**JH:** well you found those right?
Derek: but, yeah the last lesson I just couldn’t think of a good one so I just put brain teasers on there, sometimes those are just as effective probably, I would say yeah, 50/50, the review lesson was all made up off the top of my head which I did, just made up every problem, yeah I’d say real close 50/50, I mean I use a lot of their problems, but then the discussion we have after it is usually off of whatever I say, like sometimes they’ll give like suggested questions and I just don’t like their questions

**JH:** right, but they give you things to think about
Derek: too easy almost, for the kids, I like to throw in questions that I don’t think that they’ll get and that you can just oh, think about it, who cares

**JH:** so the only reason I ask that is that, if you don’t have that textbook as a reference or you don’t have a nice one, do you think that it will be harder next quarter?
Derek: a little bit but

**JH:** well that on top of it being some high school material
Derek: yeah I mean I don’t think I’ll get anything that will throw me for a loop or anything

**JH:** cause I think you’re in a great placement to try some of the things that we’re asking for and other people aren’t really in
Derek: yeah, that’s what I’m worried about winter quarter

**JH:** places where they kind of have to fight against what the students are used to
Derek: yeah, that’s what I’m worried about (10182010 individual meeting, lines 766-798)

Derek demonstrated somewhat of a reluctance to stick strictly to the book and was more than willing to adapt lessons and activities if he considered them “boring.” *I made sure to emphasize that textbooks can have great ideas because I knew it was common for PSMTs to think textbooks do not have worthwhile information.* Derek mentioned his biggest
adaptation being the questioning and discussion he facilitates, remarking that the book discussion questions were too easy for his students. *I pushed Derek to reflect on his reliance on a decent textbook and a placement aligning well with program philosophy and he did admit his concern about entering an environment that may not be conducive to his style of teaching.*

Derek was consistent throughout fall quarter in being open about what he was doing to work on his classroom practice in small group. He shared a method he was trying to encourage himself to involve a wider variety of students in his lessons.

One thing that I did after I watched my first two lessons, was I started carrying around a class list and I, marked down every time I called on a person, whether it was me calling on them or them volunteering. (Derek, 10222010 small group, lines 370-372)

*The method that Derek had put into practice and shared was one that I had suggested and turned out to be a great way for him to collect data on his classroom practice and adjust based on the evidence. This was one example of many of Derek’s drive to improve himself as soon as he received feedback.* At small group he also shared his frustrating experiences with one lesson in particular. He had taught a lesson involving student use of graphing calculators and “felt like he was giving procedure after procedure after procedure.” He shared that his main struggle was that he could not think of any way to “make it more constructive” and he could tell his students were bored (Derek, 10222010 small group, lines 469-489, Figure L.25). Derek’s description of the lesson and his frustrations demonstrated his perspective and interpretation of constructive approaches to teaching. *Derek seemed to have a perspective about teaching from a constructivist perspective meaning that students should never be given any guidance and expected to*
just figure everything out without instruction. This was a common conception I had observed from my experiences as a supervisor. Derek also demonstrated his low tolerance for lessons where he, as the teacher, was bored. This perspective of boredom on his part or the part of the students was something that drove his approach to planning and classroom practice throughout his observations and experiences. I was hoping to see it develop more into a concern with meaningful learning and less on whether the students were necessarily having “fun.”

During the same small group Derek shared what he had done with his mentor’s suggestion of getting feedback from his students. He had asked his students to share one thing they had learned from him as well as one positive and one negative. He shared how it was helpful for him to have his students point out areas for him to work on and interesting to see the areas they had liked (e.g., his hooks) (Derek, 10292010 small group, lines 196-230, Figure L.26). Derek demonstrated his interest in getting feedback from his students and making changes to his practice as a result. He also commented on how important the beginning of the lesson was to engage the students. The fact that the students even commented on the hooks reinforced the importance of them to me as well. Derek’s openness and willingness to share with the rest of the group had brought the idea of student feedback as a resource for growth and development for everyone.

Derek’s focus on specific aspects in his own teaching carried over into his suggestions in critiquing the teaching of his peers. In his suggestion Derek was concerned about making sure his peer was providing students with time to think as well as engaging more than the few students who are willing to respond quickly. He shared the possibility
of students surprising you with their knowledge if you give them the opportunity, as he had been able to witness several times in his own placement. He also suggested ways to encourage accountability and assess student understanding (Derek, 11022010 peer critique, Figure L.27). *He brought attention to a critical common conception that PSMTs have in relation to hearing the right thinking from a couple students and assuming the rest of the students understand as well. This is typically a critical area for PSMTs to think about and be challenged on in order for them to consider more thorough methods for formative assessment.*

Derek continued conducting observations of teachers in his district placement high school and commented and reflected on some of the same issues he had been working on improving in his own teaching. In this observation Derek took note of the different methods this teacher had used to involve the students in the lesson and keep them accountable for their work and explanations. He was interested in this teacher’s use of what he called “effective” ways for students to be interactive and cover the homework problems (Derek, 11032010 observation reflection, Figure L.28). In his observations Derek took note of methods he found to be effective.

She asks for people who got it wrong to explain their reasoning and gets several volunteers to do this. I really like this approach it allows kids to learn from their mistakes and is a way to avoid common misconceptions. She insists that the students make any corrections needed to any of the problems they got wrong. At one point in the lesson she said, “You guys do not look enthused at all, let me find a problem that will challenge you.” This was fantastic because she could read the students and tell that they were bored so to keep them interested she found a problem that was much harder and caused many of the kids to have problems. [This teacher] also does a very good job of using the slides on the smart board to keep students from working ahead or just flying through the checking of homework leaving them with nothing to do. (Derek, 11032010 observation reflection)
This reflective comment demonstrated Derek’s interest in focusing on students’ misconceptions and welcoming errors for the sake of discussing common misconceptions. He also brought up his issue of students getting bored and appreciated this teacher’s approach to and concern with challenging her students.

Derek was also critical of some of the teachers he observed and suggested his view of a more effective way to respond to a reluctant student.

At one point [this teacher] calls on a person to manipulate the terms to get x by itself. The student says he doesn’t know how to do it and [this teacher] says that’s ok and just does the problem himself on the board. I thought he could have asked another student to help the struggling student or to have another student explain their method. Maybe in this way the struggling student would understand better. (Derek, 11032010 observation reflection)

*Derek’s suggestion was exactly the same advice and method I had suggested in the summer methods course and he had actually already put into his practice several times.

He acknowledged the value of not having the teacher always respond to struggling students, as the teacher may not explain concepts in a way that makes sense.

*Silent Lesson Experience

For my last observation visit during fall placement Derek was teaching a lesson he had planned based on a challenge I suggested to all of my PSMTs. I had challenged them to plan a silent lesson where they posed a problem to their students and then basically listened to their students’ thinking. Their goal was to say as little as possible and respond with questions if necessary in order to learn as much as they could about their students’ thinking. Derek chose to plan his lesson around a problem he had done in the summer methods course. We spoke after the lesson about his experiences.
Derek: any type of lesson like that where they can work together and they have nothing to go off of besides their prior knowledge of each other, it makes for a good lesson as a teacher because you can definitely tell what certain kids know and what definitely certain kids don’t

JH: or what they’re not thinking about

Derek: yeah, and you can tell very easily the level of thinking kids have just by, like all I asked [one student] was, he said, what’d he say

JH: he’s originally the first one I heard say that he has 10 ways to die and two ways to live

Derek: he said 10 ways to die and 2 ways to live and I was like, oh, so he can die everywhere and he was like, yeah, and I walked away and then when I came back he had made the connection that you can’t but, I mean, I just restated what he said in a question, so, he picked up on it, so you can tell he was really critically thinking then I dropped a big hint on these two up here and they didn’t, they were working towards it but, I think if they had 10 more minutes I think they would’ve cause I saw them turning the bear like we were all doing in class and like can he go off there, no, then they were doing it again but they never came up with a conclusion (11042010 post-conference, lines 818-831)

Derek had carried out the suggested methods for the lesson by just responding to students’ questions with questions and observed what his students were able to come up with when left to think about different concepts related to the problem. He even shared his thought that other students would have been able to get to that point if given a little more time to think about the problem. He did not suggest that he should have told the students how to think about it but was convinced they just needed more time to think about it on their own. This demonstrated a strong belief in the abilities of his students and the importance of providing them with opportunities to think through the mathematics and not just be told how to think.

JH: did you feel like you got the opportunity to learn about all of the students as well as you would’ve wanted to

Derek: not 100%, I feel like I learn a lot more in, my regular lesson plans because I set them up to gauge that basically, but this really gives you a absolute insight into what they think (11042010 post-conference, lines 837-841)
This comment demonstrated Derek’s thoughts about the different perspectives of students’ thinking he is able to access with his typical approach to lesson implementation in comparison to the silent lesson. *It seemed he considered the silent lesson to provide a deeper idea into his students’ thinking that goes beyond specific content ideas and more into how they approach problem solving and broader concepts.* Derek expressed his excitement about the different ways his students thought about the problem and the fact that they were all able to think about the problem in a way that made sense to them and was beneficial. He also commented on his opportunity to observe specific student ideas and make notes about the type of thinking and approach to problem solving he may have wanted them to share with the class. He then spoke about the idea of the problem-solving lesson and his desire to make it more of an integral part of his teaching rather than a random lesson for a day (Derek, 11042010 post-conference, lines 844-855, Figure L.29).

Derek: oh yeah, I mean really they had very close to the same reasoning we as college students had I felt, I mean they didn’t get to the tree diagram part which would explain a lot, you know once they get there then, if just one person would’ve been able to get there and do the tree diagram I would’ve let them and I would’ve showed it at the end but nobody was quite far enough ahead and had enough time to even think about that, yeah they were definitely on the way JH: so could you see this lesson as something that you do over the course of a couple days and maybe get into that eventually Derek: yeah, or I could see at the end of one class putting in the quarter flipping part, like the last fifteen minutes like flip these, we’re gonna use these tomorrow to keep track of your results, he lives, he dies, whatever and then the next day, have a 25 minute work session where they all work on 1-4, yeah I could definitely see that if I had that time (11042010 post-conference, lines 886-897)

Derek compared his seventh grade students’ thinking to the reasoning his peers had done on the same problem in the summer methods course. He also considered and suggested different approaches he could have taken to implementing the lesson to allow the students
more time to work on the problem and think about the consequences of the sequence of moves.

I had noticed some interesting perspectives and conversations from his students about the concept of “fair” and decided to see what Derek noticed.

Derek: yup, said there is a quarter to a half of the time, I was like what! But I didn’t say anything, I was just like okay, I was hoping [one student] would say no that’s not right fair is 50-50 but they’re so used to games that they play, it’s harder to win, than it is to lose, a lot of kids refer to video games and say well there’s not near as good of a chance to win so to make it fair you have to make it more challenging which makes it more fun and I’m like, but that’s not fair

JH: yeah the idea of fair is gone

Derek: exactly, and it was said over there, here

JH: yeah somebody said it’s more fun cause it’s more challenging

Derek: yeah that was up over there and then back there [another student] said fair is 50-50 and I was like okay, is this game fair, she’s like, it can be, and I was like, what do you mean it can be, and she was like well the, something about the way you flip it, if you flip it this way this way and this way it’s fair and I was like, yeah but fair depends on the outcome of the game, no matter what happens you know it’s completely on the flip, and she’s like yeah but I’m saying you have to flip it right, okay, but the majority of the kids when I asked them said no it’s not fair because you have two bridges and 10 places to die and then as I kept asking them that same question, their thinking started to change, it was 2 and then 8 and then it was 2 to 4 (11042010 post-conference, lines 930-946)

Derek noticed and learned about his students’ thinking on games and fairness. He picked up on the possible impact of his students’ experiences on their thinking about games.

Even though he did not expect this thinking from his students he reflected on their ability to reflect on the questions he posed and adjust their thinking. He reflected further in his daily lesson reflection and blog post on the same lesson. In his lesson reflection Derek shared the interest he and his students had in the lesson as well as his objective to motivate his students to think about mathematics outside of his classroom based through his lessons. He also commented in his blog on his enjoyment of the lesson and the
opportunities he had to observe student misconceptions and student thinking (Derek, 11042010 lesson reflection, 11072010 blog post, Figure L.30). *I was not sure about whether the experience would be especially meaningful for Derek because the point was for him to focus on student thinking and he had already been doing that throughout his lessons. He was able to learn more about his students’ thinking though and reflected on the use of the lesson to achieve specific objectives through challenging his students.*

Only a few days later Derek traveled to observe a peer teach a lesson in her placement. Throughout his observation notes he commented on several areas that were areas he had focused on in his own teaching, demonstrating consistency in his perspectives. Derek appreciated his peer’s implementation of a method demonstrated in the summer methods course that he had also used in order to hold students accountable (Derek, 11082010 observation reflection, Figure L.31). *As a result of Derek’s focus on encouraging student participation and implementing learner-responsive pedagogy, he often had experiences with these pedagogies to share at small group.*

I have one kid, he’s not supposed to go to the board, he’s not supposed to be called on in class and my first time teaching I didn’t know that and so right away I was like hey how about you cause he sits right in front, I was like hey how about you come up to the board and he came up there and he did the problem and it was fine and everything, I mean it was slower than most kids do it but then after the class my mentor teacher was like oh, I should have told you that this kid has an IEP, and ever since I’ve done that, he volunteers (Derek, 11122010 small group, lines 632-639)

*Sharing this experience at small group was critical to demonstrate to the other PSMTs the power of challenging students. The issue of having students participate was often a contentious topic of discussion at small group because many students resist participating.*
Derek demonstrated the benefit of encouraging student participation in a safe classroom environment.

As the quarter began to wind down, Derek reflected in his blog about his lessons for his fall placement. He mentioned the same lesson he did not enjoy because it was not interactive or “constructive” and went on to comment on his philosophy of teaching and how he perceived it had changed to be more “constructive”, since he began the program. (Derek, 11112010 blog post, Figure L.32). Derek’s fall placement was full of meaningful observations and experiences. Derek’s goals for himself for winter placement involved focusing on building his rapport with a group of students in a different context and incorporating more cooperative learning into his lessons (Derek, 11142010 FEAG). With his drive and ability to have experiences consistent with the learner-responsive perspective he was able to make amazing strides in his development as a professional.

Knowing Derek was going to be in an environment that was not likely to be as welcoming I focused my goals for him on coming up with ways to establish a learner-responsive environment, to keep his enthusiasm and passion for student engagement, and work on his use of pre-/post-assessments (JH, 11152010 FEAG).

Winter Placement – Putting it to the Test

Derek’s winter placement was in an urban high school teaching Algebra 2 classes. He was out of his comfort zone in this placement with a mentor who did not have a teaching philosophy similar to his and older students with which he was not used to working. Derek was initially greatly concerned with the prospect of changing the classroom environment of lecture and in-class homework too quickly. He also struggled
with the idea of not being able to assign any out of class work for his students because he wanted to have time in class for his typical hands-on activities. Derek was persistent and pushed the limits of his mentor’s comfort and was able to impact his students’ approach to class through strongly encouraged participation and accountability.

Struggling to Adjust

Derek mentioned his concerns about his placement at the first small group meeting for the quarter. Derek provided a long list of characteristics about his placement and his mentor in which he was challenged to think about how to approach. He commented how his mentor was “easy going” and would let some students sleep while she lectured for the first 10 minutes and then used the rest of the class period to let her students work on a worksheet. He questioned whether he could jump straight to his style of teaching because of the large difference (Derek, 01142011 small group, lines 210-220, Figure L.33). Derek’s description of his mentor’s teaching approach was something I was not surprised to hear based on the context of his placement and I had expected him to struggle at first with adjusting and finding ways to deal with the different environment. He wrote more about his frustrations with his mentor’s classroom practice in his reflective blog. Derek shared his refusal to lower his expectations for his students and wrote about his efforts to begin having an impact on the classroom environment and expectations. He was concerned about students sleeping while he was being evaluated by the program but wrote about it as generally conflicting with his overall philosophy (Derek, 01152011 blog post, Figure L.34). It was never a question about whether he would let the students sleep in his classroom, it was just a matter of how he could
motivate them and let them know that his expectations for participation were different than his mentor’s. This demonstrated his strong belief in the methods he was putting into practice and his unwillingness to give in to pressure and other obstacles.

In his first formal reflection for the quarter he described in more detail what he saw as his challenges for the quarter. Even though he had expected low motivation and behavior issues with his students in his winter placement, he had not anticipated working with such a large number of ESL students. He shared how he had quickly discovered that his ESL students did not understand as much English as he had assumed and he did not have many ideas for how to communicate effectively with them. He wrote about his need to get to know his students better and his belief that the ESL students may need more explicit instruction (Derek, 01172011 first reflection, Figure L.35). Derek’s writing in his reflection demonstrated his concern about finding a way to reach all of the students in his class. It also demonstrated his ability and drive to find ways to work with a diverse group of students. I was concerned with his conclusion that ESL students do not do well with “constructive” teaching. I questioned his thoughts in my feedback and provided him with some ideas to think about.

Just because they like detailed instructions does not mean that it is the best way for them to learn the material at a deeper level. They are uncomfortable with a different style of teaching just like any other student would be. It is just more pronounced since the language causes an extra barrier for them. (JH, 01172011 first reflection feedback)

My goal was to remind Derek of the possibility of students not necessarily knowing what types of experiences would help them learn the material at a deep level. In my experiences as a teacher and supervisor, I had observed students rebelling when learner-
responsive pedagogies were used based on lack of experience and comfort and then realizing the value of the approach as they adjusted to the methods. The PSMTs had even demonstrated this evolution in the summer methods class. Derek continued his reflection with ideas to encourage participation from his ESL students through collaborative work and wrote about his general feelings about the situation.

Overall, I was extremely shocked at the severity of the struggles for some of the ESL students. I was shocked at the overall number of ESL students. And I was not prepared to teach these students effectively. Within the first weeks I have made drastic strides and am now connecting with these students, but it has taken a lot more planning on my part, as well as seeing a lot of my plans fail. I have become very effective at resorting to a back-up plan when my first plan is not working. I am looking forward to the challenge of working with these ESL students this quarter and I know that I am going to have to be very creative in my teaching techniques to make sure I include these students in the learning with the rest of the class. (Derek, 01172011 first reflection)

I appreciated his reflective thoughts and ideas to address the issues he noticed and suggested other ways he could try to help the students feel more comfortable with participating.

Something else to try would be individual whiteboards for students where they could write questions, show their work, or indicate that they are not understanding in a way that may be more difficult for students to see easily. (JH, 01172011 first reflection feedback)

Derek was honest throughout this reflection about his assumptions and areas he viewed himself needing to grow as a teacher. Despite the fact that some of his suggestions for improving his effectiveness with his ESL students were not consistent with learner-responsive perspectives, he was obviously concerned about improving his ability to reach all of his students while still holding onto his general teaching philosophy.
Derek was so challenged by the obstacles in his winter placement he scheduled a time to meet with me to discuss ideas for approaching lesson planning.

Derek: her idea of a good lesson, my idea of a good lesson are two drastically, drastically, like not even remotely close ideas

_JH_: did you show her your lesson or talk to her

Derek: she looked at it today for, I don’t know, 30 seconds, I don’t know if she’s gonna look at it more or not, it’s hard because we don’t have a conference period, so, it’s like 1st, 2nd, 3rd, the only time we have any time to really discuss stuff in depth is the math lab time and it’s just based on the day, some days kids are constantly up asking questions other days we have the whole period to ourselves, so I don’t know, she might look at it more or whatever, she looked at it and was like, it’s good (01182011 individual meeting, lines 1031-1039)

Derek was frustrated with the clash between his mentor’s teaching philosophy and his own. He was struggling to adjust to the new placement with a mentor who did not value the same things his previous mentor did. He was also realizing he was not going to be getting what he would deem good feedback from his mentor based on time constraints and differing philosophies.

Derek: her idea is just put it out there, do three examples, give them a worksheet

_JH_: right, focus on the procedure, not the concepts

Derek: exactly, so, I want to teach my own style and I will teach my own style but I’m 99% sure I can’t go in and do that immediately, so I gotta ease, you know constantly keep pressuring it in you know, my first lesson is quadratic formula which you read through, they work on examples, whatever, the second one she wants to take a whole day to practice and just with real roots still, which seems really excessive to me, maybe it’s not but whatever, I mean it’s her decision

_JH_: well they’re not doing homework so I see that as being a reason why she would say that (01182011 individual meeting, lines 1046-1055)

Derek began to question whether getting the students to adjust to his style would be able to happen smoothly or quickly. He ran into many conflicts when trying to plan his lesson similarly to how he had in the past because the ideas I had suggested and he had agreed
with would not be feasible with the constraints on the material that was allowed to be covered and the time that was set aside for specific purposes.

How do I make this lesson constructive, so I have my second lesson done and what I, the best I can do is, we review, well hook, review, for the first few minutes and then, they have a worksheet, she has a worksheet that she wants me to use with them, cause it’s worked with her kids in the past and she likes it so we’re doing even problems and then I was gonna have, kids come to the board and work through ones that they’re struggling on or whatever, think-pair-share on a harder one where it’s not set up for them and they have to rearrange stuff but I’m just at a loss of, like the only way I can make it constructive is having kids come to the board and talk  (Derek, 01182011 individual meeting, lines 1056-1063)

I could sense Derek was somewhat at a loss at this point. He wanted to engage the students but was being forced to use materials that focused more on procedural ideas than conceptual ideas and were lacking context or any interesting aspect. I was not surprised that this was an issue Derek was encountering as I had seen many other PSMTs run into this issue in the majority of placements. So I focused on brainstorming with him about different methods to try to use.

JH: what about having them work in pairs and actually have to work it out and present it?
Derek: like up at the board you’re saying?
JH: or doing a jigsaw or something, saying we work in a group, we solve this one, we make sure it works, cause you can check them right?
Derek: I have that as an accelerated option for kids that are getting done fast they can check them on their calculator or by factoring
JH: but having them do some sort of jigsaw then, I don’t know if a jigsaw would work well though, because then it’s just showing them how to do it and it’s not really them working it out, but something where they’re responsible for doing it, not like, cause if you just have them work individually or if you want to work in pairs or whatever, they end up working individually, some of them do it, some don’t, you have some come to the board, the other ones just copy it down, right? So I’m thinking that they have to have some accountability
Derek: these guys do work well in groups cause they’re situated in groups although I’m gonna move some of them but, so I feel like I can use that to my advantage definitely, I mean so, is the best way, to, obviously she’s not gonna let me go 100% constructive you know
JH: well you said that she wants you to use this worksheet, if you were to go to her and say, I want to do this instead, would she be really upset?
Derek: I don’t know, this was the only thing that she was adamant on, you know usually other stuff she didn’t really care but she was like the five problems that I made up for last night were fine but then she was, today she was like, I’d really suggest using this worksheet.

JH: the other thing I was thinking was to maybe throw in an application problem at the end or something like that, that could take a while to find one, because personally I think, they haven’t done graphing I’m guessing.
Derek: they will have done solving by graphing, they will have

JH: oh they’re doing that this week, okay, because if, quadratics are amazing to solve by graphing and so they could do the algebraic and graph and put them together with an application and I think that, and there’s so many applications with the quadratics.
Derek: yeah definitely.

JH: that would just make it not just
Derek: I threw in at the end of the second lesson if there’s extra time, to do a baseball problem or someone hits a ball, one like that, which it would be fun.

JH: another thing that would be kind of cool, and this is something that, cause I think [another intern] had similar issues last quarter where it was like, we learn something really simple and then we’re supposed to take a whole day to just practice it and so I think it was linear equations though, I’ve never suggested it for quadratics, but to maybe do an application at the beginning for a hook and then later on say, now make up your own application problem.
Derek: that’s a good idea.

JH: just to get them to think the other direction you know, I mean I understand still wanting to get them to practice and that’s fine but I mean you do that for 50 minutes it’s like, okay.
Derek: that’s what I’m thinking, and then

JH: but I’m just trying to throw out ideas in terms of trying to make it
Derek: yeah that’s all I wanted to get was just more ideas, because every time I read your comments I’m like yeah that’s a really good idea, so I guess I should really focus on a lot more group stuff that makes them responsible.

JH: I think the issue with, especially when you’re walking into a classroom where students are used to not working, unless you hold them accountable in some way shape or form, they’re like, well what’s the point, oh he’s just gonna tell me to work, fine I’ll just sit here until he tells me to work, but if there’s something where, oh I have to get up and talk about this, you know in ten minutes, I need to, and that’s not necessarily gonna work for everyone, but it might work for some, but it’s something that, I mean you’re not gonna expect to work right away, I mean it’s gonna take time, which is the other reason why I suggest, not just doing it her way for a little bit and then switching to your way, because, it takes a while for them to adjust to a different type of teaching and you’re only teaching for 6
weeks, so if you don’t start changing things until the second or third week in, they probably aren’t gonna have time to adjust by the time you’re done
Derek: okay, yeah, that’s why I was trying to implement a lot of getting them up right away in that first lesson, even though I don’t, I don’t think it will work but I know three of them I can probably get up to the board, if I have, like you said if I have other kids tell them what to write that’d be a good first step (01182011 individual meeting, lines 1064-1140)

I took the approach of throwing out several ideas to let Derek think about whether he could see them fitting in his classroom. My philosophy, as I shared with Aubrey, is that I do not believe there is one effective method for facilitating learning in each situation but maybe methods that may be more effective in specific contexts. Especially with Derek, I made the assumption that he was familiar with his context and what he could do with his students. From my experience with him fall quarter I knew he was concerned about getting to know his students. After providing my suggestions Derek commented that he just needed some ideas and a little affirmation that it was okay to really just focus on engaging the students through participation and accountability. I also emphasized the importance of really working toward getting the students to adjust as soon as possible since I knew he was only going to be in the classroom for six weeks and it takes time for people to adjust to new contexts and expectations. I viewed Derek’s ability to see the effectiveness of a learner-responsive environment built by him as a way to truly solidify his belief in the perspective.

After a while our conversation went to the issue of the high school mathematics curriculum and the difficulty of putting some of the concepts into context or to make them seem applicable to teenagers in an urban setting.

Derek: none of this surprises me, it’s just, what do I want to do to be, cause when I’m making my lesson plans I’m like, this is a fake lesson plan, cause I wouldn’t
just say here’s the quadratic formula, practice it, and I’m looking ahead and I’m teaching quadratic formula, and then we go back to complex numbers, so now I have to teach complex numbers which will be, I don’t know, I mean, it seems like everything I have is one of those topics that would be like, 90% of this is rote, so it’s, I don’t know, cause when I was teaching last quarter, even when I did have a lesson, say the calculators, I still was like, okay this is one lesson out of eight that I have teach regularly

JH: it’s middle school vs. high school
Derek: yeah, it probably is

JH: I mean, as you get into the higher content, first of all there’s so much of it and second of all, it’s like, I don’t know when they’re gonna use this again, not that it’s not important for them to think about it but how am I supposed to motivate them to learn this when the applications of it are so far advanced that I can’t

Derek: so maybe that’s what I need to change in my mind, is it more like I should think of making my constructive, my lessons constructive more with the class interaction than with the actual material

JH: right, cause you can’t get them to come up with things like complex numbers
Derek: okay, that’s what I need to change in my head, okay
JH: yeah it’s less of I want them to discover this, let’s just get them to think about this and think about why, how it’s useful
Derek: okay okay, I can make that change

JH: I mean there’s gonna be some examples where it’s like, yeah I could get them to try to think about this and just start thinking about it and it’s always good to, if you can, give them a problem where they have to start thinking about something and they might not figure out what you want to teach for the day but at least their minds are on that problem
Derek: yeah, okay, yeah I think that’s where I’m getting caught up, cause in the middle school it’s so easy to let them, it wasn’t easy but I mean it was a lot more fun (01182011 individual meeting, lines 1195-1224)

Derek commented that he was struggling with his lesson plans because he felt they were just manufactured and constrained outside of his typical approach to teaching. I perceived that Derek was starting to get stuck in the perspective that constructivism means students need to create and develop ideas such as the quadratic formula and complex numbers. I view this perspective as a little bit of a misunderstanding of constructivist ideas or maybe an over reading of the philosophy. My perspective is that it is not realistic to have this expectation, especially in a high school classroom where a large amount of advanced
content becomes crammed into a small amount of time. Therefore I tried to get Derek to think more about engaging the students in thinking about the concepts, not expecting them to construct them from scratch. Derek seemed relieved by and optimistic about his perspective of focusing more on student participation and accountability and just general thinking ability.

Onto the Battlefield

Derek began teaching for his six full weeks shortly after our meeting and he reflected extensively on his experience teaching in this new context. In his first lesson Derek was able to continue to validate his perspective of the usefulness of a hook or warm-up problem that would engage the students. While the students did show the typical disinterest in a different style of teaching, Derek was encouraged to show them otherwise and the students actually ended up liking his method of teaching (Derek, 01252011 lesson reflection, Figure L.36). I was excited to see his success and excitement at implementing changes in the style of teaching from the beginning. His success gave him more confidence in his teaching philosophy and he continued to reflect on his experiences as the quarter progressed. In his second experience Derek continued with his learner-responsive methods and even pushed the students to get out of their seats and up to the board. He was excited by their willingness and interest, which most likely encouraged him to continue with his methods as he was seeing the impact on the students’ attitudes as well as learning more about what knowledge they were bringing to the classroom (Derek, 01262011 lesson reflection, Figure L.37). In his next lesson he incorporated a flash assessment and reflected on his decision to deviate from his planned
lesson based on a student stumbling upon the idea of complex numbers. He also commented on how his students struggled on the calculator lab he had used but he had wanted to challenge them (Derek, 01272011 lesson reflection, Figure L.38). *His comfort and ability to be flexible with his lesson when students brought up the concept of complex numbers provided him with the opportunity to work on building an environment where students were encouraged to think about what they observed.*

As Derek got more acquainted with his students in his fourth lesson he began to zero in on specific concepts where his students were struggling and began to consider different ways to adapt his lessons based on the areas where his students needed help. He reflected in-depth on this lesson after watching the classroom video. Many examples of Derek’s use of learner-responsive pedagogy were throughout his description of the lesson. He was able to create an environment where his students felt comfortable participating through his use of a hook and was encouraged by his students’ willingness to get up to the board and help each other. He remarked several times throughout that he was confident learning was taking place in the situations where he had the students discuss with each other instead of only relying on him (Derek, 02012011 self-critique, Figure L.39). *In my feedback I made sure to highlight the areas where he was having success and remark on the great experiences. I also pushed his thinking a little trying to get him to come up with concrete ways to address areas he wanted to change.* At a point in his video viewing his reflection took on a different tone. Derek specifically pointed out a time when he did not think learning was taking place because his mentor was taking thinking opportunities away from students by immediately correcting their mistakes at
the board when Derek was purposefully given them time to notice their mistakes and learn from them (Derek, 02012011 self-critique, Figure L.40). This observation was critical in solidifying his belief in his teaching method and philosophy in comparison with his mentor’s. He noted the importance of his students using their own thinking and the lack of any opportunity for thinking when they were just corrected immediately. My feedback on this section was to offer him support as his supervisor and talk with his mentor about her involvement while he was teaching. He also commented on the required time for students to practice the content as well as his areas for improvement where he could allow more wait time and talk less in order to allow students to talk more (Derek, 02012011 self-critique, Figure L.40). Derek was noticing so many great aspects throughout the observation of his lesson. With the perspective of focusing on opportunities for student thinking he was able to pick out areas where this was impacted and reflect on the possible benefits for the students.

Only a little over a week after Derek taught his first lesson he commented on his observations and feelings in relation to his class and students in a reflective blog post.

I am definitely starting to like the class that I am teaching a lot more now. I just had to get the students adjusted to my teaching style and my expectations and now things have gone a lot more smoothly. Participation is way up in my class and the students love the hooks. (Derek, 02032011 blog post)

Despite Derek’s original reservations about the students adjusting to his teaching methods, he was able to see how quickly he could impact the classroom environment with a little perseverance. For my first observation visit Derek demonstrated his ability to consider his students’ thinking and his curricular objectives in order to plan his lesson.
After observing the lesson I probed his thinking behind the questioning strategies he used in his lesson.

JH: so when you have students come up to the board and they show their work, what’s your approach when you ask, what are you thinking because you drill them with questions, what’s your whole objective with what you’re doing while you’re asking questions
Derek: so my objective is so that they give an explanation in students’ terms and they are using, when they’re writing it gives me time to think that I don’t have when I’m up there writing my own
JH: I was just curious because a lot of times we have students just say, they kind of just say something and nothing anybody’s listening to, so I think by asking questions you’re doing several things in getting them to explain more, you’re also showing students examples of questions they could ask, and I don’t know if it would be useful to say, pay attention to the types of questions I’m asking guys cause if, you know I’m curious about what you’re doing and I think that other people would benefit from hearing it so if you see something that you don’t understand why they’re doing it, but I think you’re asking good questions, so you may want to bring attention to why you’re doing it (02042011 post-conference, lines 1359-1376)

Similarly to his previous discussions of being flexible and able to respond and react to situations in the moment, he commented that he thought of questions during his lesson in the same way. I was excited to hear about the questioning method he was using because it really helped the students to expand their thinking and explanations while up at the board. I decided to push Derek to think about making his method even more learner-responsive by getting his students to take on more questioning responsibility themselves. I asked him to share his approach to questioning at the next small group meeting. He shared that once his students start writing he tries to view the explanation through the eyes of his students and asks questions about what is written based on this perspective (Derek, 02042011 small group, lines 52-65, Figure L.41). Derek provided more insight into his thinking about his questioning approach from a student’s perspective. This
demonstrated to me that his thinking was often focused on his students instead of himself and his own actions and thoughts, which seemed to be critical in his ability to incorporate and implement so many different learner-responsive pedagogies.

At the same small group Derek shared his goals for the quarter: to involve all of his students in his lessons, find ways to make “rote memorization lessons more interactive or applicable to real life,” and to get his students to stay in their seats until the bell rings (Derek, 02042011 small group, lines 83-90, Figure L.42). Derek’s goals were consistent with his overall perspective and focus on encouraging student participation and engagement in his lessons. He was specifically focused on his ESL students because he was having the most difficult time finding ways to encourage their participation. He also brought up his struggle to make the curriculum in Algebra 2 seem interesting to his students. He continued to demonstrate consistency in his beliefs with his peer critique of Jacob, suggesting several improvements and commenting on things to commend Jacob on similar to his criticisms and marks of excitement about his own teaching methods. He pointed out Jacob’s use of wait time and encouragement of different solution methods and suggested methods for encouraging more student participation. He also suggested the use of a flash assessment to gauge whether his students were grasping the content before moving on (Derek, 02082011 peer critique of Jacob, Figure L.43). One of Derek’s suggestions for improvement hit the nail on the head with Jacob in his need to assess student understanding before moving on to a different topic or new problem. This was a common issue for Jacob and a frequent goal I assigned for him to work on. This
demonstrated Derek’s ability to notice areas where learner-responsive methods were not being considered and come up with ways to try to make improvements.

A Series of Small Victories

As the quarter progressed Derek continued to run into little snags with his mentor’s constraints. Derek had different ideas for the way class time could be effectively spent but was restricted to his mentor’s wishes. Despite his restrictions he still put effort into finding ways to challenge those students who were ready to move on with new material. He also continued to make progress with his students developing more comfort in his newly created classroom environment.

Today’s lesson went very smoothly. I planned on calling students up to the board so that they would go over the test on their own, but I didn’t really even have to call on them. They volunteered themselves. I stayed in the back of the classroom a lot of the time while the students discussed their answers at the board. The students did a really nice job of going over the practice test. I questioned the students while they were at the board and they did an excellent job of explaining. I was especially proud of one student, he has never been up to the board before in one of my classes and he volunteered to come to the board today. He did the problem correctly and was very proud walking back to his seat. (Derek, 02142011 lesson reflection)

Derek noticed his students’ willingness to be active participants and how participation seemed to be contagious as more students volunteered to play an active role. He was excited about how well his students were able to adjust and carry on a meaningful discussion and made note of yet another student being willing to volunteer who had not in the past. For his formal reflective paper I asked Derek to reflect on his progress on his self-determined goals for the quarter. It was evident from the way Derek commented on his goals progress and his actions to achieve his goals that he was motivated and cared deeply for providing opportunities for his students to learn. He realized the importance of
classroom environment and encouragement with classroom participation. He also took note of his lack of knowledge on incorporating ELL students into his lessons and went out of his way to look for resources (Derek, 02152011 goals reflection, Figure L.44). I suggested he talk to a colleague of mine who was specializing in ELL students in mathematics education and he incorporated many of her suggestions into his practice. I also cautioned him on making final decisions on some of the methods he was trying

I think it is important to keep a list of ideas for working with them because while you may find that a few work well with these students this quarter, others may work well with students you have in the future. (JH, 02152011 goals reflection feedback)

Overall, Derek realized the importance of just talking to his students, getting to know them as well as their learning styles. Derek even commented to me in a post-conference discussion that he felt his knowledge of working with ELL students had grown 400% just out of having the opportunity to actually work with them.

When I visited for my second observation Derek spoke to me about trying to implement some of his ideas to get one particular ELL student involved in the lesson that day.

I’m trying to get the ELL students involved, she’ll be sitting with her back to you, she’s right in front of me, I’m trying to get her involved in anything, so today when she walks in, I’m gonna tell her I’m gonna call on her to review what we did yesterday, that way she has time to think before class and write something down, and then just get her to say it and I’ll write it for her (Derek, 02182011 pre-conference, lines 1555-1559)

Derek knew this student was quiet and self-conscious and had devised a plan to help her feel more confident about speaking up in the classroom so she could begin to feel
comfortable with sharing. We discussed the result of his efforts after the observation and he mentioned it in his lesson reflection for the day.

I thought today’s teaching went great. I had lots of class interaction and I had two new students come to the board today that had not been to the board yet while I was teaching. I also got one of my really shy ELL students to volunteer twice in class today, which I considered a huge accomplishment from where she started with me when I began teaching. (Derek, 02182011 lesson reflection)

Derek was excited that he was finally able to get this student to participate and surprised by how well it worked. He even commented on a couple other students who volunteered to come up to the board who had never done so in the past. Derek was obviously having an impact on these students.

As the quarter began to wind down, Derek tried to do some team teaching with his mentor teacher just as he had in his fall placement. However, he quickly realized the difficulty of team teaching when working with someone with a different philosophy about teaching. He described how he would intend to give the students time to think and his mentor would jump in with hints taking away the opportunity. He also described how his mentor spent most of the time at the board explaining while he tried to ask questions most of the time (Derek, 02222011 lesson reflection, Figure L.45). The next day he was excited to have complete control back and observe more progress in students’ willingness to be more active in the classroom.

I had several students at the board and I had all ELL students at least volunteer once in class today. It was great to see! One student came to the board that was not here yesterday. The class walked him through the problem very nicely. It worked out really well because he kept asking questions and the students would answer his questions as if they were the teacher!! (Derek, 02232011 lesson reflection)
Derek’s ability to see positive results from his efforts seemed to solidify his belief in the benefit of incorporating those methods into his teaching philosophy.

During a small group meeting, a peer shared a struggle he was having with working with a student in his class. After hearing how his peer had approached the issue Derek provided some advice.

I’d definitely try to change your style, I mean there always comes a point where when you’re doing something and you’re like, okay this is absolutely not working and you just have to really sit down and alright I give up I’m gonna try your way now (Derek, 02252011 small group, lines 428-430)

*Derek demonstrated his openness to different ways of thinking and his ability to get out of his own way for the benefit of his students.* His peer also wanted advice on how to get students to work in groups without complaining.

I’ve made them split up groups twice and the first time, it was a bunch of whining and complaining and I just put my foot down and I was like, you can either get in the other groups or everybody can get zeros today, I don’t care and then real quick everybody’s there and so as soon as I did that and then the second time there was no complaining (Derek, 02252011 small group, lines 552-556)

Derek demonstrated his approach to classroom management. *Many PSMTs that I had worked with had difficulty implementing learner-responsive pedagogy because of the resistance from students who had little experience with the methods. Derek had decided he knew what was best for the students and did not give them power over his methodological decisions in those instances.*

Derek summed up his observations of the progress he had made with the classroom environment in his placement in a reflective blog post. He was able to finally not use his mentor’s method of worksheets for a couple days and his students seemed shocked and liked it. He also commented on how he had more students make the trek up
to the board for the first time, leaving only 5 students to have not tried it (Derek, 02272011 blog post, Figure L.46). At the beginning of his placement Derek was so concerned about the policies put in place by his mentor that he did not agree with and did not think he had any way around them. He was able to try some lessons without her requirements and observed the students’ positive reactions from the changes. In one of his final lessons for his winter placement Derek commented on how engaged his students were in the content of the lesson. He described how his students had essentially conducted their own discussion, debating different approaches for binomial expansion (Derek, 03012011 lesson reflection, Figure L.47). Derek had taken a class of students who were sleeping and disengaged and within only 5 weeks he had them debating mathematical concepts as a result of his perseverance to enact his philosophy of teaching in an environment where it was not initially welcome by the mentor or the students.

As Derek was completing his last week of teaching in winter placement he ran into some final frustrations with his mentor and he shared the experience at a small group meeting. At the beginning of his winter placement experience he had discussed his mentor’s tendency to make a noise when students were making a mistake at the board in order to get them to correct it right away. I had subtly brought it up in the initial meeting and he had not had any issues until one of his last lessons. For this lesson he described how he had decided to take the approach of giving the students responsibility for sharing their thinking with their peers who had missed the previous day’s lesson. Unfortunately, as soon as his students showed a little confusion his mentor started providing hints. He tried to remind her of his goal to only have students talk and the intervention specialist
reminded her as well. His mentor was stubborn though and eventually suggested that she was a student and Derek described it as her taking over the lesson. He said “it’s just so obvious that the students aren’t learning anything when she’s just telling them exactly what to do” (Derek, 03112011 small group, lines 134-213, Figure L.48). Derek demonstrated his teaching philosophy and perspective on student learning throughout his description of his experience. I saw that Derek thoroughly believed that his learner-responsive pedagogy was more effective than the teacher-centered approach. He had observed the different approaches fall quarter with other teachers and winter quarter he was able to actually experience the difference first hand between his teaching and his mentor’s. By this point, his beliefs seemed solidly aligned with the learner-responsive perspective.

For the last small group meeting in winter quarter I showed a classroom video of a discussion Cathy Humphreys had with her class about participating in class. Derek was critical of the methods he remembered Cathy using where she asked questions and called on students to respond. He said “I just feel like there’s so many more ways that you can get class involvement” (Derek, 03112011 small group, lines 384-394, Figure L.49). Derek’s experiences and drive to find different ways to encourage student participation in an environment where it was not originally welcome allowed him to recognize the wide variety of approaches that could be used to encourage a learner-responsive classroom environment. The discussion in small group with his peers moved to the issue of letting a student off the hook if you called on him to answer and the student said he did not want to. Derek explained his perspective on that approach sharing that he saw student learning
being set up through classroom management approaches. He felt that if you emphasized collaborative work and student participation then it was important to “stick with your guns” and expect all students to participate. (Derek, 03112011 small group, lines 505-523, Figure L.50). At this point Derek seemed to have fully integrated his perspective on classroom management with his teaching philosophy. He did not see them as separate issues where he had to learn how to manage before he could use certain methods but that they came hand-in-hand.

He summed up his winter placement experiences in a reflective blog post. He wrote about it as a “great experience” providing him with the opportunity to work with diverse students. He reflected on his initial assumption that classroom management would be his biggest obstacle but did not have many problems and was able to “turn a very non-constructive teaching classroom into a constructive classroom” (Derek, 03192011 blog post, Figure L.50). Derek had observed his ability to change what had been labeled as an unmotivated, lower ability level classroom of students to a classroom where the students were actively engaged and challenged to think about the material on a deeper level. He even remarked at one point that his class was performing better on the assessments than his mentor’s class even though they had the same assessments and it had not been that way before he started teaching. He definitely viewed his experiences as meaningful but was energized to return to an environment where he knew he could continue to improve his teaching methods and not have to fight against other teaching philosophies. My goals for Derek for spring placement continued to suggest a focus on incorporating pre-assessments as he still had not incorporated this form of assessment
into his lessons and to work on a formal closure in his daily lessons (JH, 03082011 FEAG). Derek had similar goals to generally incorporate more informal assessment methods, continue to promote ELL student learning, and get all students to participate, just as he had mentioned in his blog post (Derek, 03052011 FEAG).

Spring Placement – Solidifying Beliefs and Practice

For Derek’s spring placement he was back where he felt most comfortable and started teaching full time shortly after returning. He had great experiences and was even slightly challenged by three different class preparations and a high IEP and inclusion class. Throughout his teaching experiences during his spring placement, Derek incorporated many different methods and lessons providing opportunities for students to engage and be challenged with the content. In one lesson he reflected on how well his students reacted to having the opportunity to find surface area with any method or tools (Derek, 04132011 lesson reflection, Figure L.52). Derek demonstrated his interest in allowing students to develop their own methods for solving problems. He also anticipated his students’ initial thoughts and planned a way to get them to think more deeply about the activity.

For Math 7 this was an easy day. I was much more of a facilitator. I let different students take turns being the teacher and answering questions at the board. I really liked doing this because the students did such a great job of explaining the material and the students sometimes can do a better job explaining methods to their peers than what a teacher does. (Derek, 04182011 lesson reflection) The discussion today was led by the students and they pretty much covered every question that I wanted to cover. It worked out great letting the students lead the discussion and come to the board to show their work. I think the students really like doing this and it gives me an opportunity to walk around and check on each student’s work. (Derek, 04202011 lesson reflection)
Derek continued to show his interest in incorporating many opportunities for students to share their thinking, especially with other students. He referred to himself as a “facilitator” indicating a learner-responsive perspective on his role in the classroom.

Honors lesson went very well. It might have been one of my better lessons of the school year. The kids really liked the human number line activity and I think I challenged them just enough. The students basically taught the lesson and I just guided it. I spent more time at the back of the room than I did at the front because students wanted to go to the board to write so much. The only thing I would change about this lesson is to maybe have a few more challenging examples to throw at the students at the end of class. (Derek, 04262011 lesson reflection)

Derek demonstrated his interest in challenging his students through different pedagogical methods. He also addressed a different perspective on his role in the classroom as being more of a facilitator or guider of ideas rather than the one with all the information. In several reflections Derek was focused on providing his students with opportunities to develop their own solution methods and ideas about different mathematical concepts. He was purposeful about not just telling students what formulas were and made sure they were able to link formulas to a visual idea of what the formula was describing. (Derek, 0518/05192011 lesson reflection, Figure L.53). *His comment about liking his choice to have students find formulas because it kept them interested and busy suggested a continued focus on entertaining students instead of learning with understanding.*

Derek also had lessons where he struggled to balance his desire to teach in a learner-responsive fashion with curriculum requirements and his perceptions of student abilities. In one lesson reflection Derek realized he did not have a good understanding of his students’ abilities and had to redesign his lesson plans in order to accommodate the difficulties the students were having (Derek, 04132011 lesson reflection, Figure L.54).
This demonstrated his flexibility to adjust his lessons based on his students’ needs and not just push through the curriculum. He also began to show more interest in his ability to assess than just making sure his students enjoyed a lesson.

The only thing that I didn’t like about this game was I couldn’t exactly tell who was struggling and who was not. This is where the clickers are much more of an advantage. I think for the next review I do with Honors I will use clickers and see which one I think is more beneficial to the kids. (Derek, 04202011 lesson reflection)

This comment demonstrated Derek’s concern with actually being able to assess his students’ understanding. Many PSMTs focus on ways for students to have fun through games and do not consider whether there are any benefits to the game in the way of assessment or learning. In other lesson reflections he demonstrated his frustration with curriculum requirements and the resulting less learner-responsive lessons. He was “crammed for time” with a lesson covering the Pythagorean theorem and felt he had no choice but to teach it “very methodically and formula based.” He also struggled with thinking of constructive ways of presenting particular content he was required to teach (Derek, 0425/05122011 lesson reflection, Figure L.55). This showed Derek’s encounter with similar issues that other PSMTs had but it also demonstrated his dislike for these methods. My concern with his comments was not knowing the point where he would not give in to the circumstances and fight against them as he had in his winter placement.

A fellow supervisor visited Derek mid-quarter for an observation. The supervisor praised Derek’s use of a pre-assessment and emphasis on gaining participation from all of his students. He also commented on Derek’s ability to challenge and engage his students and encourage them to develop their own solutions. When complemented on this ability
Derek “credited [me] for having encouraged him to believe in [his students’] abilities and said it had become one of the most enjoyable aspects of teaching for him” (04292011, supervisor feedback). In his self-critique Derek demonstrated his growth and development throughout the year by reflecting on his use of different teaching methods. He incorporated manipulatives and had students work individually as well as collaboratively. He had students go to the board and participate by calling on them. He used “think-pair-share” with challenging problems and then finished the lesson with a review of the lesson objective. He also focused on his ability to get his students to think about “why” the formula for volume of a rectangular prism works and was persistent about them coming up with some explanation (Derek, 05092011 lesson reflection, Figure L.56). In this lesson Derek used an approach similar to one we watched in a video during the summer methods course. In the video the teacher encouraged students to try to think “why” the length times width times height method works to give you the volume and some of the students developed the idea of talking about volume in terms of layers. Derek seemed to have built his lesson around this idea and was excited about the results and the way his students were able to develop communication skills as well as a better understanding of volume. He was critical of not thinking to include a real-life example for students to think about and I commented on this to give him a different perspective to consider.

This is a valid point, but I also think it did not necessarily take anything away from their learning to not have this discussion from the beginning. Sometimes these discussions can distract from focusing on developing understanding of the concept and may make more sense once the students have a deeper mathematical understanding of the concept. (JH, 05092011 self-critique feedback)
I knew that emphasizing applications of concepts over deep understanding was a mistake that I had often made as a beginning teacher and wanted Derek to have the opportunity to reflect on this perspective.

Overall, Derek had many learning experiences and summed up his view of his experiences in his last lesson reflection for the program. “It has been a great year and a great experience that I wouldn’t trade for the world!!” (Derek, 06082011 lesson reflection). His goals for his future teaching were to focus on using pre-assessments and incorporate interactive manipulatives (Derek, 05242011 FEAG). My goals for Derek in his new teaching position were to continue to be proactive about reflecting on his teaching and to work toward a deeper understanding of his students’ thinking by keeping track of student thinking and developing a resource to build his own understanding of how student learning progresses (Derek, 05272011 FEAG).

Final Interview & Synthesis

We began the interview with a prompt to get an idea of Derek’s perspective about mathematics and how students learn mathematics.

I guess I think of math as application, math is something that students are gonna use throughout their everyday life, in ways other than problems in a textbook so, going off that, students learn math by doing, by feeling, by touching, by applying it to their everyday lives, I really feel as much as we can get them to relate what we’re learning to a concept that they are familiar with the better, the more I can get them to touch and feel and move the stuff, whether it be on computers or hands-on, anything that I think helps them learn the best no doubt (Derek, final interview, lines 2014-2020)

His perspective of the effectiveness of hands-on learning was something he had believed from the beginning of the program and his experiences seemed to have solidified this perspective. This perspective coincided with the application-related view of mathematics
and learning as a process, not just through practice and repetition. I followed his explanation with a question regarding how he used this perspective in his practice.

Well, every one of my classes I try to have a real life example, and if I can’t I try to let the kids come up with a real life example, I include some type of hands-on activity in every one of my lessons just about if I can, especially at the middle school level, and I try to use a lot of the, any online interactive thing I think really helps so I try to include them, once or twice a week, in lessons, (Derek, final interview, lines 2024-2028)

Derek’s view of mathematics as something that is applied was consistent with his explanation about learning mathematics through engaging with it. This was also consistent with his perspective on teaching mathematics as well as the reason why he struggled with the curriculum in his winter placement when he could not present the concepts as readily through applications.

I followed this with a question about his perception of how his beliefs had changed and been challenged throughout his experiences.

I don’t think they’ve been, my beliefs, well, my beliefs coming in were entirely different, but I don’t think of it as they were challenged, I think they were altered, I never, well, maybe at first I put up a front against it a little bit but, I was pretty open to ideas and stuff and I think I found out firsthand really quickly that a traditional math class doesn’t work, (Derek, final interview, lines 2038-2042)

Derek was quick to say that he did not really fight against the philosophy of the program while he did later admit that he did not completely believe in the philosophy until he was able to observe the issues presented in the philosophy in practice. I probed him to think about any experiences that he felt had led him to that understanding.

Just by interacting with the kids, teaching, just making lesson plans a lot of times I would think to myself, this isn’t even gonna be fun for me as a teacher so, through interaction, through the reading that we did in class, but mainly through the student teaching is where I picked up on it right away (Derek, final interview, lines 2044-2047)
The interactions and the teaching is by far the most influential, I just think the constant reiteration by the professors and stuff that we had here, really drove it home, but mainly the kids (Derek, final interview lines 2051-2053)

Derek struggled to provide specific examples during the interview however his reference to his experiences in his placements being the most influential was supported in consideration of the types of experiences he had and how he had reflected on those experiences throughout the program. While he did give credit to the program faculty and staff and the consistency in method throughout his classes, he continued to emphasize the impact being from his experiences with students.

My next question was about his understanding of the theory of constructivism and whether he considered it as being reflected in what he would call a student-centered classroom.

To me it just means letting the kids think in their own way, letting them come up with their own theories and their own formulas and how the concept that I’m teaching works for them in their minds, as a teacher just being open to whatever ideas they may present, a lot of kids think of it in entirely different ways than me or somebody else thinks of it, but just letting them come up with their ideas on their own and letting them act on those ideas (Derek, final interview, lines 2056-2060)

I think it’s different because you can have a student-centered classroom and it doesn’t have to be constructive, I mean I can have kids at the board doing work in front of a class or I can have the kids be doing some type of activity, hands-on activity but where I tell them exactly what formula I want them to use and I, and they’re writing the notes exactly how I want them or whatever they’re doing at the board, well then that’s student-centered, they’re still doing it, I’m not, but it’s not constructive because they’re using my ideas or maybe one other person’s or something like that, whereas constructivism would be letting the kids come up with their own ideas on their own (Derek, final interview, lines 2063-2070)

Derek’s perspective of constructivism was centered on the cognition of the students and where their ideas were coming from. While he admitted that student-centered could be constructivist he cautioned that it could also be viewed as just student participation.
through regurgitation of the teacher’s ideas. So I asked him how he viewed his own
teaching.

I mean there’s certain lessons where I feel like I have to give them some
guidance, I feel like I can be a lot more constructivist with, honors kids and
accelerated students than with the lower level kids, I still think I teach
constructively but I have to give them a little bit of guidance whether it be guided
notes or something that gets them going in the right direction and kinda keeps
them more on the task at hand (Derek, final interview, lines 2073-2077)

Derek did not view his own teaching as completely constructivist because of the guidance
he provided students, remarking that he tended to provide more guidance to lower level
students, which demonstrated the influence of his experiences in spring placement with
his IEP class and the tendency for teachers to approach instruction for IEP students more
traditionally.

I then showed Derek his responses at the beginning and end of the summer
methods course to the prompt asking him to describe a lesson in his classroom.

Derek: at the beginning, okay, that’s what I thought, it’s not as traditional as I
thought it was, but it’s still definitely more traditional
JH: so what’s more traditional about it
Derek: just I would lecture for the first 20 minutes, definitely, and then the last
fifteen minutes of class I use for them to work on homework individually or as a
group, I never do that (final interview, lines 2109-2113)
Derek: I think it’s funny that we were just talking about homework and then it’s I
would assign homework nightly, which I do assign homework but here I was
thinking much more like 20 problems but, yeah, it’s not as traditional as I thought
it was though, cause I remember thinking back to writing that and I was like
woah, but, yeah I mean, the other thing I really changed was, I never thought
hooks were so beneficial, but yeah they’re definitely (final interview, lines 2117-
2123)

Derek was surprised by some of the learner-responsive characteristics of his original
response, just as I had been when juxtaposing his written response to his MBS results.
The critical interpretation could be in the difference between student-centered and
constructivist as he had described earlier because he had consistently been focused on
students but had developed this focus into meaningful incorporation of students
throughout his teaching experiences in his placements.

I followed his response up with a question about why his perspective had changed
on the value of homework since it had been a big deal to him at the beginning of the
program. Derek’s explanation here demonstrated some insight into influences on his
perspectives. He mentioned several times the issue of being bored himself when he
planned or even implemented more of a teacher-centered lesson with lecture. He also
mentioned realizing the importance of a hook from the summer methods course based on
the change in his response. Mostly, his view on homework changed based on his
experiences and observations of his mentor during his fall placement. He reflected on the
usefulness of short but challenging homework for students and the importance of
activities and discussion in class instead of time to work individually on homework
(Derek, final interview, lines 2129-2148, Figure L.57). I then asked him why he thought
so many teachers taught more traditionally when it was so obvious to him that it was
boring for him and the students.

Well it’s easier, but, I mean it’s easier to prepare and to teach a class that way and
not have any type of room for chaos or error or something to get out of hand, you
have a lot more control I think but sometimes control’s a bad thing in the
classroom because I mean if your kids are so structured, you know they’re never
going to be able to think for themselves and think outside the box, so I think that’s
the easiest thing, the other thing is you can really base your lessons on time, you
know when you’re doing it that way, I’m gonna go through these three examples
and then where, I don’t know, I’d rather let the kids lead where we go and if we
have extra time at the end we can always throw something in (Derek, final
interview, lines 2151-2158)
Derek acknowledged how easy it was to plan and manage a classroom when the teacher was doing most of the talking but shared his perspective on it not challenging the students to think. He expressed his interest then in being more flexible based on his students’ interests and needs demonstrating a strong learner-responsive perspective.

We then explored and reflected on his belief development over the course of the year by looking at some of the changes in the beliefs instrument responses.

Uses key words as an effective way for children to solve word problems, so, working with my eighth period class in spring, which had a bunch of IEP students in it, was, key words were so important, so I think actually getting to work with them in spring, it really really changed my opinion there, because we constantly pulled 5 or 6 words out of a problem that helped them, you know, try to get words into a math problem (Derek, final interview , lines 2180-2185)

In this response Derek demonstrated the influence of his experience with the IEP class on his perspective about how to work with students with learning disabilities. In this class his model had been more teacher-centered as that is typically the agreed upon approach with learning disabled students.

Children should understand computational procedures before they master them, so, this one’s kind of funny because, so it seems obvious that they should understand computational procedures before they master them, but at the same time, I feel like a lot of problems they don’t need to know a computational procedure at all, they can solve it in some other way that it’s not even, it doesn’t even seem like a procedure to them, that just came from time of working with them, we would have procedures for them sometimes, sometimes we even went over it the day before and then a girl or guy comes to the board and they’re like well, I thought of doing it this way, and I was like, yeah, that would work and that probably makes more sense to them, so, once again, just by reacting to the kids (Derek, final interview, lines 2185-2194)

Derek demonstrated a complete switch in perspective on whether students needed to know exact procedures to solve problems based on his experiences of working with students. Having the opportunity to actually observe that it was not necessary and could
actually be more beneficial for them to develop their own procedures and understanding had been impactful for him. In considering his survey response on a prompt about whether he could impact students’ value of mathematics Derek reflected on what his actual goal and teaching philosophy was.

I mean, my main goal is that they learn it so that they can apply it, I’m not worried about them memorizing it, I’m worried so that, I want them to be able to apply it and to be able to have fun doing it in a way that they will remember it, so I mean I don’t know if that’s the value of learning mathematics but I want them to be able to use it again without having to think drastically hard about oh what was that formula you know (Derek, final interview, lines 2296-2300)

His response was consistent with his experiences and emphasis throughout his professional development. He was concerned with students having fun and memorable engagement with mathematical content. This demonstrated that Derek had developed a more nuanced view of engaging his students in meaningful learning, not just entertaining them.

One of the survey prompts caused confusion and demonstrated how the responses could not necessarily be taken to mean one way of thinking.

When students are working on math problems I put more emphasis on getting the correct answer than the process followed, so strongly agree obviously wait, when students are working on math I put more emphasis on getting the correct answers, oh, okay so, how ever they get the correct answer, I don’t really care, as long as they get it with a worthwhile method of work, so if I’m teaching a concept and, say it’s proportions when in my head I always think cross multiply but in a lot of their heads they think scale factor, so, if a student wants to do that on a test or on a homework or whatever, that’s perfectly fine with me, I don’t care, as long they’re, as long as it mathematically makes sense and it’s something that will work every time then I have no problem with it, so, as long as they’re getting the answer (Derek, final interview, lines 2305-2313)

Derek’s response demonstrated how the survey statement could be construed differently as he explained that his emphasis was on students getting the same solution in different
ways. He clarified that he would not force his students to use a specific process but he
cared about their ability to use a process that made sense to them to get to the solution.

My final question to Derek was to explain my research questions and see whether he had any additional thoughts.

As far as, how do I, or how did I get shaped into being constructivist, so, I think a lot rides on the teacher that you’re training under, I think a lot, because if I had my winter mentor, in the opposite, if I had them reversed, it would be, I don’t think I would teach near as constructively, as what I do, but, I don’t feel like anything that we read really like told me this is what you want to do, I think, some of the videos we watched really kinda showed me I think, sitting in a traditional classroom really said woah, I sat in an eighth grade classroom where a teacher lectured the whole time with her back to the kids and I was able to see what was going on and kids were zoned out, being able to compare teachers, ones that do teach constructively as to those that don’t, I think that’s a very quick easy way to figure out which way you want to teach if you want to put forth the effort, I’m trying to think what else, I think just in our classes, the teachers that tried to implement teaching constructively in their classrooms, like you did it, but there was three or four times, and they wouldn’t do it all the time (Derek, final interview, lines 2391-2405)

Number one thing was being able to see and then in my case, my fall and spring mentor, teach constructively 95% of the time and see that the kids liked it, so I mean if there’s any way that you can line it up with perfect constructive teachers, I think it’s a very easy, it’s a no brainer as to what way you should teach (Derek, final interview, lines 2411-2415)

Derek reiterated here that his placement experiences had the most impact on his
perspective. While he admitted that the content in the courses and the methods used by
the instructors made him think, actually being bored sitting in a traditional classroom and
actually observing a constructivist teacher and the response of the students were the most
influential for him. He even admitted that it was important that his first classroom
experiences were with a mentor that had a philosophy that was more constructivist. He
shared that if it had been the other way around he did not think he would have had as
strong a learner-responsive perspective at this point. Derek also referred to a perspective
He credited to his father of the importance of hands-on learning and how he combined that perspective with the program perspective.

If I can get my kids to use anything, feel it, you know the more that they can have their hands wrapped around it or anything, that’s to my advantage I think, 90% of the time, so I mean I think that helps but, I think it still goes, like entirely back to the teacher and another thing, you guys constantly stress asking why, why, why, why, why, why, for some reason it just stuck in my head and it’s easy for me to do, once I started doing it it’s very easy, just why and they have to think that much harder, but, I don’t know, it’s a mixture (Derek, Final interview, lines 2445-2451)

Derek’s focus on hands-on learning was supported by his father’s approach to teaching. He also admitted that he was impacted by the focus on asking students to explain “why,” something I emphasized in my methods course as well as in my discussions with them on their lessons and after observations. Derek continued to try to think about any specific point where he felt his perspective changed from more teacher-centered to more learner-responsive.

Derek: I’m trying to think of, when it kind of flipped because at some point I had to go from lecture to no lecture at all, I don’t know when that flipped but it had to be early because, I think it really flipped when I had to plan my first couple lessons for the seventh graders and I’m really thinking how can I make this fun and then you know want me to teach them, I think that’s when I really flipped over to student-centered constructive learning

JH: yeah because I mean, by the time you were done with fall quarter you got into winter quarter and it was really like, please lecture, please lecture, and you were having none if it and a lot of people in those situations will just you know essentially say okay I’ll do whatever, you know

Derek: yeah I didn’t, no, not good

JH: she didn’t kick you out, it worked out

Derek: I can talk most people into letting me at least try stuff, once she saw that I could do it she was fine for that it was just that initial I don’t want to give them homework time, I’ll give them 6 minutes, that was my leeway with her but, yeah I don’t know, I guess I can’t really pinpoint one thing that was like oh, I should switch over, I just think it was a constant you know, examples

JH: you got it beat into your head enough
Derek: yeah, it doesn’t take much though, that’s the big thing, I think once you have that experience and you see that it does work then, I think the hard part is, trying to like, okay I know I want to teach constructively but how do I make this lesson constructive you know, I think that’s where a lot of people really really struggle and that’s where it’s a little bit tough and a lot of people well, the easy way would be to write these notes and give them these two examples or I think few just think a little bit harder and find a way it makes your lessons so much better (final interview, lines 2453-2475)

Derek reiterated how his opportunity to observe and experience examples of the benefits of learner-responsive teaching really solidified his perspective even when he was challenged in his winter placement. He then admitted that once he was convinced that he wanted to teach constructively, the difficulty was in how to actually develop and implement constructive lessons. This was demonstrated in his meeting with me at the beginning of winter placement when he struggled with the high school curriculum that was less easily approached through applications.

I don’t think I ever had one of those moments, and I think it was easier for me because it was real easy for me to see because my mentor was so open and she was like yeah, just try it, just go, and I think in the back of her mind she knew what I was trying was gonna work but I didn’t at the time so it was easy for her to be open about it and be like, go, and as soon as I made my first couple lessons I was onto it but I can see where if you had a teacher where it was strictly what they wanted to do, it would be very hard because you’d never get a good taste of what you were capable of (Derek, final interview, lines 2484-2490)

Derek finished by reflecting on the impact his mentor had on his teaching through supporting him to try learner-responsive methods and understanding why other PSMTs without that support would really struggle without ever getting the opportunity to observe the benefits for the students and reflect on their own abilities to teach using those methods. Overall, Derek had made the most progress toward developing strong learner-responsive pedagogical methods out of all of the PSMTs I had worked with in three
years. This was ironic to me based on consideration of his initial survey scores being so low and demonstrating the least change after the summer methods course. A summary of his responses to the MBS in Table 9 provides a snapshot supporting the demonstration of his beliefs development.

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| Factor 2 Items |          |          |          |          |          |          |          |          |          | sum  |
| Teacher’s role in curriculum | 2 | 8 | 9 | 13 | 14 | 20 | 23 | 25 | 26 | 27 | sum  |
| Pre             | 6 | 1 | 4 | 6 | 3 | 3 | 5 | 3 | 1 | 3 | 35  |
| Post 1          | 5 | 2 | 5 | 4 | 3 | 3 | 6 | 3 | 1 | 4 | 36  |
| Post 2          | 6 | 3 | 5 | 1 | 4 | 5 | 6 | 3 | 3 | 5 | 41  |

| Factor 3 Items |          |          |          |          |          |          |          |          |          | sum  |
| Procedures and problem solving | 1 | 3 | 5 | 7 | 10 | 11 | 16 | 19 | 21 | sum  |
| Pre             | 5 | 3 | 4 | 2 | 3 | 5 | 3 | 4 | 3 | 32  |
| Post 1          | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 40  |
| Post 2          | 6 | 6 | 6 | 3 | 5 | 6 | 6 | 4 | 6 | 48  |

Table 9: Derek's MBS Score Summary

His scores initially demonstrated low alignment on all three factors (factor 1: how children learn; factor 2: teacher’s role in deciding curriculum sequence; and factor 3: the relationship between procedural and problem solving mathematical abilities) with learner-responsive perspectives and barely changed after the summer methods course.
However, following his field placement experiences he demonstrated significant growth on all three factors. This growth following field placement experiences was not common for the eight PSMTs I worked with and also not a pattern demonstrated in research on prospective teacher beliefs. By the end of the program his MBS scores ended up being one of the highest at 131 and one of two of the eight PSMTs whose scores had increased after his field experiences.
Chapter 5: Discussions

The overall lack of observed classroom practice in U.S. schools aligning with a learner-responsive approach to teaching is concerning. The purpose of this research was to both explicitly impact and explore the process of the development of beliefs and classroom practice for a small group of PSMTs through a Teacher Development Experiment (TDE). With support from the literature and my own experiences as a student, teacher, supervisor, and graduate research assistant, I set out to focus on helping a small group of PSMTs toward developing the belief in, and skills to be a learner-responsive teacher. From the cases presented in the preceding chapter, it should be apparent that the process is anything but simple. However, based on analysis using my conceptual framework as a guide, I have found evidence to strongly support the importance of consistency in support, beliefs, and experiences aligning with learner-responsive pedagogy in order for prospective teachers to have the opportunity to develop elements of learner-responsive classroom practice. In this chapter, findings from the three separate case studies are considered separately as well as concurrently to attend to the research questions (Figure 7) guiding the study. The questions are addressed through a discussion of the cases using the lens of the conceptual framework developed in Chapter 2 (Figure 8) positing the importance of consistency between beliefs, experiences, and
support of KCS development in order to work toward development of learner-responsive pedagogy.

1. What is the process of learning and development of practice for three prospective secondary mathematics teachers in a graduate teacher education program?
2. How does a teacher educator’s explicit support to focus on the development of knowledge of content and students (KCS) influence the prospective teachers’ learning and development of practice?
3. What specific components of explicit support or implicit influences seem to play a larger role?

Figure 7: Restatement of Research Questions

Figure 8: Factors of Development of Learner-Responsive Pedagogy
Using this conceptual framework as a guide, I have pulled together evidence from the findings to discuss PSMTs’ demonstrated beliefs, specific experiences impacting their beliefs and development of classroom practice, and the types of support provided. While other themes for each case emerged in analysis, I chose to focus on the themes that allowed me to more clearly answer the research questions posed. In each category of the conceptual framework displayed in the following figures, factors are listed with a (+) if they were determined to have a positive impact on the development of learner-responsive pedagogy and a (-) if they were determined to have an adverse impact. Whether a factor fell into one category or another was a result of analysis of data along with corroboration with findings from the literature and a peer reviewer. A synthesis and interpretation of the findings from the data is introduced through a metaphor developed as I gained more insight about the difficult process of development for prospective teachers. I also provide a glimpse into my own growth and development throughout this process. Following this synthesis is a discussion about the limitations of the research as well as implications for prospective teacher education and future research.

Learning to Walk a Tightrope

As I surrounded myself with data from my research and noted reoccurrences of obstacles and the constant balancing acts PSMTs were forced to navigate, I began to relate their journeys to the process of learning to walk a tightrope. Before I use the metaphor of the tightrope to provide a synthesis of the findings and the subsequent implications, I discuss a summary of the learning and development of each case separately because the initial beliefs and overall experiences of each case differed on so
many levels. Each PSMT’s learning and development is discussed using examples from their experiences in each field placement visually organized by the categories of impact on learner-responsive pedagogy from the conceptual framework.

*Jacob’s Learning and Development*

Jacob demonstrated a promising impact on his espoused beliefs by the end of the summer methods course. This was evident in his overall MBS score increasing from 93 to 129 as well as what he shared in his reflective writing. In his reflective writing he acknowledged the influence of the teacher on the classroom environment and the importance of sparking the curiosity of students. He also characterized the teacher-centered teaching he had experienced as a student as stifling and commented on the importance of focusing on student learning, not curriculum coverage. However, his demonstrated beliefs in the classroom by the end of the program were quite different. He often commented on a difficulty with being able to “think on his toes” in front of a classroom full of students. There were also several instances throughout his teaching experiences where he demonstrated a lack of deep understanding of mathematical concepts. Both of these areas paired with environments and mentors that were unsupportive of learner-responsive approaches were critical in impacting his ability to learn from his teaching experiences and develop more learner-responsive perspectives.

A summary of Jacob’s demonstrated beliefs, experiences, and types of support during his fall placement experience is provided in Figure 9. Coming from experiences in the summer focused on building theoretical knowledge of constructivist approaches, Jacob was initially critical of the model of teaching provided by his fall placement...
mentor. He acknowledged his need for and appreciation of my guidance to include learner-responsive methods in his lesson because he did not have such a model to depend on from his mentor. He also frequently claimed to be a blank slate when it came to teaching because he had not been in teaching situations. This demonstrated a conflicting belief with learner-responsive perspectives due to a lack of acknowledgement of the implicit knowledge he had built as a student about teaching.

Figure 9: Jacob's Fall Factors of Development of Learner-Responsive Pedagogy
Even though Jacob had demonstrated a strong alignment with learner-responsive perspectives in the summer, the beliefs he demonstrated through his actions and discussions with me were not supportive of learner-responsive perspectives. This is evident in considering the beliefs category in Figure 9 above. As is evident in the support category of Figure 9, I provided Jacob with frequent support through suggestions of methods he could implement in order to gain access to student thinking. My verbal ideas were not sufficient to combat Jacob’s discomfort with the complex task of teaching and his mentor’s model of teacher-centered teaching. I attempted to refer to the vicarious model of teaching I provided in the summer methods course and the verbal models from the readings as examples for him to reference. He was able to create some opportunities to notice student thinking but struggled to make sense of it mathematically or was so overwhelmed with the act of teaching that he did not notice it. Jacob demonstrated the overwhelming influence his current observations and enactive mastery experiences had on him by continuously choosing to implement those methods. Even when provided with ideas for methods to encourage student thinking he often did not take advantage of them and eventually adapted his lessons to more closely match his mentor’s teacher-centered methods. His reasoning for making the teacher-centered adaptations was that he felt he needed to succeed at teacher-centered instruction before he could make adjustments and be flexible in considering student thinking. This perspective led him to focus on improving his teacher-centered methods giving him enactive mastery experiences that had less chance of positively impacting his beliefs about a learner-responsive approach to teaching.
Jacob’s winter (Figure 10) and spring (Figure 11) placement experiences continued to fail to provide him with sufficient learner-responsive models or many enactive mastery experiences with learner-responsive pedagogy to impact his beliefs about teaching and learning in mathematics. This is evident when looking at how the majority of beliefs he demonstrated were not supportive of learner-responsive perspectives and he also had more experiences that were unsupportive of learner-responsive pedagogy in his winter and spring placements combined. I continued to provide verbal and vicarious support through references to models he had experienced

Figure 10: Jacob's Winter Factors of Development of Learner-Responsive Pedagogy
and methods to use in his lessons. The few lessons where he was able to productively encourage student communication resulted in excitement and optimism that was subsequently diminished due to other pressures in his placement from his mentor or students. His occasional demonstration of growth in his ability to reflect on his use of learner-responsive methods provided evidence to support the importance of having successful enactive mastery experiences with those methods. However, he had more enactive mastery experiences to solidify his perspective on the need to use teacher-centered methods in the context of the environments he was in. Jacob was even excited about improvement in his ability to explain mathematical ideas to his students without any concern for assessing his ability to impact student learning.

While he continued to express beliefs in emphasizing “conceptual” mathematical understanding with his students, he spoke about mathematics from the Platonist perspective: static and connected truths instead of a dynamic, process-related subject (Ernest, 1989). He even made comments throughout his experience on how boring and dry it was to just talk to students but still spoke about improving the way he lectured in the next sentence instead of coming up with some way to increase student engagement. He characterized himself as a “blank slate” and “absorbing” what he saw when it came to his beliefs and knowledge about teaching but was quick to not characterize students in the same way. This lack of consistency demonstrated a possible conflict between Jacob’s theoretical beliefs and practical beliefs about teaching and learning in mathematics and the possibility of holding learner-responsive beliefs but not necessarily knowing how to
demonstrate those beliefs in practice. Lonka et al. (1996) suggested that this may be an obstacle prospective teachers would encounter.

Figure 11: Jacob's Spring Factors of Development of Learner-Responsive Pedagogy

Jacob exemplified the point Jacobs et al. (2010) made with professional noticing and the importance of going beyond use of methods perceived to be learner-responsive and actually using those methods for the purpose of interpreting and using student thinking to inform instruction. During the summer methods course and beginning of his placement experiences, Jacob frequently mentioned the importance of knowing more about his students, but he struggled to include and implement methods to elicit student
thinking without significant support from me. With my support he was able to include opportunities for eliciting student thinking a handful of times throughout his teaching experiences but his difficulty with understanding the students’ mathematical ideas made those opportunities less of a learning experience for him. He also struggled to even focus on the actions and knowledge of students in his classroom due to his intense focus on his own actions and abilities, pedagogical and mathematical.

Overall, Jacob never made it past the CGI Level 1 of “providing few, if any, opportunities for children to engage in problem solving or to share their thinking” (Fennema et al., 1996, p.412). He may have expressed interest about emphasizing student learning of conceptual mathematics but his actual lesson implementation focused on the traditional, teacher-centered methods of talking to the students and demonstrating example after example without assessing whether students were actually understanding the concepts. One roadblock to Jacob’s ability to progress in the CGI levels framework was his need for everything in his life to be structured. He commented several times on wanting to make a list of the necessary skills for him to use. This suggested that he viewed teaching as something that was static. This view does not coincide well with an ability to make split-second decisions to change the direction of a lesson based on assessment of student thinking. In the final interview, Jacob spoke about knowing his classroom practice was falling short of the learner-responsive approach. He shared how he planned to try to change his practice within 5 years but knew it would be difficult without support. He also suggested that consistency in models of learner-responsive pedagogy from university faculty would have helped him to make more progress.
Aubrey’s Learning and Development

Aubrey’s prior experience teaching at the university level provided her with enactive mastery experience building stronger beliefs for teacher-centered practices. The summer methods course seemed to have a promising impact on her belief in taking a learner-responsive approach to teaching with her MBS scores showing an increase from 111 to 155 and her supportive comments in her reflective writing. She did express concern about her own ability to implement methods she was so unfamiliar with. However, with consistent support from me she was able to engage in learner-responsive enactive mastery experiences throughout her placement experiences to help her build a perspective supporting the effectiveness of a learner-responsive approach to teaching. Summaries of Aubrey’s support, experiences, and demonstrated beliefs related to learner-responsive pedagogy development in fall, winter, and spring are in Figures 12, 13 and 14 below.

During her fall placement she demonstrated difficulty with breaking from teacher-centered practices and tended to overshadow student thinking with her own ways of thinking. After encouragement from me she provided students with opportunities to share their solutions at the board and demonstrated her ability to notice and value the different solution methods demonstrated. Through additional activities promoting student communication, she commented on the benefit of student communication but did not show any intention of using student thinking to inform her instruction. Unfortunately, she was unable to focus on her progress in her fall quarter placement due to the pressure and lack of support from her mentor. This led her to avoid implementation of some of my
suggested methods to encourage opportunities for her to notice and attend to student thinking.

Figure 12: Aubrey's Fall Factors of Development of Learner-Responsive Pedagogy

Aubrey was often able to notice opportunities where she could have used learner-responsive methods such as questioning strategies or encouragement of student communication through accountability. She had difficulty actually implementing those methods though and spoke about her use of the same methods she observed her mentor use (e.g. finishing students’ thoughts with her own thoughts). She acknowledged that she
knew this devalued student thinking and took away the opportunity for those students to share their thoughts, but was having difficulty breaking herself of the habit. Despite her fall placement struggles, the learner-responsive experiences she did have and the beliefs she demonstrated aligning with learner-responsive perspectives provided her with a good foundation for her winter quarter placement experience.

Figure 13: Aubrey's Winter Factors of Development of Learner-Responsive Pedagogy

During her winter quarter placement she was able to see the value in providing students with a rich problem through my continued encouragement of incorporating a
hook. She commented on the students’ engagement and multiple solution approaches. She even brought this experience up as evidence of students being able to solve problems without knowing exact procedures during her final interview several months later. This demonstrated the impact of an enactive mastery experience on her beliefs about the teaching and learning of mathematics. In her winter quarter classroom practice she was also able to incorporate manipulatives. Unfortunately, the students resisted them, providing her with a negative enactive mastery experience. While she still spoke to the usefulness of the manipulatives for her own learning in the final interview, she seemed to have concerns about whether she could use them to help students learn.

Aubrey demonstrated beliefs in the fall about learning mathematics through memorization when applying the way she learned mathematics to the learning of her students. However, her belief in the importance of encouraging student communication to help students learn increased throughout her experiences. Her difficulty with explaining mathematical content in ways that made sense to students provided me with the opportunity to encourage her to use methods that allowed students to hear each other’s thinking and for her to hear her students’ thinking. While she grew in her ability to effectively encourage student communication and accountability, she did not demonstrate an interest in using the student thinking she was observing to inform her instruction. She also struggled with the idea of challenging students. Despite planning to provide students with time to discuss problems with each other in her winter quarter lessons, she found herself taking on the responsibility of individually helping and telling students how to
think about the problems, especially those students she perceived as “struggling”. Again, she spoke about her use of this method as an ingrained teaching habit.

She demonstrated initial concern in the summer about her lack of experience in a learner-responsive classroom making it more difficult for her to develop that kind of practice. During fall quarter she struggled with feeling that she was not creative enough to think of learner-responsive methods to use in her lessons. She commented that even though she was able to critique areas of her practice that were teacher-centered, she could not think of what to do instead that would be learner-responsive. I expressed the perspective that there were not necessarily “right” methods to employ in particular situations, only ways that would help her to encourage engagement and accountability with her students.

This was a difficult perspective for her to grasp but by the end of her experience she had demonstrated more comfort and creativity with coming up with ways to encourage student engagement that were different than the suggestions and models I had provided. This demonstrated a possible change in perspective on what it meant to teach effectively.
In consideration of Aubrey’s development using the CGI levels of teaching framework (Fennema et al., 1996), Aubrey initially demonstrated Level 1 instruction where she provided few opportunities for student to share their thinking or engage in problem solving. She gradually moved to consistently demonstrating Level 2 instruction by providing her students with more opportunities to communicate and be challenged with mathematical problems. As she gained more experience with implementing learner-responsive pedagogies with my support and encouragement, she began to demonstrate Level 3 instruction by consistently incorporating learner-responsive methods. Aubrey demonstrated the ability to attend to and even occasionally interpret student thinking but
she did not take that step Jacobs et al. (2010) suggested as critical: to make decisions about how she would respond to student thinking in her instruction.

In the final interview she expressed her belief about mathematics learning as being an active process and saw it as being solidified through her own experience with learning mathematics at a deeper level throughout her university methods courses. She admitted that while the summer methods course had provided her with reasons to consider learner-responsive methods, she did not believe in the effectiveness until implementing them herself and observing her students’ reactions and engagement. Considering the progression of her development and this response provides more evidence supporting the importance of those enactive mastery experiences to impact overall perspectives about teaching and learning.

**Derek’s Learning and Development**

Derek seemed to be the most skeptical of the learner-responsive perspective after the summer methods course. His scores on the MBS were the lowest of all the respondents at the beginning and end of the summer methods course and demonstrated the smallest change from a score of 99 to a score of 110. His responses to the writing prompts in the summer methods course also demonstrated a reliance on lecture as the only way to expose students to new mathematical concepts. However, Derek commented during fall quarter that his philosophy of teaching had been changed to be more constructive based on his experiences in the program and his fall placement. He also confirmed in the final interview that he was not convinced of the methods until his experiences in his placement with students reinforced the effectiveness of a learner-
responsive approach. These comments help to explain the difference in his responses from the summer and his learning and development throughout his placement experiences. Summaries of Derek’s support, experiences, and demonstrated beliefs related to learner-responsive pedagogy development in fall, winter, and spring are in Figures 15, 16 and 17 below.

Figure 15: Derek's Fall Factors of Development of Learner-Responsive Pedagogy

Derek did not demonstrate attachment to his teacher-centered perspective of instruction when his fall placement experience did not reinforce a dependence on lecture
and he had the opportunity to observe instruction by teachers other than his mentor that emphasized teacher talk. He was fortunate to have been placed with a mentor during fall quarter that served as an additional vicarious model of, and verbal support for, learner-responsive methods. He not only received encouragement and ideas from me but was also impacted vicariously through his mentor’s use of learner-responsive methods. Derek also observed a teacher who “reminded him of me” and commented on her use of questioning strategies similar to what I had modeled in the summer methods course.

The abundance of models and support for Derek during fall quarter reinforced the perspectives discussed in the summer methods course and provided him with many opportunities for enactive mastery experience in implementing learner-responsive methods. His initial demonstrated beliefs seemed to emphasize entertaining students as he frequently commented about students’, or even his own, boredom. He seemed to incorporate learner-responsive methods as a way to make mathematics class fun for his students. However, he consistently implemented methods I had modeled and suggested such as having students help each other explain. This demonstrated the influence of the vicarious and verbal models on his decision to incorporate the methods into his lessons.

Through his actual enactive mastery experience of those methods he was able to develop stronger beliefs in the effectiveness of the methods. He also quickly demonstrated comfort with teaching responsibilities and was able to begin to attend to, interpret, and decide how to respond to student thinking toward the end of his fall placement experiences.
I consistently pushed Derek to reflect on the student thinking he was able to observe. This resulted in comments about his amazement of what his students were capable of and his acknowledgement of the need to have confidence in his students in order to “teach constructively.” Once he entered an unsupportive environment in his winter quarter placement, his beliefs were challenged. I specifically tailored my goals for Derek in winter to help him focus on continued use of learner-responsive methods through tackling the issue of establishing a welcoming environment. With my support,
Derek’s belief in the effectiveness of learner-responsive methods was strengthened as he began to notice his impact on student engagement through use of learner-responsive pedagogy. As he gained more experience he experimented with different methods of encouraging student communication and engagement, especially with differentiating his methods for ELL students in his winter placement. His success with changing his initially unmotivated, unengaged students into students who were engaged in deep mathematical discussion within six weeks seemed to solidify his beliefs in the effectiveness of the learner-responsive approach.

Derek moved through the CGI levels of instruction framework quickly, spending little to no time demonstrating instruction at Level 1. Derek demonstrated an interest and ability to incorporate increasingly more opportunities for his students to engage in problem solving and share their thinking, moving him from Level 2 to 3 during his fall placement experience. He even began to show an ability to inform his instruction based on his general knowledge about his students’ thinking beginning toward the end of his fall placement experience and more frequently demonstrated during his winter placement experience. The small changes he made to his lessons based on this knowledge demonstrated CGI Level 4-A instruction, however, he did not demonstrate instructional changes based on knowledge about individual students, Level 4-B (Fennema et al, 1996).
His typical approach to teaching was to find a way to use his knowledge of his students’ thinking to more effectively guide them toward his initial curricular goals. He often demonstrated the ability to attend to, interpret, and even make the jump to the last level of the professional noticing framework by actually making changes to his lessons based on his interpretations of his students’ thinking. He still tended to overgeneralize the student thinking he observed to all of his students, an indicator suggesting room for growth in his professional noticing abilities (Jacobs et al., 2010). As a result, I specifically made this a goal for him in his first year of teaching.
Overall, the consistent support Derek received from summer to fall and beyond provided him with substantive verbal, vicarious, and enactive mastery experiences impacting his beliefs about teaching and learning in mathematics. His continued ability to gain enactive mastery experiences during winter quarter strengthened his perspective. He clearly demonstrated that his initial perspective on wanting to entertain students had developed into a desire to engage them in development of deep mathematical understanding. Derek also clearly stated that he believed his beliefs and classroom practice would have been drastically different if the order of his placements was switched. The consistency of philosophy between his summer and fall experiences helped him to strengthen the tentative belief change demonstrated at the conclusion of the summer methods course.

**Conclusions on PSMT Learning and Development**

In consideration of the types of experiences, support, and development of beliefs and practice for Jacob, Aubrey, and Derek, there is overwhelming evidence to support the impact of enactive mastery experiences on belief and practice development. Bandura (1977) discussed an enactive mastery experience as being the most influential source of impact on efficacy beliefs and the findings presented above provide support for extending Bandura’s theory to include other types of beliefs and actions. Table 10 below portrays a numerical analysis of the (+) and (-) factors listed for Jacob, Aubrey, and Derek. The numerical analysis provides an oversimplification of the process of development and should not be interpreted beyond the purpose of providing a snapshot portrayal of the factors impacting the PSMTs’ development of learner-responsive pedagogy.
### Table 10: Numerical Summary of Factors Impacting Development of Learner-Responsive Pedagogy

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Table 10: Numerical Summary of Factors Impacting Development of Learner-Responsive Pedagogy
Despite the consistent support from me to emphasize opportunities for eliciting student thinking, the three PSMTs developed different levels of CGI instruction and different abilities to professionally notice and use student thinking to guide their instruction. While all three PSMTs received support from me, demonstrated some beliefs aligning with learner-responsive perspectives, and had some enactive mastery experiences with learner-responsive methods, significant growth was evident only when the support, beliefs, and experiences were all substantive and sustained. This is evident when considering the overall percentage of factors supporting learner-responsive pedagogy for Jacob, Aubrey, and Derek. Overall, Jacob’s support factors were aligned 65% of the time while Aubrey’s was 70% and Derek’s was 93%. Jacob’s beliefs were aligned 21% of the time while Aubrey’s were 70% and Derek’s were 75%. Finally, both Aubrey and Derek, at 75% and 92% respectively, had more successful learner-responsive experiences than Jacob at 36%.

Even though Jacob’s responses to the MBS in the summer demonstrated strong learner-responsive beliefs, he actually demonstrated beliefs throughout fall quarter that were not supportive of learner-responsive pedagogy in his instruction and discussions with me. This is evident in Table 10 where his demonstrated beliefs were 12.5% supportive and 87.5% not supportive. This supports the importance of going beyond survey results to consider prospective teachers’ actions as an indicator of their beliefs, whether conscious or not (Ernest, 1989; Philipp, 2007; Strauss, 1993). In Jacob’s enactive mastery experience supporting teacher-centered methods, he was able to solidify his practical beliefs for teacher-centered teaching because his focus remained on himself
instead of his students. If his view had been broadened to consider whether his methods were effective for student learning, it may not have reinforced those beliefs as strongly. However, with the focus only on his ability to implement methods such as clear explanations, whether students learned from his explanations was not a concern he demonstrated. Even though he continued to exhibit interest in teaching mathematics from a conceptual perspective, he viewed it as something to eventually work towards, and not necessarily something that was even attainable in reality. This exemplifies Ernest’s (1989) statement that even with similar knowledge, that knowledge can be put into practice in different ways dependent on a person’s belief. Jacob had theoretical knowledge of a constructivism but Felbrich et al. (2008) found that the theoretical knowledge would only guide actions if they’ve been incorporated into a person’s belief system. Jaocob’s continued demonstration of beliefs inconsistent with a learner-responsive perspective despite his knowledge of constructivism supported Felbrich et al.’s conclusion.

Aubrey was also distracted by her own classroom practice abilities and demonstrated less of an alignment with learner-responsive beliefs during fall placement than may have been indicated in her MBS score with 55% supporting and 45% not. She was outwardly stressed during fall quarter due to her difficulty with implementing any learner-responsive methods in an environment where those methods were viewed as laughable. However, she was still able to successfully implement some learner-responsive methods. She was given more flexibility to gain experience with methods suggested and supported by me during her winter placement, however the delay in
enactive mastery experience with learner-responsive methods made it more difficult for her to break away from the methods she was accustomed to using. As a result, her development of comfort with learner-responsive methods was slow and she continued to focus on her own abilities in the classroom instead of the impact of her methods on the learning of her students.

Derek also exhibited an initial focus on his ability to implement specific methods in his classroom. However, the consistency of support between his placement and supervisor allowed him to progress in his development of classroom practice more quickly. This consistent support is evident in the overwhelming percentage (100%) of supportive factors for learner-responsive pedagogy in his fall placement. His increased use of learner-responsive methods resulted in sufficient comfort for him to begin to focus on student engagement as well as the impact of his methods on student learning. Subsequently, despite having less support in his winter placement, his development of supportive beliefs and ability with using learner-responsive approaches in his classroom practice seemed to outweigh the lack of support from his mentor.

By the end of the program, Jacob’s focus was on the type of thinking he wanted his students to be interested in and capable of while Aubrey’s focus was on getting her students to communicate and listen to each other in hopes that it would help them learn. Derek’s focus was on learning as much as he could about his student’s thinking and adjusting his instruction accordingly. Jacob and Aubrey were both more focused on their ability to put specific methods into practice and less on how the methods they used impacted student learning, while Derek demonstrated focus on his students’
entertainment and eventually engagement in his lessons. The three PSMTs demonstrated different levels of use of student thinking in their instruction, which coincided with their use of learner-responsive methods in their classroom practice. Sherin (2002) and Fennema et al. (1996) also found that exposure to novel student thinking was a critical component to helping teachers develop different perspectives on teaching. The more Jacob, Aubrey, and Derek used learner-responsive methods, the more opportunities they had to observe student thinking. Jacob struggled the most with including opportunities to elicit student thinking in his lessons and also demonstrated little ability to even notice the student thinking much less begin to interpret it and use it to make instructional decisions. Aubrey was slow to progress in her encouragement of student communication but was eventually able to demonstrate confidence in her use of learner-responsive methods, which allowed her to take note of more student thinking and interpret the different ways of thinking her students demonstrated. However, she did not demonstrate an ability to move to the next level of altering her instructional approaches based on this knowledge. Derek encouraged the elicitation of student thinking in practically every lesson he taught and was able to progress to frequently demonstrating flexibility in his lessons based on his assessment of his students’ thinking. The level of professional noticing exhibited by the three PSMTs seemed to coincide with their use of learner-responsive methods in their classroom practice. This observation supports the impact of use of leaner-responsive methods on the PSMTs learning about student thinking. Without opportunities for students to share their thinking, the cycle of learning Fennema et al. (1996) and Sherin (2002) conceptualized about teacher development is absent. Both Derek and Aubrey had
instances throughout their field experiences where they commented on the impressive knowledge their students demonstrated. Just as Fennema et al. (1996) observed, noting this knowledge from their students led them to provide their students with more opportunities to demonstrate their thinking, which again provided Aubrey and Derek with more opportunities to attend to the mathematical thinking of their students. Derek took more advantage of these opportunities than Aubrey and also demonstrated more growth and development of learner-responsive beliefs and classroom practice.

All three of the PSMTs were exposed to the same vicarious experiences and verbal persuasion to impact their beliefs in the summer methods course. Their development and use of learner-responsive methods depended on whether they were able to successfully implement those methods consistently throughout their experiences in order to strengthen their practical beliefs in the effectiveness of a learner-responsive approach. Derek had the most alignment between his practical and theoretical beliefs while Aubrey was a little more hesitant to acknowledge whether she would be able to continue her learner-responsive approach to teaching without support in her new teaching position. Jacob seemed to still hold his theoretical and practical beliefs completely separately as he had little evidence to convince him of the realistic possibility of developing learner-responsive approaches.

The Tightrope

In considering the journeys of the PSMTs discussed above in the context of the importance of consistency between beliefs, support, and experiences, I see many connections between this process and my imagination of the process of learning to walk a
tightrope. Picture the typical experience of a woman who eventually enters a teacher preparation program. As described in Chapter 1, these experiences are typically in classrooms where mathematics is presented as a collection of procedures and rules. When she enters a teacher education program premised on learner-responsive perspectives, the prospective teacher is essentially being pushed to climb a decently tall ladder up to a landing that is far removed from the reality she has experienced up to this point in her education. This is most likely an uncomfortable and scary place for the prospective teacher to be, however, it is also exciting as she envisions the wonderful impact she plans to have on her students. That is until she sees the thin rope stretched out before her and she is informed that her goal will be to learn to balance on that tightrope by trying to use unfamiliar learner-responsive teaching methods in order to be an effective teacher. The difficulty of the task is elevated even more when she is given several balls to juggle while trying to balance on the tightrope. She is asked to juggle a mentor teacher who is unlikely to support learner-responsive methods, students who are unfamiliar and uncomfortable with learner-responsive methods, a school context and curriculum that is not supportive of a learner-responsive approach, and ongoing coursework at the university where faculty speak highly of learner-responsive methods but do not consistently use those methods in their own teaching. Thankfully, she is not left alone with this task and is provided with a safety net of a university supervisor to give her guidance on this journey.

My Journey

Providing support and guidance for someone learning to balance on a tightrope and juggle at the same time was also quite a journey for me. While I had extensive
knowledge of literature and past experiences with providing support as a supervisor, that did not mean I always knew what would most effectively help the PSMTs to develop learner-responsive beliefs and classroom practice. My belief in the importance of learning as much about my students’ thinking and experiences as possible was strengthened throughout this process. Even though Jacob, Aubrey, and Derek all participated in my summer methods course, they interpreted their experiences differently and emerged with different perspectives about learner-responsive pedagogy. My goals and suggestions for them differed based on what I perceived as their strengths and weaknesses. I attempted to focus my suggestions on areas that they were enthusiastic about related to their students. For example, Aubrey consistently brought up the importance of student communication, so I focused on helping her to encourage meaningful student communication in her classroom.

The challenges each of the PSMTs encountered in their placements were also challenges for me as I tried to find ways to help them work against and within each context. I approached every interaction and observation with the PSMTs from the perspective of trying to find ways for them focus on student thinking and learning. I was focused on assessing the flexibility of the mentor and context for each PSMT in order to determine how hard I could push the PSMT toward the use of learner-responsive methods. For example, the lesson in silence Derek implemented during his fall placement experience was suggested for all of the PSMTs I worked with. Aubrey’s fall placement mentor lacked the flexibility to allow Aubrey freedom to adjust the curriculum in any way. Jacob was struggling so much with mathematical content and implementation of
methods requiring flexibility, I decided to not push him to try the lesson. Derek, on the other hand, was in a placement where his mentor provided him with freedom to adjust the curriculum and explore different methods with her full support. My decisions about whether to push each PSMT toward more use of learner-responsive methods, dependent upon their abilities and the context of their placement, inevitably impacted their overall growth and development.

While analyzing data, after the conclusion of the three placement experiences for the PSMTs, I had more opportunity to reflect on my own actions as a supervisor and teacher educator. I noticed ideas I had mentioned but not emphasized in the summer methods course that were often misconstrued by PSMTs. For example, the concept of student-centered was often interpreted to refer to involvement of students but not necessarily in a meaningful way. This led to my development of the term learner-responsive to refer to perspectives and methods supported by the current reform approach in mathematics education. I also noticed my tendency to back off on the PSMTs at times when I could have pushed them to make more progress. With Jacob I struggled to know when to push him due to my belief that he lacked some mathematical knowledge and comfort in the classroom that would allow him to benefit from use of learner-responsive methods. For Aubrey, her doubt in her abilities and stress from the pressure caused me to hesitate on pushing her too hard at times out of fear that I would drive her out of the teaching profession if she did not succeed in implementing a difficult method. Overall, I feel I struggled with the delicate balance in deciding when to push a PSMT, knowing that
difficulty or failure while attempting to implement a learner-responsive method may lead to less belief in the effectiveness of a learner-responsive approach.

In consideration of the whole process and the findings from my research, I have a clearer understanding of the importance of providing prospective teachers with as many levels of support and learner-responsive influence as possible. Additionally, it was important for me to get to know the PSMTs as learners as the instructor for their summer methods course. The more I knew about their beliefs, strengths, and weaknesses, the more I could tailor my suggestions and interactions to better support their development of learner-responsive classroom practice. For Jacob, I was the only factor consistently supporting learner-responsive development and I became aware of weaknesses in areas that made it difficult for me to support him, especially without consistent learner-responsive models. His continued demonstration of beliefs not aligning with learner-responsive perspectives and lack of demonstration of learner-responsive practice suggests that he will continue to struggle to implement learner-responsive methods in his classroom without substantive support. Aubrey demonstrated more beliefs and successful experiences aligning with and supporting development of learner-responsive perspectives, which leads me to believe she will attempt to persist to focus on encouraging student communication in her classroom. Without support, the meaningfulness of that student communication may dwindle as she becomes overwhelmed with the responsibilities of a teacher. Derek showed the most perseverance in implementing learner-responsive methods in a context where they were not supported. This suggests that he may continue to use these methods, even under pressure in his first
year of teaching. Based on the rich experience Derek was able to have in his winter placement experience, I do see it as important to provide PSMTs with a challenge to test and even possibly strengthen learner-responsive perspectives.

**Limitations**

As with any research, the findings and discussion of results for this research has limitations. The findings discussed above should not be generalized for every prospective teacher or even just those learning to teach secondary mathematics. The cases are meant to provide insight into the complexity of prospective teacher development of beliefs and practice resulting from explicit as well as implicit influences. While other prospective teachers may encounter similar contexts and situations, it cannot be assumed that they would respond similarly based on my findings.

An integral part of the presentation of qualitative research is the decisions made by the researcher. These decisions impact the story that is portrayed. One key decision was the choice of the three participants to focus on in the development of the cases. While this was conducted with the intent of choosing three individuals who demonstrated a wide variety of beliefs, classroom practice development, and experienced a variety of contexts, this choice focused on three distinct individuals. Of the five other participants, there were similarities in types of experiences, reactions to those experiences, demonstration of beliefs, and classroom practice development in comparison to the three cases provided in this dissertation. However, there were unique aspects about the cases chosen that were not shared with the five other participants. For example, Derek was the only participant out of the eight who worked with a mentor teacher who frequently
implemented and encouraged the use of learner-responsive pedagogical methods. Derek’s case did not introduce new overall conclusions, but provided strength in supporting those conclusions.

In addition, as with any qualitative research conducted over a long period of time, a sizeable amount of data was collected to support this inquiry. Through the process of analysis focused on responding to the posed research questions, only a fraction of the collected data was used and presented. Additional themes emerged for each PSMT that were distinct, yet impacted the development of that PSMT. For example, even in the data presented there is evidence of Aubrey’s interest in teachers’ perceptions of students. Throughout her experiences her perspective in this area matured based on the interactions I encouraged her to have with students. This was a theme that was unique to Aubrey’s experience and beliefs and played a role in her overall development. However, through analysis focused on responding to the posed research questions I chose to not emphasize this theme. This is one example of the influence of the researcher’s perspective and choices on the way each case was constructed and shared. Additionally, even though copious amounts of data were collected, there were many experiences that were not captured within the collected data that also impacted the development of the PSMTs. For example, each PSMT’s life outside of the university, their family, friends, living situations, etc., impacted the amount of time they were able to devote to their studies. Even though my supervisory objective was to tailor my suggestions to the individual needs and thinking of each PSMT, I did not know much about the experiences they had growing up that had inevitably impacted their beliefs and actions.
In consideration of the collected data, improved methods of data collection could provide more specific detail to allow deeper analysis of PSMT development of beliefs and classroom practice. For example, additional individual interviews with PSMTs following the summer methods course and each placement experience would provide a more thorough glimpse into the thinking of each PSMT. Also, more frequent observations of teaching as well as quality videos of PSMT teaching experiences would provide detailed data about the development of classroom practice and demonstration of beliefs. These adaptations would be feasible for a case study on one or two individuals or carried out by a team of researchers.

Implications

In consideration of findings from the research presented above, just getting a prospective teacher to climb the ladder and get on the tightrope, even with a safety net, is most likely not enough to have a good chance of that teacher being prepared to effectively believe in and use learner-responsive methods. The depth and consistency of a prospective teacher’s beliefs and the types of successful experiences implementing learner-responsive methods have been demonstrated to have a strong influence. Jacob’s struggle also demonstrated the issue of sufficient mathematical understanding, which has been a common topic of discussion in the field of mathematics education for a long time.

While the nature of case study research does not provide opportunities for generalizations concerning the development of all PSMTs in all teacher preparation programs, it does provide a detailed perspective of the development of PSMTs and insight into factors impacting their beliefs and classroom practice development. Based on
the methodological approach of a teacher development experiment, findings from this research could inform implications for design and implementation of prospective teacher education programs as well as future research on the development of learner-responsive classroom practice and beliefs. Possible implications in these areas are addressed separately below.

_Educational Research_

Existing research on the impact, development, and change of teacher beliefs rarely provides connections to the development of classroom practice. A common approach has been to attempt to impact prospective teacher beliefs in university coursework and not provide any support in field placement experiences. As a result, methods that have been used to impact teacher beliefs toward learner-responsive perspectives have not been shown to necessarily result in use of learner-responsive methods in the classroom. Guskey (1986) cited the ineffectiveness of presuming that impacting teacher beliefs would have to precede substantive development of classroom practice. He suggested teachers’ observations of positive student outcomes resulting from implementation of specific pedagogical methods would have more impact on teacher beliefs. Von Glasersfeld (1993) also suggested, “If one succeeds in getting teachers to make a serious effort to apply some of the constructivist methodology, even if they don’t believe in it, they become enthralled after five or six weeks” (p.37). The factors impacting PSMT development discussed above do not support a conclusion on impacting beliefs or classroom practice as needing to precede one or the other. However, they do support the importance of beliefs and classroom practice impacting each other.
Additional research in this area may find more details about the direction of influence with beliefs and classroom practice.

The findings from this research also support the complexity of the process of belief and classroom practice development as well as the individualized and contextual nature of the process. It is likely that the context in which prospective teachers will learn to teach for student teaching or enter as first-year teachers will conflict with the perspectives and pedagogies supported by current reform efforts in mathematics education. Seeing the conflicting impact of classroom contexts on the development and use of learner-responsive pedagogical methods suggests a need for continued research on ways to provide more support in conflicting placement experiences. My consistent support throughout their placement experiences had different degrees of impact for each case, yet seemed to result in some evidence of impact on beliefs, whether practical, theoretical, or both. The focus on student thinking and learning provided the PSMTs with a reason to consider learner-responsive methods over teacher-centered methods but the lack of specific research-based models to help PSMTs interpret the student thinking at a fine-grained level may have limited the significance of their progress and effectiveness of their classroom practice on student learning. While there have been promising results from CGI and other recent research focused on helping teachers to learn about student thinking through research-based models of learning progressions, these research-based models are not prevalent for secondary mathematical concepts. With the use of these models, the beliefs and practice of PSMTs could be more meaningfully focused on learner-responsive methods.

343
Despite the fact that the literature suggests many prospective and practicing teachers may hold beliefs inconsistent with learner-responsive perspectives, this does not indicate that teachers’ beliefs are all exactly the same. Just as reform efforts in mathematics education emphasize the importance of assessing, understanding, and using student thinking to inform instructional decisions, it is important for teacher preparation programs to be prepared to take the diverse beliefs of individuals entering the programs into account. From the perspective of beliefs as a system or mental model, teacher educators could take the approach of facilitating learning experiences that build from the existing mental models of the prospective teachers in order to have a better chance of impacting them (Buehl & Fives, 2009; Correa et al., 2008; Gill et al., 2004; Strauss, 1993).

This research provides evidence to support the difficult process of prospective teacher education as well as the myriad factors to consider in the development of beliefs and classroom practice for prospective teachers. While I do not see it as the role of prospective teacher preparation programs to prepare expert teachers in learner-responsive pedagogy, I do feel it is important to prepare them with the tools and perspectives that will help them to continue to develop effective approaches to teaching. In all three cases described in this research, the PSMTs agreed on the importance of support and consistency in the models of teaching in their university coursework as well as field placement experiences. While providing consistent models in placement experiences may be difficult, it appears extremely important for the initial models of classroom practice to
be consistent in order to support the tentative belief development of prospective teachers. Consistency in support from the university supervisor in pushing prospective teachers to gain experience with learner-responsive pedagogy also seemed to play a role in their development. Methods of assessment for prospective teachers also need to align with learner-responsive perspectives, as Aubrey wrestled with the conflict of a teacher as a facilitator but needed to demonstrate her ability to “teach” in a video of her classroom practice. Overall, it is the role of teacher preparation programs to find as many ways as possible to provide enough support to prospective teachers to allow them to develop learner-responsive beliefs and gain enactive mastery experiences with learner-responsive methods. These actual teaching experiences are the most influential in their overall belief and practice development and even though the current classroom context does not generally support learner-responsive pedagogical methods, it is possible for prospective teachers to have impactful experiences with consistent support.


Kuhs, T., & Ball, D. (1986). *Approaches to teaching mathematics: Mapping the domains of knowledge, skills, and dispositions*. East Lansing: Michigan State University, Center on Teacher Education.


Appendix A: Research Timeline
<table>
<thead>
<tr>
<th>Month</th>
<th>Research Task</th>
</tr>
</thead>
</table>
| Spring 2010   | • Prepare IRB application  
• Submit and receive IRB approval                                                                                                               |
| Summer 2010   | • Consent forms for general survey responses signed and secured  
• Initial survey and prompt data collection on the first day of summer methods course  
• Collect reflective writings from summer methods course  
• Second survey and prompt data collection on the last day of summer methods course  
• Preliminary analysis of survey responses and reflective writings from summer methods course  
• Purposeful participant selection for case study  
• Consent forms for case eight case study participants signed and secured                                                                 |
| Autumn 2010   | • Audio-record weekly small group meetings  
• Visit each participant in placement three times to conduct audio-recorded pre-/post-conference and observe classroom practice  
• Collect and provide feedback on formal and informal reflective writings and other lesson and experiential artifacts  
• Contribute to personal reflective writings  
• Member check with participants  
• Begin transcription and preliminary analysis of small group audio-recordings                                                                 |
| Winter 2011   | • Audio-record weekly small group meetings  
• Visit each participant in placement three times to conduct audio-recorded pre-/post-conference and observe classroom practice  
• Collect and provided feedback on formal and informal reflective writings and other lesson and experiential artifacts  
• Contribute to personal reflective writings  
• Member check with participants  
• Continue transcription and preliminary analysis of small group and pre-/post-conference audio-recordings                                                                 |

Table 11: Research Timeline
Table 11 continued

<table>
<thead>
<tr>
<th>Month</th>
<th>Research Task</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Spring 2011</strong></td>
<td>• Revise, submit, and receive IRB approval for continuation of research and analysis through June 2012</td>
</tr>
<tr>
<td></td>
<td>• Continue limited contact with participants through phone, email, and feedback on formal and informal reflective writings and other lesson and experiential artifacts</td>
</tr>
<tr>
<td></td>
<td>• Collect observation notes from peer supervisors observing participants’ classroom practice</td>
</tr>
<tr>
<td></td>
<td>• View participant classroom videos, take notes, and provide feedback</td>
</tr>
<tr>
<td></td>
<td>• Collect formal and informal reflective writings and other lesson and experiential artifacts</td>
</tr>
<tr>
<td></td>
<td>• Contribute to personal reflective writings</td>
</tr>
<tr>
<td></td>
<td>• Member check with participants</td>
</tr>
<tr>
<td></td>
<td>• Finish small group transcription</td>
</tr>
<tr>
<td></td>
<td>• Continue transcription and preliminary analysis of pre-/post-conference audio-recordings</td>
</tr>
<tr>
<td></td>
<td>• Final survey data collection</td>
</tr>
<tr>
<td></td>
<td>• Conduct and audio-tape final interviews</td>
</tr>
<tr>
<td><strong>Summer 2011</strong></td>
<td>• Purposeful selection of three cases to focus further analysis</td>
</tr>
<tr>
<td></td>
<td>• Proposal approved by Dissertation Committee</td>
</tr>
<tr>
<td></td>
<td>• Complete transcription and preliminary analysis of pre-/post-conference audio-recordings</td>
</tr>
<tr>
<td></td>
<td>• Code and develop themes for pre-/post-conference transcripts</td>
</tr>
<tr>
<td></td>
<td>• Complete transcription and preliminary analysis of final interviews</td>
</tr>
<tr>
<td></td>
<td>• Code for developed themes in final interview transcripts</td>
</tr>
<tr>
<td></td>
<td>• Code for developed themes in reflective writings</td>
</tr>
<tr>
<td></td>
<td>• Code for developed themes in small group transcripts</td>
</tr>
<tr>
<td></td>
<td>• Preliminary development of case studies</td>
</tr>
<tr>
<td><strong>Autumn 2011</strong></td>
<td>• Revision of case studies</td>
</tr>
<tr>
<td></td>
<td>• Write and revise Discussion and Implications</td>
</tr>
<tr>
<td><strong>Winter 2012</strong></td>
<td>• Defendable draft approved by Dissertation Committee</td>
</tr>
<tr>
<td></td>
<td>• Schedule Oral Defense for February 2012</td>
</tr>
</tbody>
</table>
Appendix B: Summer Methods Course Readings


Appendix C: Micro-teaching Rubric

Micro-Teaching Guidelines & Rubric
Due June 28

The purpose of this assignment is to assess your ability to plan a well-thought-out lesson focused on providing opportunities for meaningful learning and to provide you with an opportunity to teach a mathematical topic on a small scale.

Guidelines:
• you will be assigned one of 6 possible mathematical topics
  1. division of fractions
  2. cross multiplying (ratio/proportion)
  3. distributive property
  4. multiplication of multi-digit numbers
  5. addition/subtraction of fractions
  6. comparing fractions/decimals/percent
• you will develop a 10-minute lesson plan according to the microteaching template provided, consisting of
  1. lesson objective(s)
  2. learner prior knowledge
  3. teacher/learner actions
  4. materials
  5. methods of assessment(s) – summative does not have to happen within the 10 minutes
• Electronically submit the lesson plan and any accompanying documents in the appropriate dropbox before class on June 28

Method of assessment:

<table>
<thead>
<tr>
<th>Point Values</th>
<th>Components</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5</td>
<td>Objectives are included and measureable</td>
</tr>
<tr>
<td>2</td>
<td>Prior knowledge that students are expected to have in order for the lesson to be accessible are included and reasonable</td>
</tr>
<tr>
<td>3</td>
<td>Teacher and learner activities are thoroughly described</td>
</tr>
<tr>
<td>2</td>
<td>Materials necessary for instruction are listed and included</td>
</tr>
<tr>
<td>3</td>
<td>Methods of assessment are clearly described and measure the stated objective</td>
</tr>
<tr>
<td>2.5</td>
<td>Lesson is engaging and focused on methods of instruction that could lead to meaningful learning</td>
</tr>
</tbody>
</table>
Appendix D: Lesson Plan Rubric

Lesson Plans Guidelines & Rubric
Due July 7, 14, & 21

The purpose of this assignment is to assess your ability to plan lessons incorporating meaningful assessment items/tasks.

Guidelines:
• You will develop and turn in three lesson plans, one for each of the three full tutoring sessions occurring on July 2, July 9, and July 16.
• Each lesson plan should include the following:
  o Student Objectives (related to goals developed for case study)
  o Materials Needed
  o Student Activities & Rationale
    ▪ What specific problems or resources will you use and how will they provide evidence of learning in relation to the listed objectives?
    ▪ What questions could you ask to help your student delve into the problem(s) and think about the mathematical concepts at a deeper level?
    ▪ Make sure to include open- and closed-ended tasks.
    ▪ Make sure to address and explain any potential bias contained in problems or resources you are including.
  o Methods of Assessment
    ▪ Describe and explain how formative and summative assessment are included in the lesson. (e.g. which parts of the lesson lead to formative vs. summative assessment opportunities)
• Submit electronically every Wednesday following each tutoring session in the appropriate dropbox.

Method of assessment for each lesson plan:

<table>
<thead>
<tr>
<th>Point Values</th>
<th>Components</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>What is being assessed is clearly defined and measureable (objectives)</td>
</tr>
<tr>
<td>2</td>
<td>Items/tasks produce evidence of learning and explanation for how this is accomplished is provided</td>
</tr>
<tr>
<td>2</td>
<td>Both formative and summative assessment are included and explained</td>
</tr>
<tr>
<td>2</td>
<td>Potential bias in items/tasks is addressed and explained</td>
</tr>
<tr>
<td>2</td>
<td>The items/tasks are clearly stated</td>
</tr>
<tr>
<td>2</td>
<td>Open- and closed-ended items/tasks are included</td>
</tr>
</tbody>
</table>
Appendix E: Case Study Rubric

Case Study Guidelines & Rubric
Due July 7, 14, &/or 21

The purpose of this assignment is to assess your ability to purposefully and thoughtfully reflect on your experiences at the tutoring clinic.

Guidelines:

• You will develop and turn in two documents from two to three full tutoring sessions occurring on July 2, July 9, and/or July 16 (or other dates you have rescheduled).
• Each document should include the following:
  o Session Summary: This section should contain a brief overview of the session, setting the scene and stating any assumptions made at the outset of the tutoring session (e.g. how you anticipate your student to react to your planned activities). Important aspects to note are the attitude of the student or yourself.
  o Problem Identification and Analysis: This section should include an analysis of how you are making meaning of the case. Some questions to consider are ‘What particular issues will you take into consideration while tutoring your student?’ “What is the primary or central focus of the session?” and ‘Why do you see this as the primary focus?”
  o Goal Setting: This section should contain realistic goals to match each identified problem. Each goal should be accompanied by a brief explanation of why the goal was chosen.
  o Potential Pitfalls: This section should include at least two obstacles that your student may face while implementing the planned student activities (listed in your lesson plan) and further suggest ways to overcome these obstacles.
  o Reflection: This section should contain your thoughts on the tutoring session. Answers to the following should be included:
     ▪ In what ways did your student demonstrate mastery?
     ▪ What would you change about your approach or the resources used during the session?
     ▪ A brief overview of your plan for your next session.
• In addition to the above requirements, one of the two case study documents must include an additional reflective piece developed in the following manner:
  o Audio-record one full tutoring session.
  o Transcribe 5-10 minutes of the session that includes a significant amount of back and forth between you and your student (ideally you would be asking questions). This transcription should be included in what you turn in.
  o Reflect on this transcription by considering the following:
     ▪ What type of thinking did your questions focus on? (e.g. use Bloom’s Taxonomy)
     ▪ What level of thinking did your student demonstrate in response to your questions?
     ▪ What would you change? What would you do the same? Why?
• Include copies of student work when appropriate
• Submit electronically the appropriate Wednesday following each tutoring session in the appropriate dropbox.

Method of assessment for the entire case study:

<table>
<thead>
<tr>
<th>Point Values</th>
<th>Components</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Each element of the case study is included and thoughtfully completed</td>
</tr>
<tr>
<td>2</td>
<td>The case is well written</td>
</tr>
<tr>
<td>3</td>
<td>One 5-10 minute transcript is included</td>
</tr>
<tr>
<td>5</td>
<td>Reflection on the transcript is included and thoughtfully completed</td>
</tr>
</tbody>
</table>
## Mathematics Beliefs Scale

Directions: This questionnaire is designed to help us gain a better understanding of the way you think about teaching mathematics. Please indicate your opinion about each of the statements below. Your answers are confidential.

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Teachers should encourage children to find their own solutions to math problems even if they are inefficient.</td>
<td>(1) Strongly Disagree</td>
<td>(2) Disagree</td>
<td>(3) Slightly Disagree</td>
<td>(4) Slightly Agree</td>
<td>(5) Agree</td>
</tr>
<tr>
<td>2. Time should be spent solving simple word problems before children spend much time practicing computational procedures.</td>
<td>(1) Strongly Disagree</td>
<td>(2) Disagree</td>
<td>(3) Slightly Disagree</td>
<td>(4) Slightly Agree</td>
<td>(5) Agree</td>
</tr>
<tr>
<td>3. Teachers should teach exact procedures for solving word problems.</td>
<td>(1) Strongly Disagree</td>
<td>(2) Disagree</td>
<td>(3) Slightly Disagree</td>
<td>(4) Slightly Agree</td>
<td>(5) Agree</td>
</tr>
<tr>
<td>4. The use of key words is an effective way for children to solve word problems.</td>
<td>(1) Strongly Disagree</td>
<td>(2) Disagree</td>
<td>(3) Slightly Disagree</td>
<td>(4) Slightly Agree</td>
<td>(5) Agree</td>
</tr>
<tr>
<td>5. Mathematics should be presented to children in such a way that they can discover relationships for themselves.</td>
<td>(1) Strongly Disagree</td>
<td>(2) Disagree</td>
<td>(3) Slightly Disagree</td>
<td>(4) Slightly Agree</td>
<td>(5) Agree</td>
</tr>
<tr>
<td>6. Even children who have not learned basic facts can have effective methods for solving problems.</td>
<td>(1) Strongly Disagree</td>
<td>(2) Disagree</td>
<td>(3) Slightly Disagree</td>
<td>(4) Slightly Agree</td>
<td>(5) Agree</td>
</tr>
<tr>
<td>7. An effective teacher demonstrates the right way to do a word problem.</td>
<td>(1) Strongly Disagree</td>
<td>(2) Disagree</td>
<td>(3) Slightly Disagree</td>
<td>(4) Slightly Agree</td>
<td>(5) Agree</td>
</tr>
<tr>
<td>8. Most children have to be shown how to solve simple word problems.</td>
<td>(1) Strongly Disagree</td>
<td>(2) Disagree</td>
<td>(3) Slightly Disagree</td>
<td>(4) Slightly Agree</td>
<td>(5) Agree</td>
</tr>
<tr>
<td>9. Children’s written answers to paper-and-pencil mathematical problems indicate their level of understanding.</td>
<td>(1) Strongly Disagree</td>
<td>(2) Disagree</td>
<td>(3) Slightly Disagree</td>
<td>(4) Slightly Agree</td>
<td>(5) Agree</td>
</tr>
<tr>
<td>10. The best way to teach problem solving is to show children how to solve one kind of problem at a time.</td>
<td>(1) Strongly Disagree</td>
<td>(2) Disagree</td>
<td>(3) Slightly Disagree</td>
<td>(4) Slightly Agree</td>
<td>(5) Agree</td>
</tr>
<tr>
<td>11. Teachers should allow children who are having difficulty solving a word problem to continue to try to find a solution.</td>
<td>(1) Strongly Disagree</td>
<td>(2) Disagree</td>
<td>(3) Slightly Disagree</td>
<td>(4) Slightly Agree</td>
<td>(5) Agree</td>
</tr>
<tr>
<td>12. Children will not understand an operation (addition, subtraction, multiplication, or division) until they have mastered some of the relevant number facts.</td>
<td>(1) Strongly Disagree</td>
<td>(2) Disagree</td>
<td>(3) Slightly Disagree</td>
<td>(4) Slightly Agree</td>
<td>(5) Agree</td>
</tr>
<tr>
<td>13. Children should understand computational procedures before they master them.</td>
<td>(1) Strongly Disagree</td>
<td>(2) Disagree</td>
<td>(3) Slightly Disagree</td>
<td>(4) Slightly Agree</td>
<td>(5) Agree</td>
</tr>
<tr>
<td>14. Children learn math best by attending to the teacher’s explanations.</td>
<td>(1) Strongly Disagree</td>
<td>(2) Disagree</td>
<td>(3) Slightly Disagree</td>
<td>(4) Slightly Agree</td>
<td>(5) Agree</td>
</tr>
<tr>
<td>15. Time should be spent practicing computational procedures before children are expected to understand the procedures.</td>
<td>(1) Strongly Disagree</td>
<td>(2) Disagree</td>
<td>(3) Slightly Disagree</td>
<td>(4) Slightly Agree</td>
<td>(5) Agree</td>
</tr>
<tr>
<td>16. The goals of instruction in mathematics are best achieved when students find their own methods for solving problems.</td>
<td>(1) Strongly Disagree</td>
<td>(2) Disagree</td>
<td>(3) Slightly Disagree</td>
<td>(4) Slightly Agree</td>
<td>(5) Agree</td>
</tr>
</tbody>
</table>

Figure 18: Mathematics Beliefs Scale
Directions: This questionnaire is designed to help us gain a better understanding of the way you think about teaching mathematics. Please indicate your opinion about each of the statements below. Your answers are confidential.

<table>
<thead>
<tr>
<th></th>
<th>How much do you agree?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Strongly Disagree</td>
</tr>
<tr>
<td>17. Allowing children to discuss their thinking helps them to make sense of mathematics.</td>
<td>(1)</td>
</tr>
<tr>
<td>18. Recall of number facts should precede the development of an understanding of the related operation (addition, subtraction, multiplication, or division).</td>
<td>(1)</td>
</tr>
<tr>
<td>19. Teachers should tell children who are having difficulty solving a word problem how to solve the problem.</td>
<td>(1)</td>
</tr>
<tr>
<td>20. Most children can figure out a way to solve many mathematics problems without adult help.</td>
<td>(1)</td>
</tr>
<tr>
<td>21. Teachers should allow children to figure out their own ways to solve simple word problems.</td>
<td>(1)</td>
</tr>
<tr>
<td>22. Children should not solve simple word problems until they have mastered some number facts.</td>
<td>(1)</td>
</tr>
<tr>
<td>23. Children’s explanations of their solutions to problems are good indicators of their mathematics learning.</td>
<td>(1)</td>
</tr>
<tr>
<td>24. Time should be spent practicing computational procedures before children spend much time solving problems.</td>
<td>(1)</td>
</tr>
<tr>
<td>25. It is important for a child to know how to follow directions to be a good problem solver.</td>
<td>(1)</td>
</tr>
<tr>
<td>26. To be successful in mathematics, a child must be a good listener.</td>
<td>(1)</td>
</tr>
<tr>
<td>27. Children need explicit instruction on how to solve word problems.</td>
<td>(1)</td>
</tr>
<tr>
<td>28. Children should master computational procedures before they are expected to understand how those procedures work.</td>
<td>(1)</td>
</tr>
<tr>
<td>29. Children learn mathematics best from teachers’ demonstrations and explanations</td>
<td>(1)</td>
</tr>
</tbody>
</table>
Appendix G: Sample Small Group Agenda

Small Group Agenda 10/1/2010

❖ Five sailors survive a shipwreck and swim to a tiny island where there is nothing but a coconut tree and a monkey. The sailors gather all the coconuts and put them in a big pile under the tree. Exhausted, they agree to go to wait until the next morning to divide up the coconuts.

At one o'clock in the morning, the first sailor wakes up. He realizes that he can't trust the others, and decides to take his share now. He divides the coconuts into five equal piles, but there is one coconut left over. He gives that coconut to the monkey, hides his coconuts (one of the five piles), and puts the rest of the coconuts (the other four piles) back under the tree.

At two o'clock, the second sailor wakes up. Not realizing that the first sailor has already taken his share, he too divides the coconuts up into five piles, leaving one coconut over which he gives to the monkey. He then hides his share (one of the five piles), and puts the remainder (the other four piles) back under the tree. At three, four, and five o'clock in the morning, the third, fourth, and fifth sailors each wake up and carry out the same actions. In the morning, all the sailors wake up, and try to look innocent. No one makes a remark about the diminished pile of coconuts, and no one decides to be honest and admit that they've already taken their share. Instead, they divide the pile up into five piles, for the sixth time, and find that there is yet again one coconut left over, which they give to the monkey.

The Question: What is the smallest amount of coconuts that there could have been in the original pile?

❖ Share solution strategies, encourage trying to solve without formal algebra
❖ How could you use this or something like this in the classroom

❖ Quarter Goals
❖ What is one thing you want to focus on, maybe in your first lesson, maybe in an observation?

❖ Lesson plan expectations and checklist
❖ Discussion about detailed lesson plans and “reality” – what can you get out of spending so much time on detailed lessons this year?
❖ Discussion about components
❖ My personal expectations

❖ Lesson to Focus on Student Thinking
❖ This quarter is a lesson in how students learn. What could be better to learn as a teacher?
❖ Research shows the methods you are learning about work (and work well) – your job is to begin to figure out how to get them to work in the classroom.
Grade is NOT determined on how well you succeed with these methods – but can be affected by not making a good faith effort to implement these methods.

Practice on being silent/listening! Pose a problem, write down what you have to keep yourself from saying. Should be practically the entire class period.

Evidence Tracker

“I am going to focus on learning about what and how you are thinking. Why would it be important for me to know more about what you are thinking?”

Proactive classroom management.

Aim for this lesson to be one of your horizontal 3, you should start looking/thinking of ideas for this lesson now and bringing them to small group.

Required Activities and assignments

- Lesson in silence activity
- Focus on student thinking
  - Focus on only asking questions. Not guided questions, not telling, not teaching – you are focusing on what your students are thinking. Not the whole class – but each student. (CGI)

Reflection article and/or reflection discussion

Due dates

- “Experience” Reflection due next Tuesday
- Horizontal/vertical reflection is due 2 days after lessons are taught
- Make sure you bring your DVD for the session on 10/23
  - Record first or second lesson!

When are you teaching first lesson?

- If you know – post to discussion board, should have a good idea by the end of next week and start planning a lesson
- Think about when you are going to teach. It helps me plan, and that is important!

Discussion board

- How should we use it?
- Pressing Questions, small group topics, general information.

Scheduling Observations
Appendix H: Pre-/Post-Conference Protocol

The following questions will be used to help guide discussions with subjects during pre-lesson interviews.

- How have you planned to uncover student thinking in this lesson?
  - You have a plan for uncovering student thinking, how have you planned to use the feedback you receive from your students?
- What mathematical concepts do you see as being related to the concepts you are teaching in today’s lesson? Why?
  - How do these relationships help you plan a lesson to teach these concepts?
- What type of learning environment are you trying to build in your classroom? How does this lesson support your view?
- What types of questions do you feel it is appropriate for you to answer for the students? What makes you feel this way?
- How do you intend to bring closure to the lesson?
- Will you foreshadow the concepts you will teach in your next lesson? Why or why not?
- What content & process standards are involved in today’s lesson?

The following questions will be used to help guide discussions with subjects during pre-lesson interviews.

- How do you think the enacted lesson compared to your intended lesson?
- What challenges did you experience in the lesson you just taught?
- What evidence of learning do you have?
- Do the students understand the concept you were teaching today? How do you know?
- Do you feel you met your objective for the class? Why or why not?
- What would you change about the lesson? Why?
- What would you keep the same about the lesson? Why?
- How could you use what you learned about your students today to help plan future lessons?
Appendix I: Final Interview Protocol

Interview Questions:

1. How do you think people learn mathematics?
2. Is this reflected in your teaching methods? If not, why? If so, how?
3. What do you see as impacting your perspective the most? Can you think of specific methods course experiences? Can you think of specific supervisor impact? Can you think of specific mentor impact?
4. Have your beliefs about teaching and learning in mathematics changed and where/when do you think your beliefs were challenged?
5. What do you think constructivism is, student-centered means?
6. Are you going to be a student-centered teacher in your own classroom? If not, why? If so, what factors do you see enabling or inhibiting you from doing this/accomplishing this?
7. Specific questions based on responses to writing prompts and surveys, etc.
8. Share research questions. Do you have anything you’d like to add in consideration of these questions?
9. I plan to use pseudonyms to share any of this research. Would you like to pick a name for yourself that could be used instead of your real name?
Appendix J: Raw Data From Jacob

It’s funny I’ve never, until sophomore year of college ever even imagined teaching. I don’t have any, my family’s all farmers, my dad’s a landscaper, and I was in, I always excelled more so, I’m an average student I would say, but I was always better at math and so I was in engineering, just mechanical engineering and I think halfway through my sophomore year I got, I was the guy, I was pretty much in it for money because that was, my high school guidance counselor’s like, oh you want to make a lot of money, alright, be an engineer, cool. And so I started thinking about what, what to switch to and, teaching popped to my mind and I was like, that is the dumbest thing, there’s no way I’ll ever be that and then the more I thought about it, it just stuck and yeah, definitely, working with high schoolers, is, I would say a passion of mine just the influence that you can bring and make on people’s lives and stuff for the positive (10222010, small group, lines 200-211)

Figure 19: Jacob, 10222010, small group, lines 200-211 (J.1)

One element of [my mentor’s] class that I especially like is how he creates a competitive atmosphere. In the first days of class, they formed groups and made team names with (most often) one or two of their friends. Coming back 4 weeks later, I saw that his strategy is working. When I asked a student who was on top of the ‘leader board’, they sadly pointed to a nearby group. The group in first place heard our discussion and smiled proudly at the acknowledgement that they were in beating everyone. Here are some of the reasons why I like this competition so much:

- It puts the kids in groups and allows them to work together. Students must be able to do this in the real world. Those that cannot work with others are at a serious disadvantage.
- Peers become resources (theoretically). I noticed on the last day of the competition where they had to work through a handout of equations they had to simplify, when they were supposed to be working together, they more often just worked independently and then gave each other the answers if they were correct. If either this competition was structured differently or a heavier emphasis was placed on the importance of helping out your classmates learn then I feel that this specific competition would have been much more successful.
- The competitive students in the class quickly become attentive to the material and usually the rest of the class follows.
- The kids enjoy it. Multiple students have popped their heads into [my mentor’s] class and asked, “Are we having a competition today??” I understand that those that are not having fun probably are not speaking up, but from what I have seen so far, there have only been positive reactions.

Figure 20: Jacob, 09272010, experience reflection (J.2)
On the other hand, according to Jo Boaler, the competitive nature of males actually puts young females at a major disadvantage in the math classroom. According to her research, girls choose “understanding” as the most important aspect of learning mathematics while boys more often choose “memorization of rules” as the most important (Boaler, 2008). Ironically, a team of girls is currently on the top of the leader board in [my mentor’s] classroom. To offset this male tendency to be the fastest or furthest ahead, [my mentor’s] competitions could instead be centered around understanding. This sounds great, but how can depth of understanding be quantified and objectively judged? The best I can think of would deal with short answer questions but this would have to be judged overnight because they would take forever to go through.

Figure 21: Jacob, 09272010, experience reflection (J.3)

I think one of my major errors for this lesson was that I did not know the students’ ability level with regard to constructing algebraic equations. At first, I anticipated to just have them compute/ solve equations since they do this every other day and are good at it. When I revised the lesson plan to have more student interaction and higher levels of thinking, I did so by trying to get them to analyze, discern, and ultimately create their own algebraic equations from a given scenario. I did not take into consideration that maybe they are not used to this process and that they could not perform it to the expectations that I had mentally set for them.

The lesson plan itself did not model what I put such an emphasis on in the discussion. I emphasized how conceptual understanding was more important than algorithmic solving and then we spent 10 minutes algorithmically working through four equations as a class. I wonder how many students picked up on this. For the discussion, I would like to have the same purpose of trying to motivate them to think deeper in mathematics and to understand and not just do. I think the amount and quality of questions I had to begin with were good, but I needed to ask follow up questions to their responses to get them thinking a little more.

We could slowly work towards harder problems. I definitely would like to challenge them with difficult problems, but asking them to come up with the equation for the coconut problem was completely unrealistic for this being their first experience with creating equations. My expectations were too high for these students.

Figure 22: Jacob, 10062010, vertical 2 reflection (J.4)

I was amazed to see that the majority of the students only wanted to get the answer. In a certain situations, when I would ask a question in response to their question, they would continue to think and would usually catch their problem. When I gave a yes or no answer and then tried to explain, they almost immediately toned me out once I gave them the answer they wanted.

Figure 23: Jacob, 10192010, lesson reflection (J.5)

I feel like it was good, I feel like they struggled through the whole concept of function which they don’t seem to be too, from his explanation they don’t seem to be that great with, they haven’t really covered it that much, it’s kinda like an abstract weird thing right now to them, so I think it’s good, I feel like we might have broken some ground.

Figure 24: Jacob, 10282010 post-conference, lines 756-760 (J.6)
This one was much more streamlined, it was, I want to say basic, I feel like, intro, concept, talk about the concept, here’s the worksheet, work it out, and I like that but, I like the fact that it not only knocked out the objective but it kinda shook deeper foundations, it dealt with concepts more so, I don’t think I accomplished anything last time

Figure 25: Jacob, 10282010 post-conference, lines 903-906 (J.7)

The part I liked most about this lesson was the richness of the worksheet that was worked on. The entire purpose of that day was to make sure that every student could successful graph points on a coordinate plane. Since my pre-assessment showed that nearly every student could do this before the lesson, it allowed us to focus on the deeper concept of functions throughout the period.

If I were to teach this lesson again, I would have changed many elements to my plan of teaching. In the beginning, I feel that my setting up the worksheet was done very poorly. Specifically, I would have liked to ask the students, “How would you use the coordinate system to solve this?” Instead, I started plotting points on the graph without properly introducing why. By the time I got to passing out the materials, I had done the initial problem, but I am not sure how many of the students knew what they were doing. Instead of me jumping up to the smart board, I should have sat back and let one of the students graph the points while I asked questions about functions in preparation for the rest of the worksheet.

One measure that could have been taken prior to teaching this lesson would be to talk about the lesson in depth with my mentor. It seems that knowing your students and their ability to process different concepts is a key factor in preparing a lesson. I feel like each lesson must be customized to a small degree for each class since each is different. For my next lesson, I would like to come up with all the discussion questions that I can, have my mentor teacher sit down as a student, and then run through the lesson. This would first off give me practice in dealing with the information on the fly and also it would provide me with some more accurate information of how the students will respond. Since I have not been working with these students nearly as long or as closely as my mentor, I see him as the linking piece to successfully anticipating the students’ actions and responses.

I call your attention to the part of the lesson from 21:00 (21 minutes and 0 seconds) to 23:15. I am pleased with the depth of the questions that I begin asking the students, namely, “What were you thinking?” and “What is this question asking?” I am much more concerned with their thought process than the answer that they got for the problem. I feel that this segment illustrates my desire for the students to have deep conceptual knowledge while demonstrating my ability to get on their level and reason through problems with them. (10282010, self-critique 1)

Figure 26: Jacob, 10282010, self-critique 1 (J.8)
Once no one else wanted to volunteer, I jumped straight into lecture mode. I found that in this lesson, I was able to give better clarity to the activity I wanted them to do. One thing that [my mentor] and I have begun doing differently is that I have been able to run through the lesson with him. This has helped me to not only run through the lesson, but also to get feedback from him as to what the students would say in that situation. Originally this activity was much more abstract and required the student to almost build the process up from nothing. By running through this activity with [my mentor] he was able to suggest giving it more structure by creating a physical worksheet for them to work with. Students were able to successfully do the activity.

The second group that volunteered was a brighter group. They thought of a full-proof method, but they messed it up because of a small error. After this, I was surprised to see that no one else wanted to volunteer. I am not sure if they were bored or they lost hope because the ‘smart’ group failed, but something changed. One regret I do have in response to their error is that I did not emphasize enough how good their method was and their thought process behind it.

If I were to re-teach this lesson again, I would change the style in which I lectured the material for the standard form. In the initial introduction of the equation, my description of the equation itself was not clear. For my transition, I got them produce different linear equations they had seen, but I did not use that as a spring board into the standard form. A good way of doing this could have been to look at the slope-intercept form that kept coming up and say, “Here we have y by itself, x with a constant, and then a constant by itself.” Then we could have looked at another equation, drawing out the variables and their respective coefficients if any and then moved to the standard form. Even better, I could have started with the slope intercept form, moved the x value over to the other side of the equal sign, and then just introduced it then. Past the introduction, it seems that the students need much better guided notes than what I provided. I do not really like this since I feel like their learning becomes heavily scaffold, but [my mentor] already has them at this place.

I call your attention to the part of the lesson from 11:45 (11 minutes and 45 seconds) to 25:45. This is my introductory or ‘hook’ activity that challenges the students’ current ability (or inability) to draw lines precisely. The hook is abstract and requires the students to think in a manner different than they are used to and it this is one of the reasons it is so difficult to get the students on the right track. I am able to easily show a contradiction in their initial explanations simply by drawing the line they described. This makes the students aware and challenges them to think of a method that would make copying a line much more accurate. The focus of this activity is on the method and their thought process behind it. Within this is room for the students to use their creativity and express their knowledge in ways outside of the traditional classroom. (11022010, self-critique 2)

Figure 27: Jacob, 11022010, self-critique 2 (J.9)

I kinda did a lecture, and for today I have more structured notes for them to go through whereas yesterday I just had the gizmo up, and I was able to, explain using that but then I didn’t really have anything for them, I had questions for them to go through but I didn’t have any like here’s notes, here’s this and so this is kinda more so the way they go about it, so it has the equation on it, it has examples, things we can go through, these are the problem examples and we’ll go through that in coordinate form, we’re not necessarily gonna give them the function or the equation, we’ll just go with the relationship of rise over run, so what determines the rise, the y-coordinates.

Figure 28: Jacob, 11032010 pre-conference, lines 1041-1049 (J.10)
Yeah it’s just I feel like the lecture times are so dry and boring
I’m thinking of the notes part, cause I just think of how grueling that was, I, getting them, I guess I’ll be
looking more when I’m observing I’ll be watching him more intently on doing those notes parts because
he’s able to, he does a great job at, doing the problem, engaging the students with that problem initially and
then the kids will come up to the board and he’ll hang back in the class and just different things like that so,
I guess being more attentive and just trying to follow that a little bit better.

Figure 29: Jacob, 11032010 post-conference, lines 1150, 1174-1179 (J.11)

When I have a class of my own, this is an issue that is worth being intentional about. Should I as a teacher
spoon feed the material to the students or should I give them an opportunity to figure out how they digest
information personally and then allow them to practice that throughout the year? I feel the latter is not only
much more beneficial for the students in the long run, but it also is easier on the teacher in that they do not
have to produce guided notes. In order to check up on the students and make sure they are not completely
lost, it might be wise to check their notebooks periodically and maybe even give them a grade. I would
consider this important enough to be worthy of a grade.

Figure 30: Jacob, 11032010, horizontal 2 reflection (J.12)

I am a very systems-oriented person. In the way I structure my life and perform my daily routines, each
element has a small system or method. For example, I rarely loose things because when I walk in the door,
I put my keys on a hook in the entry way, put my backpack down on my desk, and then put everything else
away as I can get to it. I say all this to point out that I do not yet have a system for teaching. I have yet to be
able to break a lesson down to small enough chunks that I can have just the right questions to ask when the
timing is appropriate. Possibly having an outline on the board would be helpful to reference throughout the
class. Given enough time and experience, one will come to me. I just have to be patient in the mean time.

Figure 31: Jacob, 11042010, blog post (J.13)

But even 20 years into it, with all that experience and with I mean hopefully some analysis showing that
yes I can do this successfully, should we still have the attitude of, hey I may not be the best at this or hey I
may not, I mean I feel like at the foundation of our teaching philosophy or life there should be this humility
of, hey if someone else has got a better method, am I open to that and am I willing to try things out, yeah,
am I willing to be open for the sake of my teaching, for the sake of the student, I mean, who am I to say
that I’ve got everything figured and I feel like that’s arrogant claim to be like, my method’s the best way,
what? Who the heck are you? So I don’t know.

Figure 32: Jacob, 11052010, small group, lines 449-456 (J.14)

I did the notecards where they all wrote feedback on it and I was surprised at how well they cued in on me
being nervous and just being confident in front of that many students all at once, just, I’m thinking in
particular when I go to the board I just try to write as fast as I could so we could move on with the rest of,
and then so I make stupid errors and I just, I get flustered easily so I’m curious to, I’m excited to I guess
nail that down and get better with that, so the feedback was extremely helpful.

Figure 33: Jacob, 12032010, small group, lines 115-131 (J.15)
The most commented area dealt with my clarity of speech/ explaining things and my general nervousness in front of the class. In general, my goals for teaching will be to have a more relaxed teaching approach and be more thorough when planning discussions (consider possible tangents, struggling points, or points to emphasize while acknowledging that anything can come up). Another goal would be to continue operating in my strength of using creative lessons and discussions, and making a safe environment for students to express their thoughts.

Figure 34: Jacob, 12282010, blog post (J.16)

I think my main fear/weakness is that when I get in front of so many people, I easily lose my train of thought. Once I lose my train of thought, then I can’t follow or answer a student’s question, and then I get self-conscious about the entire class thinking I’m an idiot. From here, it’s a downward spiral where I just get more and more nervous and then I begin fumbling around, sweating more, etc. I think naturally, I have a slower pace when it comes to thinking and speaking in technical terminology, but when I get in front of a class, my extraverted social side comes out and I begin bouncing off the walls. Trying to balance these two sides of the same coin (me) will be interesting to see how it plays out.

Figure 35: Jacob, 01172011, blog post (J.17)
For the first lesson taught with this class, I feel pretty good about how well it went overall. The students are great, they performed the activity well and in a timely manner, they were engaging in the discussion time, and they were not disruptive throughout the class. I think that if I did not know everyone’s name, this class would have turned out significantly different strictly because of my confidence. This possibly lies in my ability to address any conflict personally and accurately by calling on the specific person.

My questioning throughout this lesson also needs some improvement. I planned well to summarize the radian activity by asking the question, “If everyone had a different sized circle, how were all of the radian measures the same?” Some variation of this question was on the smart board and the majority of the students were paying attention when I verbally asked this to the class, but a good answer was not produced. This would have been a great time to have the students talk to their table partner and dialogue about this for a few moments since this was such an intricate question. Instead, I gave a couple of seconds of wait-time and fumbled through an answer after hearing crickets.

Also, looking at this same question being posed to the class, this would have been a great opportunity to informally collect evidence of student learning. So often, an activity is done by a class as an introduction to a unit or in exploration of a specified content, but the class moves on so quickly afterwards that the intent of the activity was lost. Having the students take a moment to stop, reflect on the activity and talk with a partner nearby as mentioned above would have been helpful not only to their own learning, but it would have given me an opportunity to walk around and listen in on their conversations. The opportunity for this summative informal assessment of the activity was missed, but I am assured that some learning occurred by the fact that (the student on the left in a light red hooded-sweatshirt) spoke up and gave a partially correct answer. After correcting his minor error, I moved on to another topic but [my mentor] made me aware after class that [this student] never speaks up in class. She was surprised at his relatively high level of participation during this lesson.

Please note the part of the lesson from 13:00 (13 minutes and 0 seconds) to 17:00. This is an initial formative discussion to see where the students are in their knowledge of circles. I am pleased with this clip because of how well it worked. Since this was their first interaction with me teaching their class, I was hesitant to begin with a discussion, but it worked out well. Possibly they were more comfortable with me since they knew that I cared enough to learn all their names (see the first 13 minutes of the DVD). The students were knowledgeable and willingly volunteered an abundance of information. I feel that I was able to facilitate this discussion effectively while I collected all the information they gave on the smart board in a comprehensive format. This clip shows my value of class discussion, equal participation of students, and effective formative assessment.

Figure 36: Jacob, 02022011, self-critique (J.18)

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**Planning:** Anticipate long, difficult questions, that will take a long time to go through. *If there is enough time*, have the students discuss the problems in detail. Otherwise, if I only have a 10 minute window to address the questions, I need to fly through them. This also means that I need to be fluent with the material. Practicing the problems and knowing the answers (have teacher’s edition on hand) are helpful to this.

**Discussion questions vs. getting information from students:** Where is the balance? When there is limited time, how do you keep the audience captive by addressing their input without only looking for a specific detail?

**Adjusting:** having the perspective to set the exit ticket aside and press on with content should come with experience. (01202011, lesson reflection)

Figure 37: Jacob, 01202011, lesson reflection (J.19)
Today I taught on 4.2 the unit circle which went well. The content that we covered today was intended for last Thursday and they should be familiar with it to some degree so I’m not worried about their understanding it. I used the hooks and post assessment on Thursday, so today was pretty much notes but the students seemed pretty interested throughout the class. There were a couple of times where I was able add some energy to the class by starting up a round of applause for someone that came up to the board, etc.

Figure 38: Jacob, 01242011, lesson reflection (J.20)

The review activity went great. Students were willing to go to the front and did a great job of explaining the concepts in a different way. [One] corner group was still hesitant to come up and present. I had to almost push them all up. From what I’ve heard of the way they interact with each other, they are very judgmental of their group and everyone else. This could link to their hypersensitivity to being in front of others. I was caught off guard by how quickly the students went through the problems and I was not quite prepared with good questions to ask them. After a couple groups went up, I was able to recover and ask some good questions. Looking back, I was glad that I did not drill them with difficult questions initially since they were just getting comfortable with being in front of the class. I feel that it was a casual, relaxed first day of the class discussing problems together. I hope for many more to come.

Figure 39: Jacob, 01312011, lesson reflection (J.21)

Yeah, so I mean there’s, I think there’s enough room in the next couple days to touch up what we messed up today I guess, I mean just, things that are unclear I guess still, but I mean I feel like it’s not necessarily, I just feel like time’s the, I just feel like if we had more time, I mean that’s always gonna be the issue if we, I mean if things didn’t get pushed back, if I would’ve had a full day, because all the translations and stuff I was intending to do Friday, and so they would have a weekend to work with them, like solidify over the weekend come in and I was going, I had it all set up to like reference back to what we talked about, talked about the translations again, use the sliders and, me being behind plus it getting, yeah, so I’m pretty much a day and a half behind where I was at least.

Figure 40: Jacob, 02072011 post-conference, lines 1716-1723 (J.22)

Today was the first day where I really thought I completely mislead students. As stated above, I’ve been playing catch up to [my mentor’s] other honors classes. This has resulted today with me going through examples at the board. These are somewhat difficult concepts that would take a good amount of additional time to explain, but since there is none, this has gotten pushed back to after the quiz. After giving these topics some time in class and letting them work it out on their own, it might be beneficial to give them an exit ticket to check their understanding of these factors.

Figure 41: Jacob, 02062011, lesson reflection (J.23)
Today I conformed to some degree to [my mentor’s] teaching style in order to get through the content for today. I am somewhat torn with this approach since I feel like it opposes this picture I have in my mind of having a class full of students willing to share their ideas, misconceptions, and openly working through complex problems while politely correcting and informing each other. I still believe this is possible, but not in the time frame that I have to work with in this placement. My hope is to get them as involved as much as possible (not necessarily getting up physically and discussing mathematical concepts thoroughly) but I have yet to figure out how this looks exactly. Thoughts would be to give flash assessments with colored note cards, letters, or with clickers. The issue with this is the ever-decreasing time element. Creating multiple choice questions whose answers are reflective of the various misconceptions to that concept takes time both to research the topic and discover the misconceptions, and also to create answers that reflect those misconceptions. I would like to have my students do a project before I leave about creating concept maps, but this will also take a considerable amount of time to create the directions sheet, a rubric, and some models.

Figure 42: Jacob, 02102011, lesson reflection (J.24)

Walking into [winter placement], I had this vision of how teaching would be conducted that was very similar to the introductory to Joan Boaler’s book “What’s Math Got to Do With It?” The picture that is painted here is of a classroom that is a completely open environment. Students are up at the board confidently working through difficult problems. The teacher is able to stand back and give direction while challenging and encouraging the students. On top of this idealistic vision, we have been learning how to teach constructivist, inquiry-based lessons that involve activities, manipulatives, and hands-on learning. After being immersed in this culture of teaching, I arrived at [winter placement]. [My mentor] structures her classroom in much more of the traditional way. At first glance, I looked down my constructivist nose at this style and thought that I was going to change the entire dynamic of the room the moment I began teaching. With no consideration of how quickly this change would occur, I thought that students would instantaneously shift gears into precisely where I wanted them. When I began teaching, I was somewhat thrown off at first when I got my first taste of students pushing back against my dream for them. I asked a couple of students to come up to the board to discuss their answers and they actually told me, “no”. They seemed scared to go up in front of their peers. They seemed scared to be wrong. What is going on?!

My naïve perception that students would immediately conform to the ideals that I value was pretty unrealistic. I realized this about the same time that I began falling behind [my mentor’s] other classes because I was basing the lessons too heavily on discussion. Necessity regarding pacing, prior tendencies of [my mentor’s] teaching, and the conditioning of the students all push me to teach traditionally. Getting through the material in an efficient and timely manner is the emphasis and not the depth of understanding. Grad school has prepared us for this fact, but now we get to face this conflict head on. When we begin teaching professionally, how are we going to fit all the intended content into the year, but still achieve a depth of understanding so that what is learned is actually beneficial to the students and their lives? I feel that this question answers why traditional teaching looks like it does. The former is emphasized, but the latter gets pushed to the side out of lack of necessity. How are we to maintain the constructivist intentions of this program as we jump into an environment that opposes the majority of these values? I think finding and working with experienced teachers that share these standards of teaching would be a good place to start. Perseverance through years of teaching is another major factor. The first year of teaching may look more traditional, but will there ever be a push away from this? This is determined by the teacher…

Figure 43: Jacob, 02102011, reflection on teaching (J.25)
Inverse Trig Fxns Lesson: The epitome of today’s lesson was when a relatively good student raised her hand and said, “I have no clue what’s going on...” My response to this was basically that I was sorry, I gave her some options as resources to consult, and I had to keep moving due to the amount of notes for the day. This would have been a good time to step back, ask her what exactly she did not understand, and then probe around from there. This time restriction is killing my teaching. I said something after teaching about how today could have easily been a two-day concept to cover in class. She agreed but added that to students, every concept would require a two-day lesson. Finding this balance of pressing into the difficult, and then quickly getting through the easy is an issue that takes teaching experience and constant intentionality.

Figure 44: Jacob, 02112011, lesson reflection (J.26)

Today’s class period actually turned out great. Looking back, I am annoyed at how conditioned the students are to sit back and watch someone go through examples. They are completely comfortable sitting in their seats and saying as little as possible while the teacher rambles on. I walked them through many of the examples and we did get a lot done, but they did not get much interaction directly with the material. One element that I have noticed is that students have become more willing to say incorrect answers. Usually I follow up with the importance of questioning their assumptions and thanking them for their question. Students seem to be much more comfortable with me and each other than before.

Figure 45: Jacob, 02232011, lesson reflection (J.27)

I’m amazed at the resistance that I’ve seen from the students when I try pushing for a student-centered classroom. I guess these students have succeeded in a teacher-centered classroom all this time and [my mentor] has reinforced this even more. I authentically agree that student-centered learning is significantly better but am surprised at how difficult it will be. It seems that the majority of current teachers are fixed in the traditional mindset and the students follow suit. Those that perform well in this environment are labeled as successful students and are therefore hesitant when a student teacher comes in with something different. I look forward to the ability to work with students for an entire year to break them of this in order to ultimately make them a more effective learner.

Figure 46: Jacob, 02272011, blog post (J.28)

Today was strange watching [my mentor] teach ‘my’ class. I realized how similar the flow of the class was since I tried to follow this (attendance, homework check, notes, homework). Something to remember for next quarter would be to step away from my mentor’s flow of doing things and try testing things out for myself. Another piece I was amazed at was how little the students were willing to volunteer. [My mentor] just pulled up blank slides for the class today and pretty much walked through examples. The equations were given without any context (similar to how I approached them yesterday) and students were pretty much asked to memorize them. [My mentor] also taught to the test much more than I ever did. Based on her experience (and memory) of tests she has graded in years past, she could anticipate where mistakes would be made and she made little notes of this throughout her lecture. Homework was given 15 minutes before the class ended and students worked on it for the remainder of the period.

Figure 47: Jacob, 03042011, lesson reflection (J.29)
Watching [my mentor’s] integrated class, I’ve learned how much attitude and motivation dominates one’s learning experience. I feel like the question should not be how to get them to succeed at a specific task or to understand a given concept, but to get them to be learners that naturally desire to understand. It seems that culture tells us that the easiest and fastest way to get something done is always the best. I agree with this in some areas of life, but not necessarily with education. The goal should not be to accomplish more and cover more content, it should be for depth. I always wondered why when I tried to apply mathematics to the real world, that my answers and results never made sense. A large part of this was because my knowledge base was wide but shallow. I lacked the intellectual ability to reason through certain elements of the problem because they required a broader, deeper understanding of the situation.

**Alluding to a puzzle,** I feel like what I did through my high school math education was taking the two given pieces and seeing if they fit together. There was no guidance in how to select pieces (choosing specific math methods/ approaches), how to piece together subsets that are already together (deeply knowing the interconnectedness of the math concepts), or strategies to get to the bigger picture (metacognitive practices). I didn’t know that the bigger picture looked like, so the process I usually used to work toward the goal was guess and check. I was good at seeing if two pieces fit together so I continued to randomly select two pieces and see if they fit together. On occasion, I completed the puzzle (if it was a 20 piece puzzle for toddlers), but normally I got frustrated and gave up when I hit difficulties.

Figure 48: Jacob, 03083011, blog post (J.30)

As I began teaching, I feel more confident with the material and I’ll catch myself improving in certain areas. I was able to clue into students that were making mistakes and I instinctively went back to them to check their progress at a later time. I feel like I’ve gained at least some type of groove that I have been able to get in while teaching. I’ve seen this in other areas of my life where I can just get in the zone and get after it, but teaching has been awkward and unfamiliar so far. I’m glad to see this change.

Figure 49: Jacob, 04112011, blog post (J.31)

We began the notes by going through a two-step reflection that got us to a rotation. I am up at the board for a long time describing how the two matrices are multiplied out and the result of this. I give the students a problem to work out that builds on what we have talked about and then I go around checking their work. After looking over my filming footage from earlier quarters when making my snippet DVD, I am pleased to see my progression on many levels. First, I am able to flow through the classroom much better than before and I am much more comfortable addressing individual students and the class as a whole. After seeing how much of a difference it made winter quarter, I believe this is largely based on my knowing student names and being comfortable with the students. Also, I am relaxed and confident with the material which allows for a much more clear presentation of the math content.

Please note the part of the lesson from 33:10 (33 minutes and 10 seconds) to 41:20. In this part of the lesson, I have just finished going around to the students and checking their work on how they found the rotation matrix for 180 degrees. This problem is somewhat abstract in that there are multiple approaches and my formative assessment of the class showed that they had a good idea of what was going on. The clip begins with my getting the attention of the class and asking students for their approaches to the problem. By calling on multiple students to explain their reasoning, I am demonstrating that I value multiple opinions and critical thinking. I continue to encourage student thought by later saying, “find your own way of remembering...” and “try figuring it out”. I value student interaction and I try to get the students involved by giving them a visual representation of a rotation by having them rotate their paper. There is a brief opportunity that spontaneously arose regarding the commutativity of rotations and so I turned this into a short class discussion (04132011, self-critique)

Figure 50: Jacob, 04132011, self-critique (J.32)
The issue that has been on my mind for the entirety of this quarter (and year before this) is time. With regard to teaching, as grad students we are introduced to this world of education from the opposite side of the room from what we are used to. In order to prepare us to succeed in this transition, we have been educated on the varying viewpoints and theories that come with teaching. Below, really for my own sake, I have put together an abridged description of the masters program thus far.

Summer quarter, some of us not having any teaching experience (myself included), we were trained in theory, educational technology, forms of assessment, and simply teaching math. Our ‘teaching math’ class (your class) was one of the few classes where teaching was actually modeled and we were able to learn by demonstration.

Fall quarter, we got into a school and observed a variety of teaching strategies, trying to soak up as much as we could of this. I feel that our placements have been by far the most valuable element of our education thus far, but the classes have brought many valuable characteristics that may have not explicitly come up. Winter got increasingly heavy in the course work in addition to an increase in placement. Our placements in winter allowed us to get a taste of the responsibility and record keeping, planning, and dealing with one class on a more intimate level.

Now we are in spring and as stated before, I feel like the biggest issue is time. As a student teacher I am taking my mentor’s lessons, writing them up in a highly formal plan, and then teaching her lessons with my flavor added to it. I am not going out and searching for the most constructive, inquiry-based lesson that has a high level of application to the student and this kinda bugs me. I feel like I am not producing my best work, but I am giving it all that I have right now. I am literally putting almost every waking moment into this, but am dissatisfied with the result. From what I hear, this is the case for the first year or so of teaching – you are in ‘survival mode’ just trying to get through. From here, you build off your lessons from the year before, and you begin to implement all the stuff that lets your students learn at deeper levels. They say good things take time. I hope that with time, I am able to fine-tune my lesson plans and pedagogy in order to someday get to where I want to be as a teacher.

Figure 51: Jacob, 04172011, spring reflection (J.33)

[Algebra 2] students obviously do not think like I do. Something that seems simple to me as a math major can be extremely difficult for them. This is an area where I have to be extremely intentional with setting things up, making sure that topics and concepts flow into each other, and make my explanations crystal clear. I think it would be really beneficial to take a chapter, internalize the material and then try approaching it by going through it in the most streamlined and clear manner possible while hitting all the important content.

Figure 52: Jacob, 04202011, lesson reflection (J.34)

[Pre-calculus] was even harder than anticipated. I planned for there to be group work and individual time, but the first two periods were pretty much me ranting at the students for the entire period. I was not a fan of this. During 3rd period, I talked with [my mentor and a peer] about different approaches to be taken and this was somewhat helpful, but 4th period still looked pretty similar. Emphasizing the reason for approaching this subject in this way is the only thing I can think of that would be helpful. (05042011, lesson reflection)

Figure 53: Jacob, 05042011, lesson reflection (J.35)
The outlook in [Algebra 2] regarding math is pretty poor. This is partially due to the obvious fact that many of these students hate math and are not good at it. Has anyone ever tried to make this remotely interesting to them? Throughout this entire quarter, we’ve done boring worksheets from the book, and more worksheets developed by [my mentor and other teachers] over the years. The course is very organized, neat, and simple to teach, but it seems lacking in the department of trying to get the students involved in any way. I wonder if this is just because it has been done in the past and it has flopped or because it has never been done.

Figure 54: Jacob, 05232011, lesson reflection (J.36)

JH: going back to that idea of how you think people learn math and what math is, do you feel like that perspective that you have is reflected in your teaching?

Jacob: that was one of the things that I was gonna talk about, with this, no I don’t at this point, I would hope that you know 5 years from now I have a solid, well-packaged curriculum that I would be able to unroll for these students that they would be able to go through that would highlight and you know, fully allow them to see that, to learn in that way, I feel like with the program that we had here, most case, you’re I mean you’re jumping into someone else’s, I’m trying to think of a good illustration, but you’re jumping into someone’s path already, I mean you are literally, someone’s running in one direction you are filling their shoes for those six weeks, you don’t really have much say on the direction, you kind of have your little flare that you could throw in and I mean you get to teach it in your own way so I mean it’s good for that practice but you don’t have much if any control of those bigger issues of you know what are we really trying to implement, are we trying to know solidify concrete reasoning and you know real world applications or are we trying to get through this chapter, because most of my placements were let’s get through this packet, let’s get through this chapter, and it’s and that’s what’s frustrating about it, but don’t, how’s that possible, I mean it’s, I feel like they did a great job but you can’t, I mean you can’t give a student teacher full reign in that way and that’s why I said you know five years from now, I hope to have that nailed down because even, I feel like when you come in your first year, you can completely revamp, I mean you can start from a blank slate and you can you know try to, really pull out these ideas that you want to get across but I feel like a lot of times you are given, I would hope that you know my first year I would be able to stand on the shoulders of those before me and be able to, like here’s what we do, and be able to run with them for a while, just because first year is supposed to be insane, for my own sanity and then you know from that, you know the second year then I want to do five more activities that are what I want to do and what I want to focus on and that solidify this, and then you know five more and five more and build off of that, I mean that’s where I’m getting the five year thing from.

Figure 55: Jacob, Final Interview, lines 2583-2609 (J.37)
Appendix K: Raw Data From Aubrey

I think that would help me for sure, I like to have things written out and have detail, and so I think that for some students it’s really necessary and helpful for them too, because for some of them I’m sure equations it’s like we’re coming from this makes no sense for me, that’s how I was for sure, it was like I didn’t want to look at it, so I guess that would be why.

Figure 56: Aubrey, 10062010 post-conference, lines 407-413 (K.1)

I feel like I appreciated my mentor teacher more. Cause I was always like, when I would watch her teach I would just like focus on the negative things that I was like, oh, I wish she woulda done this or this. And then after I observed, then when I watch her I was like, oh, she does that really well, you know what I mean? So, that’s one thing is that I was able to pick out the good things more, but, yeah, also, all the things that I noticed in myself when teaching that I didn’t really like or that I wanted to change I was sort of watching for that more with my mentor teacher and other teachers I observed.

Figure 57: Aubrey, 10082010, small group, lines 96-102 (K.2)

They all came up with a really interesting way to represent it, and there were actually four different answers in third period, and they were all written on the board at the same time. I thought that was really awesome because the students and I got to talk about why certain ones made sense and others may be off for certain reasons. I also tried to be really careful about not making kids feel stupid who came up and put something on the board that didn’t give the right solution.

Figure 58: Aubrey, date, autumn vertical 2 reflection (K.3)

I wonder if the fact that I didn’t have a good hook to get their attention in the first place was the reason that I couldn’t get some of them to work on it. I didn’t realize the importance of having a hook until this class. In the future I will be more cognizant of that when creating lesson plans.

Figure 59: Aubrey, 10122010, vertical 2 reflection (K.4)
Honestly, at this point I just want to make it through the program without breaking down. I always thought I’d make a really great teacher. I’ve gotten a lot of good feedback from students I’ve tutored and been a TA, and I just thought that it was such a great fit for me. I’m starting to feel really discouraged, though. Watching the DVD of my lesson just makes me wonder if I can even do it. I’m just not creative enough to think of ideas for interesting lessons or classroom management. I look at Derek and listen to him talk about the way his lessons go, and I just know that that will never be me, and I wish I had his creativity and confidence. You’ve said that the most important thing is that we recognize the things we’d like to change. But I have no problem recognizing things that don’t go well during my teaching, and I have a really hard time trying to think of how to make them better. If I have trouble thinking of these things after the fact when I have more time, how am I ever going to be able to think of them on the spot. I wanted to go into teaching to help kids and I’m worried that I won’t be able to.

Figure 60: Aubrey, 10222010, blog post (K.5)

It’s hard for me to be able to do stuff like that because my mentor teacher plans a couple weeks in advance and the only way that she strays from that is if she pushes it back because she needs more time but she has a topic for each day and I can’t just, you know what I mean?

Figure 61: Aubrey, 10292010, small group, lines 769-772 (K.6)

The closure of the class was basically nonexistent. I had planned on recappping what we had done and talking about what we’d be doing the next day, but I just have a lot of trouble getting their attention back at the end of a lesson, especially after they’ve been paired up or in groups. This is especially difficult because in [my mentor’s] class, she doesn’t really ever have any kind of closure, so they’re not used to it.

Figure 62: Aubrey, 11062010, horizontal 2 reflection (K.7)

I liked this lesson because it gave the students an opportunity to discover the relationship between points and their inverses without just telling them. Going in, I was a little worried that the lesson would flop and they wouldn’t be able to make the connection, but it ended up going well and the students caught on quickly.

Figure 63: Aubrey, 11062010, horizontal 2 reflection (K.8)

Another problem that I had at the beginning of class is that one student was mostly dominating the conversation. Since they’re not used to raising hands to be called on, it’s something that I don’t make them do when I’m teaching, but I think that I might have to start doing so, because it could prevent having just a few students being the only ones answering. It’s tough to gauge how much the students as a whole are grasping the material when you only have a couple students doing most of the talking. I think that for my horizontal 3, I’m going to try having them raise hands before speaking, and see how it goes over.

Figure 64: Aubrey, 11062010, horizontal 2 reflection (K.9)
Another really great thing about your lesson was the questions that you asked students. A lot of them were really high-level, open-ended questions that seemed to really get at how they were thinking. One of them in particular that I really liked was “What do you guys know about functions?” There are so many different answers that they could give for this, and it can really give you insight into how they’re thinking, and where their conceptual understanding is, before you get into the lesson in depth. When the girl offered a correct solution for the opening question, maybe it would have been good for you to not move on right away. It would have been interesting if anyone had a different answer or method to share, or maybe you could have called on a student to repeat her answer/method. That way, you can make sure that the whole class is on the same page and you could address any misconceptions or other points that come up.

Figure 65: Aubrey, 10312010, peer critique of Jacob (K.10)

Though some of the same students continuously volunteered, you made sure that other students were active as well. It was smart to create a lesson that allowed for so many students to share their solutions and I think implementing think-pair-share likely helped your students to be more comfortable with sharing. I also think it helped them to understand the concepts better. I frequently heard students debating on the best approach to solve the problems. I think this communication shows student growth and learning.

Figure 66: Aubrey, 10232010, peer critique of Aubrey (K.11)

I’ve been feeling pretty discouraged this quarter, wondering how I’ll be as a teacher, and if this is really what I should be doing. I never feel good about how my lessons go, and I just wonder if I’m going to be any good at teaching. I don’t want to do something for the rest of my life where I feel like I’m constantly failing, and I definitely don’t want to let my students down. I just feel like usually, when I really set my mind to something and give it my best, I succeed. But I don’t feel like I’m succeeding at this and it’s really disheartening.

Figure 67: Aubrey, 11142010, blog post (K.12)

yeah I think so, which I like them doing it way more that’s why I didn’t want to, that’s why I was like no I’m just gonna have them do two of each because I think they’ll remember it better if they do it themselves, but they didn’t even get to it, I wish that I would’ve

Figure 68: Aubrey, 11162010 post-conference, lines 1238-1240 (K.13)
I don’t think that we can say learning is the only thing that matters cause I’m thinking of this specific kid that we have in our class but he’s like a genius, he’s so smart, but he has not turned in a homework assignment like all year, like he doesn’t turn anything in but he gets A’s on the test but he has a bad grade cause his participation, classwork, and homework grades are like terrible, so he ended up I think he got like, I wanna say he got a C cause he got A’s on all the tests, but he should have an A based on how much he knows and how much he has learned and he participates in class in discussion and everything, so I think that it needs to be encouraged that they turn things in because the grades are important for their future just cause that’s how our system is, I mean it’d be great if we didn’t have grades and everything was just, like we could do things differently but that’s how it is so, I think that’s something that has to be stressed to the students.

other people made a comment about tests being a test of what you know, you even said on your final exam or whatever, but I know so many, I mean I have students in [my TA class] that like have test anxiety so bad that I know they know the material, they come to recitation everyday and they tell me, they’ve done I know they have time to do the homework but still I can tell they understand, they answer all my questions, they get it, and then I can’t believe it when I look at their midterm and they failed it, like it just like makes me so sad cause I’m like I know they know it, so I think that’s another thing that has, but then again if we change that in our high school classrooms, so we make things based on projects and class observation, classwork, things like that and projects and when they go to college and they don’t know how to take tests, that’s bad too, so I don’t know how you would.

Figure 69: Aubrey, 12032010, small group, lines 572-582, 631-641 (K.14)

There is a very noticeable contrast between the atmospheres in the classrooms of my fall and winter mentor teachers. The students in [my winter mentor’s] classroom seem much more comfortable with him and with each other. They seem to know him and each other so much better than the students in [my fall mentor’s] class. [My fall mentor’s] class was all math, and [my winter mentor] dedicates a lot of time to other things, like random conversation about what’s going on in the students’ lives. For example, he spends at least the first few minutes of each class just talking to the students, asking them what they did over the weekend, different television shows, sports, or whatever else they want to talk about. [My fall mentor] rarely talked to the students about non-math related things. She definitely didn’t let them talk about certain topics or swear in her classroom. I think that in one sense, this makes the students like [my winter mentor] a lot more, but I think that he allows too much. It’s great if the students see you as a friend, but they also need to respect you as their teacher, an authority figure.

Figure 70: Aubrey, 01262011, experience reflection (K.15)

Since I felt like they were catching on so easily, I went through the lesson quickly. I wish I would have asked students to do more. I had a couple students come up to the board and do problems which was good but I could have done more of that.

Figure 71: Aubrey, 01252011, lesson reflection (K.16)
I’m trying to decide whether time would be better spent doing more instruction (we only did 2 rushed examples and didn’t get to special cases) or just letting them work on them and helping those who need it. [My mentor] seems to think that it would be a better idea to do more instruction, but I think I might just go straight into the think pair share, spending more time on each problem if necessary. That way, I can see right off the bat how they’re doing and give extra help to those who need it. Watching [my mentor] teach after me today, he got through all of the 5 examples on the guided notes and he didn’t even seem that rushed. I have no idea how he did it. He definitely spent less time on the warm-up than I did, which in hindsight I wish I would have done. I had students come up and do the two warm-up problems on the board, but I think I could have put that time to better use. I’m really glad that tomorrow is substitution again, because hopefully that will allow enough time to get the third period students caught up and on the same page.

Figure 72: Aubrey, 01262011, lesson reflection (K.17)

We talked about it yesterday after my lesson how I never will, I mean this is how I’ve always been, but I mean I would be open to changing my mind but, my mindset is I never will make a student do anything vocally in class or presenting in class like if I call you and you don’t want to do it you pass, that’s always, I don’t know, that’s fine with me and usually I just take volunteers which I don’t necessarily think is good because then a lot of students don’t get represented at all, but then when I said that to Jenny, cause I was like I was the student in school that didn’t want to say any, I never said, like wanted to come to the board and do a problem that would be my worst, that would be the worst thing for me, and Jenny said that was me too but I kinda wish that I would’ve been cause then maybe I would’ve been more outgoing about that, you know what I mean, less shy, I guess and so, then I thought well am I doing an injustice to the students by just letting them keep that fear

Figure 73: Aubrey, 01282011, small group, lines 106-117 (K.18)

But, I have something kind of fun, it’s like they aren’t doing applications until next week which is why we haven’t done anything in class that’s like, they have two days of applications of systems, so for tomorrow, I think, yeah I’m almost positive it’s tomorrow, I have kind of a fun one, it’s the one that [peer] talked about, with the horses and everything

Figure 74: Aubrey, 01272011 post-conference, lines 1819-1823 (K.19)

Today I used that dogshow problem, or the problem you did with the horses, with the legs and eyes or arms, I can’t remember what the problem, but anyways, so, and it was just for kind of a hook I guess and they worked on it and they did it different ways, but I didn’t want, I knew that if one student came and said, I used a system and that’s what I did or whatever then no one else would try because they’d just be like oh, he got it, it’s done so I didn’t like, students kept asking me do I need to do this or do I have to set these variables and I was just like, I don’t know, you can do it a bunch of different ways, and then at the end of the period I was like let’s go back to the problem so I put it back up and they’re like, okay what’s the answer and I didn’t tell them, and then I was like keep working on it, you have more time and then the bell rang, and I was like see ya, they’re like, what

Figure 75: Aubrey, 01282010, small group, lines 240-254 (K.20)
I think also, you don’t necessarily know what they’re gonna understand which is something like I’ve seen a few times, when I think there’s something that’s way too complex but a lot of times the one student will think of it and I see, like I saw this today, a student used a different method for solving that problem and I was like, I would’ve never thought of that and then I, he started explaining it to other people around him and they were all listening and they got it, and I thought maybe it’s also not as complex as I think it’s just not a method that we have used ever because we weren’t taught this procedure, but it’s just another way to do it and he figured it out and it was cool, and everyone got it around him, so maybe it’s not that it’s more complex it’s just not something we’ve used you know, like systems of equations are complex I guess but we’ve used them so many times that we don’t think they are anymore, you know.

Figure 76: Aubrey, 01282011, small group, lines 300-310 (K.21)

I started with the dog show problem, and most of the students were really thinking about it, and some were even getting mad because they couldn’t figure out how they were supposed to do it. I decided to go right into the lesson, because I didn’t really feel like they were going anywhere with it, and I didn’t want to spend too much time on it. One student got the answer using systems at that point, but the rest hadn’t figured it out. I’m glad that I got a chance to come back to it at the end. Using it at the beginning, I mostly wanted it to be a hook to the class so I decided that I’d leave them up to their own devices and not give them any hints. Coming back to it at the end, I got the feeling that none of them would really keep working on it unless they had some sort of direction, so I’m glad that I made the comment that they could use systems to solve it. Although not many students were able to get the solution, I think it really got most of them thinking. It seemed like some of them were really starting to understand how we can use systems in real world situations, and what the variables could actually be representing. While a couple students just got started on their homework and quite a few others weren’t really working on the problem, a lot of them were writing ideas down or talking to each other about it, which made me really happy. I’m also glad that I didn’t give the students the answer to the problem before they left. Hopefully those who were on the verge of figuring it out worked on it outside of class. I also would like to come back to the problem at the end of the chapter, when the students have a couple days over applications of systems of equations.

Lastly, for almost all of the students, when they first saw the brain teaser, they stared at it blankly, but by the end of the period, students were giving each other ideas and teaching each other their possible methods for trying to find solutions, demonstrating learning through discussion and collaboration with peers.

Figure 77: Aubrey, 01312011, self-critique (K.22)

During the activity, a few of them stopped working after about 10 or 15 minutes, because they said it was tedious and boring. I just don’t know what to do because I feel like the only way to really learn the processes is to get practice, but if the students are already doing really well with elimination, should they really have to go through all 20 problems?

Figure 78: Aubrey, 01312011, lesson reflection (K.23)
I mean, I feel good about how I think I’m doing a lot better, I mean there’s a lot of things still that I notice that I do that I want to improve, my mentor and I talked about how I a lot of times just focus on the weak students and I don’t even pay attention to the other ones, and I think I’m getting better at paying attention to every student, making sure they’re all okay, but I’m still having trouble coming up with questions on the fly that are really good questions, like thought-provoking for them, I am happy because I feel like with a lot of students I have a more personal connection, I mean last quarter I didn’t have any really, so I feel like I know them well and I feel like they trust me you know, and they’re confident and or they’re able to answer questions in class if, even if they know they’re wrong, or could be wrong, or, and things like that, so I love this class, I just, I mean the students are great, and I don’t know, I’m pretty happy with how the quarter’s going, I mean there’s obviously a lot of things that I want to get better at but I feel like I’ve improved more than I expected to. Here’s another thing that I’m working on, with the group work, anytime that they’re in pairs and stuff like that, and I like really thought about it a lot yesterday as I was walking around, I think I did a good job of it yesterday, mostly, was, not always answering their questions and instead having them talk to each other, which is, I mean, last quarter groups always just never worked out, because they wouldn’t work with each other but now I’m just sort of making them, so when they’ll ask me something and I’ll say, do you understand it to another student and they’ll say yeah, so I’m like well, explain it, except yesterday one of the students got kind of mad at me that I wouldn’t answer

Figure 79: Aubrey, 02092011 pre-conference, lines 2054-2084 (K.24)

It’s really crazy how much of a difference third and fourth period are to teach. The funny thing is that my mentor loves third period and said fourth is his worst, but I actually really like teaching fourth (although he’s been teaching them all year and I’ve only taught them a few lessons). Fourth period is very outspoken and while there tend to be more behavior issues, they’re much more likely to tell me how they feel – whether that means not understanding the material, liking or not liking certain activities, etc. I love that because it makes it a lot easier for me to figure out what I need to focus on and spend more time on, and how they’re best going to learn.

Figure 80: Aubrey, 02162011, lesson reflection (K.25)

I always try to make it like discussion based and you know with them answering a lot of questions and making sure, but I kind of play it by ear based on how well they’re getting it whether I’m gonna have them do stuff on their own and sort of just walk around or if I’m gonna lead it sort of, or have them come up and do it, based on the time and then how well they’re getting it so it’s always kind of just up in the air, I mean is that okay

Figure 81: Aubrey, 02162011 pre-conference, lines 2677-2681 (K.26)

Something that I’ve been trying to do more lately is to get students to answer other students’ questions. I think that I did that pretty well today and want to continue working on it. Sometimes I think the students understand each other a lot better than they understand me, and I think that it helps the students who are explaining to really think about what they’re doing.

Figure 82: Aubrey, 02152011, lesson reflection (K.27)
I worked a lot on trying to ask students to explain their thinking. Something that worries me with third period though, is that there are quite a few students that I can think of who I honestly can’t say whether or not they got anything out of the lesson today, or whether they understood the material. Most of the students give me a head nod at least when I’m asking whether they’re okay with something before moving on, but some students just give me a blank stare. I think it might be good to implement something like the red light, yellow light, green light signs or some sort of quick signal they can give me to let me know. That way all students are accountable for responding and I’ll have a better idea where individual students are.

Figure 83: Aubrey, 02162011, lesson reflection (K.28)

During fourth period today, I had a girl say that she had a way of factoring out the GCF a lot easier than mine. I asked her to come up and share it with the class. She came up and explained it while writing out her method, and it was awesome to see how great of a job she did and see the students really interested in her method. Then they were asking her questions about it and she was basically teaching the class for a couple minutes. Then the students all got into a conversation about which method is better and why they’re going to use that one. It was AWESOME 😊

Figure 84: Aubrey, 02162011, lesson reflection (K.29)

One of my main goals for this quarter has been working on asking good questions. I’ve begun including some questions in my lesson plans to try and get me thinking about all of the things that I don’t want to forget to address, and some of these are typically high order questions. I have asked some other members of the cohort whether they prepare questions in advance or they think of them on the spot, and while some say they prepare them in advance, most have said that they think that’s not possible because you just have to see what naturally flows from the lesson. I really think I agree with that, because you never know what’s going to come up, and as a teacher you have to be able to think on your feet. I feel like the only way to get better with questioning is to practice. I’ve been trying to ask students to explain their thinking or methods as often as possible.

Figure 85: Aubrey, 02182011, goals reflection (K.30)

Something else that I’ve started doing is having something in mind for the end of the class. There’s always something that I can turn to if I have extra time which keeps me from just quitting ten minutes early and letting them socialize. Sometimes, I go back to a brain teaser from the beginning of class, or I give a preview of what we’ll be doing in the future, or I do some sort of extension of what we did that day. Having something always on hand is something that has been vital in my improvement of the pacing of lessons.

Figure 86: Aubrey, 02182011, goals reflection (K.31)
Also, lately when a student asks a question, I’ve tried to ask another student to answer it. I’ve found that this helps a lot in a couple ways. First, if they don’t understand it the first time I explain something, then usually I try to explain in a different way, but often they remain confused. Allowing someone else to answer in their own way gives a different perspective and often the confused student will understand their peers better than me. At first, I thought that this meant that I was a bad teacher, and while I’m still not fully convinced that this isn’t the case, I do think that it’s just a matter of getting a wealth of different perspectives and ways of thinking about things, because everyone learns and understands things in a different way.

Figure 87: Aubrey, 02182011, goals reflection (K.32)

Something that I’m still really struggling with is posing questions so that they’re not leading but so that students understand what I’m asking for. Sometimes I find that either I give away too much of the answer with the question, or else I ask such a vague question that the students look at me like I’m crazy. In that case, I usually can’t tell if they don’t understand my question or just don’t have an answer. And when that happens, I usually just tell them what I was asking for instead of leaving them accountable for it.

Figure 88: Aubrey, 02182011, goals reflection (K.33)

I thought today’s lesson went terribly. The thing I was most worried about was timing because we had shortened periods, but that didn’t end up being too much of an issue. The main problem seems to be their hesitation to use manipulatives. Some of them took to it right away, but many of them refused to even touch the algebra tiles. I told them that it was okay if they didn’t actually use the algebra tiles but still could draw an appropriate picture of the tiles, so that made some of them happier. I don’t know if they really got anything out of using the tiles or not. I wanted to regroup after each example and talk about it, but I could never really get all of their attention back. It kind of seemed like a jumbled mess and I wonder if they even learned much of anything (most of them – if not all of them – already knew how to FOIL). Part of me just wants to scrap algebra tiles for factoring, but then I think that factoring will be the place where they might find them most useful.

Figure 89: Aubrey, 02172011, lesson reflection (K.34)

I am so happy with how today’s lesson ended up going. I went into it absolutely dreading it because while I was away, [my mentor] said that he got a ton of resistance with the algebra tiles, and he wasn’t going to be using them with his fourth period class anymore. The fact that this was a group activity which itself tends to sometimes become a disaster just stacked the odds more against the lesson going well. I was really nervous and about to scrap it along with [my mentor], I decided that having a quadratic with leading coefficient not 1 is the most difficult of all of the topics we’ve used algebra tiles for, so I thought that it could really help them. I’m glad that I used groups of two or three, because I think it really helped to have smaller groups. I also let them know at the beginning of the activity that they were going to be cycling through the tables in the room, and that if they didn’t participate then it would mess up the activity for the whole class, so they really seemed to feel accountable to do it.

Figure 90: Aubrey, 02282011, lesson reflection (K.35)
I went back and read my old blogs, and besides the fact that it’s ridiculously annoying how much I complain, the main thing that I took away from them is just how much my attitude about teaching has changed throughout this year. I started out basically dreading every lesson I had to teach (during fall placement), and even started off winter quarter with basically the same attitude. By the end of the quarter, I loved teaching and was so sad to leave (my winter placement). I also wrote a lot in my old blogs about how I thought I was going to be a terrible teacher and that maybe it’s not what I should do with my life, but I don’t feel that way anymore. Of course I’m not going to be a great teacher right off the bat. It’s something that I’m always going to have to work at, but I’ve already seen myself improve and I know that as long as I’m always reflecting and trying to improve, I will continue to get better as time goes on. I also used to feel so uncomfortable at the front of the class, but as winter quarter went on, I felt more and more comfortable teaching lessons and interacting with students.

Figure 91: Aubrey, 03182011, blog post (K.36)

Middle schoolers are so fun to teach because there’s definitely no lack of participation. They love to answer questions and show you what they know, and also to ask plenty of questions (content or otherwise). It’s so easy to assess students when they’re so vocal about their understanding. They do a good job of getting me off task, though.

Figure 92: Aubrey, 04082011, first reflection (K.37)

I also asked the right side of the class to repeat what the class had not done because I felt like a lot of them were not paying attention. I had two of them tell me how to test them. (4/5 self critique)

I first went through each of the extended response questions and asked them to tell me what they answered for them and tried to get a discussion going with the class each time, but I feel like usually they get so excited about sharing what they want to say that they don’t listen to each other at all. Once when a girl was talking I asked her to repeat and asked everyone to listen. I still don’t know if everyone was really listening so I wish I would have asked a student to repeat her after that. (4/8 lesson reflection)

When students asked me questions that I knew that other students in their group could answer, I just referred them to each other and that ended up working out really well.

They didn’t generally have too much trouble finding the angles but they seemed really confused about how to explain their answers. By the end of the period I had made sure that everyone had really good explanations for their work, although it doesn’t seem to be something they’re really used to. (4/13 lesson reflection)

Figure 93: Aubrey, 0405/0408/04132011 self-critique, lesson reflection, lesson reflection (K.38)

I do wonder, though, if this lesson could have been taught in a more discovery type of way, because they had already encountered some transformations, so they could have found the new ones based on what they already knew. I noticed that you tend to say things like “Right?” or “That okay?” or “Got it?” a lot when you want to check understanding. I do the same thing and it’s something that I’ve really been trying to work on. It’s easy for a kid to nod their head even if they don’t really understand what’s going on (or even worse, they think they do understand but their understanding is incorrect). Instead, maybe try calling on students and asking them specific questions.

Figure 94: Aubrey, 04292011, peer critique (K.39)
Appendix L: Raw Data From Derek

She has students come display their answers and work on the smart board. I think she does this for numerous ways. First the kids love using the smart board so it is very easy for her to get people to volunteer to display their answers. Also, it helps for students to give their explanations rather than [my mentor] always giving her explanation. The students respond a lot better to students’ explanations quite often. While going over the worksheet [my mentor] comes across a major problem. Many of the kids do not know the correct order for “order of operations” so she immediately abandons her lesson and begins giving a mini lesson on “order of operations.” This was quite interesting to watch. I think she did this because she knew that it was vitally important that all the students know the correct way to use order of operations.

Figure 95: Derek, 09272010, observation reflection (L.1)

I had a pretty cool observation. I didn’t realize it when I was going over there but her class I would say it’s half project-based learning. She told me that she does a week and a half of regular bookwork and stuff and then they’ll take a week or two weeks and do a major project. And they were working on one, which she called a warm up project that took a week. She, the teacher is really good about it, she reminded me of you because she never answers any of their questions. The kids will be like, you know, do we need to label our axis and then she would ask that exact same question to the kid sitting next to her and she just lets the kids do it on their own. And then after this project they go into a 50 million dollar project and they’re given 50 million dollars and a bunch of information on countries around the world and they have to decide how they’re going to spend their 50 million. They could spend it all on one country they just have to have graphs and charts and whatever that support their idea. And she showed me some of the stuff from last year and it was amazing! She said, I give them this, I don’t give them any guidelines because they had to have it for the peanut butter project so they can do whatever they want and some of the like charts and stuff, I was like just blown away at what they could do.

Figure 96: Derek, 10012010, small group, lines 170-190 (L.2)
So for the rest of the class I followed [this teacher] around from table to table and took notes on how she worked with the students. [This teacher] began at the first table. She scanned all three students work, and asked each one a question. The first she asked, “What do these marks on the graph represent?” The second she asked, “Is there anything strange about this graph?” The third she asked, “Do you think sodium matters?” However, she did not wait to hear answers. When they tried to answer she said, don’t tell me, tell your “tablemates.” This was very interesting to me because it was quite obvious she was just trying to start discussion at the tables. She wasn’t looking for yes or no answers, but instead to just get their minds working. She proceeded in the same fashion to every table. Often picking up papers and then asking a few questions but never giving answers or staying to listen to answers. If anything confused her while she was looking at their work she would ask them to explain it or she would ask another classmate to explain that person’s work. This was very effective because it showed that students had gained knowledge and understanding of the material.

Figure 97: Derek, 09302010, observation reflection (L.3)

As I talked with the kids, they all told me that they loved doing the projects and that it made math class fun. They all like the projects so much that they stay on task without having being told to do so. There were absolutely no behavior problems throughout the class and the majority of the talking was about the project, which really shocked me. I expected the class to be a little chaotic, especially in the last half of the class, but this never happened. When I am teaching I hope to include projects like these in my class to make my class much more enjoyable for my students. I also think the students learn more under this style. Lastly, I think they realize how useful math can be in real life and in reasoning.

Overall, I was mainly just shocked to see this style of teaching being implemented. I have done a couple of research papers on project-based learning and have always wanted to see how teachers run their rooms under this style, but never thought I would get the chance to see it. After seeing it being implemented I have much more confidence in being able to apply this into my own lessons and can really see how the students benefit from this style of teaching.

Figure 98: Derek, 10092010, experience reflection (L.4)

She mainly talked through the entire lesson almost like a college lecture with no writing. The students talked a lot while she was teaching and I even had to split a few of them up as they wouldn’t stop touching each other. At the end of first period there was a scheduled activity using measuring tiles. She read the directions and passed out the worksheet and I passed out the measuring tiles. She then assigned partners and asked them to work quietly on the activity for the next 35 minutes. However, this didn’t happen. The kids were extremely loud and struggled to stay on task. [The substitute] then proceeded to sit at [my mentor’s] desk for the rest of the period. With about ten minutes left in class she asked me if I would collect the materials and she began going over the questions that the students were to have answered by now. She struggled to get student participation and eventually just began reading off what the answers should be as she was running out of time.

Figure 99: Derek, 09232010, observation reflection (L.5)
The homework was over distributing and adding like terms. Before going over the homework she gives the
students a procedure they should always follow. She says, “First distribute, second combine like terms,
third move variable terms.” This seemed very boring and I felt like the kids were not paying attention to
what she was saying. She has all of the homework problems already worked out on the elmo, and she goes
through each problem. She says exactly what she is doing and doesn’t leave much wait time. There is
hardly any class interaction. It is a very traditional classroom and a very traditional way of teaching. She
has the class grade their own papers based off of the answers she has on the board. There are quite a few
students talking throughout this homework review. On the homework she offers bonus problems which
stretch the students’ knowledge. I think this is a great idea because it allows students to test their skills. If
they get both bonus problems correct [the teacher] knows that the students have a very good understanding
of the material. It felt as if she was trying to get through the homework as fast as possible which leaves
very little opportunity for understanding for the students and for question asking.

Figure 100: Derek, 09302010, observation reflection (L.6)

First I’ll show that youtube video and one of the students did bring up cross multiplication yesterday so that
worked out perfect, and when it gets done I’m gonna ask them about reducing that fraction or leaving it as
is or if one is decimal, what’s better, also I’m gonna ask if that’s the only way they can solve proportions,
hopefully somebody will bring up something different cause we went over three or four ways yesterday, or
they brought up three or four ways.

Figure 101: Derek, 10072010 pre-conference, lines 23-27 (L.7)

Then I’ll have them try to predict once they get an idea of how many they think’s gonna be in here and
then, once they realize that they can use weight, I’ll have them, try to use proportions to figure out, we’ll
see what we get, it might be way off too but that’s another perfect discussion we can have if it’s off, and if
we have extra time we can take the average of some of their proportion, where they’re using proportion
predictions and see if it gets closer, with it being completely random, I mean you don’t know, so, it’s
basically just a lesson to make them think and see how it can be used, real world I guess

Figure 102: Derek, 10072010 pre-conference, lines 100-107 (L.8)

I think they’re gonna say what’s the total number of M&M’s in the bag and, which is cause then that tells
me that they’re thinking along the right track, if they’re really struggling I might hold up a smaller bag and
say can we connect these two in some way

Figure 103: Derek, 10072010 pre-conference, lines 70-72 (L.9)

However, I was so glad to get the perfect demonstration by [one student] that I didn’t ask for other ways
and I wish I would have. I know that the students still knew that there were numerous ways to solve the
problem, but I wish I would have had another student demonstrate the other ways as well.

Figure 104: Derek, 10182010, self-critique 1 (L.10)
When I’m going with the flow I just went off that, and I don’t know if that’s really bad or but when I get up there, I don’t look at my lesson plan hardly at all, I read it the night before and in the morning but I just, I mean I know what I want to get to, like the key bullet points and then I more or less let the discussion go as it goes and I can change on the fly, that’s just I don’t know, one thing I’m pretty good at and I don’t know if that’s a thing that I should be doing?

Figure 105: Derek, 10072010 post-conference, lines 266-271 (L.11)

One thing that I have noticed immediately is that so far my picking of “hooks” has been pretty good. The first hook I used was having the class think about their dream car and how it could be scaled down to a replica version. This “hook” worked so well that it kind of shocked me at the participation I got. The hook for my second lesson was a very different kind of hook but it worked equally well. It was a YouTube video on proportions that had a young kid singing a rap song about cross multiplication. The whole class loved it and actually asked me to play it again. After using both of these hooks I realized that having a good hook is essential to your lesson. My hooks caught the kids’ attention and allowed them to loosen up a little bit before class started. After the hooks I knew I had the kids’ attention and they were ready to move on with the lesson.

Figure 106: Derek, 10182010, self-critique 1 (L.12)

If I had to do it again I don’t think I would speed up the lesson at all because the students were giving me such good explanations as well as numerous ways to solve proportional problems that I felt it was necessary to let them keep talking out their ideas. I also felt as if the students were doing a great job of coming up with their own definition for proportions and they even came up with the term scale factor on their own. If I had to change one thing about my first lesson I think I would have had a few different students volunteer more because when I think back I can only remember about half of the students volunteering.

Figure 107: Derek, 10112010, horizontal 2 reflection (L.13)

I tried to make this lesson fun for the students and I think that it really was fun for them, but I also think they saw how proportions can be useful. The lesson in itself was very hands on and I really liked this part of it because it gave the kids ownership to their learning. They all liked having the candy in front of them to manipulate and record their data. I thought we had great discussion once again and we even brought up terms from the first week of school such as “skewed” which I was really impressed with.

Figure 108: Derek, 10112010, horizontal 2 reflection (L.14)
When I was watching the video I was looking for a really strong point that showed me that the students were actively learning. I found this point in the video from 18:15 to 21:45. This is the discussion we had about how we could find the number of red m&m’s in the big bag without actually counting them. At first the students were just guessing, but then when I told them that there is a logical way of doing it, they began to think much harder. I started to get students asking about serving size and how much the big bag weighed. I even had one kid state that we could use a scale and find the amount of m&m’s that make one gram and then multiply it by the weight of the bag. This reasoning would not work, but I really liked the multi-step math that he was thinking of. I thought it was great how each student built off the previous students’ ideas. This showed me that they were listening and also brainstorming their own ideas. I knew that the students had made a proportional reasoning connection when I held up the small bag of m&m’s with the big bag. Their eyes lit up and the ideas started flying at me. [One student] had a very good explanation using proportions. I really liked the way he slowly explained it and was thinking while he was talking. I could tell he had the right idea and that he had made the connection I was going for. I was happy enough with this, but then I thought it was even better that as soon as he said this I saw the light bulb go off in [another student’s] head. He then gave an excellent method of how to solve the problem on the board. He used cross-multiplication, which was fine because it was one method that I showed them yesterday. I liked how his example was clearly written, labeled, and thoroughly explained. This entire discussion was a great display of active learning and that is what I am trying to implement in my classroom.

Another discussion that I really liked was when the kids began giving me data values. I asked what could be done to make it more accurate. I was amazed at what the kids said. They brought up calculating the average, throwing out outliers, taking larger samples, and how bad data will skew graphs. This was another bit of evidence of learning because we talked about skewed graphs in the first week of school so for them to remember this and to be able to use it showed that they had learnt material from the first week of school as well.

Figure 109: Derek, 10182010, self-critique 1 (L.15)

I’ve already taught two lessons and, I’m kind of the wrong person to talk about it cause I don’t really get nervous, so … I wasn’t nervous but what I would say would help you guys is to have a good hook. Cause both my lessons plans, knock on wood, the hooks were good and instantly everybody was ready to go. And I don’t know, I just think that if you have a good hook they’re ready to go right away, and like Aubrey said, there’s gonna be certain kids that you have a better connection with than your mentor teacher does. I know there’s like four or five that never volunteer for my mentor teacher but their hands are always up when I teach. So, I think kind of latch onto those kids. I mean, once you get up there it’s pretty fun. I mean, I don’t let, like I said, I don’t really get nervous so.

Figure 110: Derek, 10082010, small group, lines 66-86 (L.16)
I was gonna say one other thing, I was telling Jenny this yesterday for what I’ve learned so far, with my lessons is the thing that you don’t think kids are gonna say but they’re not gonna, you leave this and you hope that they’re gonna say but in the back of your mind you’re thinking that they’re not going to, nine times out of 10 my kids will come up with what I want them to say but in making your lesson plans it’s a really good idea to have just a little hint that you can use, like already have a hint. Yesterday with my M&M’s I was asking for predictions with bags, or I held up the big bag without even showing them the small bag and I was like, how can you, you know how can we count the number of red M&M’s in here and they were throwing out all kinds of crazy guesses and stuff and I’m like no, let’s think logically and they didn’t have a very good idea and then my hint that I had on my lesson plan was hold up a small bag and then see and as soon as I did that, like they started saying proportions, ratios, and everything was going off, so I mean, one of my biggest drawbacks to teaching constructively was I didn’t have confidence in the students, I didn’t think that they knew near as much as what they know, it’s absolutely amazing what they have in their heads if you just give them time so, once you have that in your lesson plans, once you have that confidence in your students I think it’s a lot easier to write a lesson plan because you know that they’re going to say what you want them to say.

What I did, the first day and second day I taught, cause I, my teacher let me teach a little bit before because I didn’t want my first lesson to be the time that I taught my actual lesson so, she’d given me like some notes like one was “get away from the board” like sometimes “go to the back of the classroom, let the kids just be up at the smartboard and you teach from the back of the classroom.” But, what I did was, I had four key points taped to the inside of my binder that had my lesson plan that I wanted to like make sure I did, so every time I walked up to look at my lesson plan or anything I saw, “get away from the board” and, “make sure you call on 3 or 4 students that hadn’t been volunteering” so I had that I wrote down and that really helped because it was just 3 or 4, it wasn’t like I was looking through my whole list to find something, it was just right there, bang.

yeah and as I went around I tried to get to almost everybody and ask them a couple questions just to make sure they had an idea, I asked a lot of “why’s” and I really didn’t have many kids that didn’t understand, so I think that’s cool.

yeah she explained it and I had her picked out ahead of time because I knew she would, she just explains stuff really well, I thought the kids would understand her so I know I wanted to call on her eventually and then she said they’re similar right away, as soon as she said that I knew I could use that, which it’s like a game, you’re trying to get them to say it without you saying it and then as soon as they do you’re like I can use this.
On the fifth question we had a disaster performance as a class. Only four students got the problem correct. This immediately showed up on the pie chart on the board and I said, “We need to go over this one.” I asked for a brave person who got it wrong to display their work on the board. One girl allowed this and we found that her mistake was the same that most of the kids had made. I really liked doing this because it was a great way of showing a common misconception and I think all of the kids connected with it. I think I really got the point across, whereas I don’t think I would have if I just showed the students the correct way to do it without looking at a specific mistake.

Figure 115: Derek, 11082010, self-critique 2 (L.21)

I had the class start to draw the first wump. As I walked around I noticed some of the students were drawing the second wump instead of the first wump. This made me change my original lesson plan. I was going to have the kids guess what the second wump would look like based off of the points and how the first wump looked. However, after some had already drawn it they would already know what the second one looked like. So I place both wumps under the Elmo and asked for connections and how the first wump was different and similar to the second one. This was an alteration, but it worked to my advantage as the students made very good points on why the two wumps looked similar. I think this was actually a lot better conversation than what we would have had if I asked them to predict the second wump. As they drew the wumps I walked around asking a lot of questions such as why is the second wump bigger? Or how do you know your points are correct for your second wump. I liked this because it gave me individual time with each student and I could personally see the understanding level of each student that I talked with. Looking back, I wish I would have made sure that I talked with every student in the class at some time in the lesson, but I know I didn’t get to two or three of the kids.

Figure 116: Derek, 10172010, vertical 2 reflection (L.22)

The area of student participation that I think I struggled with this lesson was when I called students to the board. For some reason I mainly called on the students in the first two rows to come to the board. I definitely need to change this and make sure I get a variety of students at the board. In my future lessons I may draw names out of a jar for who comes to the board.

Figure 117: Derek, 11082010, self-critique 2 (L.23)
I call particular attention to the video at the 38:20 mark because this is one of the spots where I am sure student learning took place. This was a great discussion with a lot of class participation. The students were predicting what the third wump was going to look like, which was not going to be similar. The first few arguments that were given were the opposite of what was going to happen, but this was a great starting point. The class continued to discuss and give reasoning and change opinions. I know student learning took place because the two students that were wrong at the beginning were saying that they needed to change their answer at the end of the discussion. I also saw several people give the expression, “oh,” as if they finally got what was going to happen. I also know that learning took place because their reasoning kept getting stronger and stronger as the discussion went on. They were learning from each other; they were taking the previous ideas and manipulating them and adding to them to make their own answers better. The other part where learning for sure took place was at the very end when I asked which wump was an impostor. They all began saying that the third one was an impostor because he was not similar because his angles were different. This is a key feature of similarity and this is a way to tell if objects are similar so by the students coming up with this on their own it shows big signs of learning.

My last lesson was with graphing calculators and how to plot these points, and it was probably the worst lesson I’ve taught, not that it went bad and they didn’t learn but I felt like I was giving procedure after procedure after procedure and every single kid has a problem with his calculator and not that I explained it wrong but that there’s something in the y= that shouldn’t be there or their windows are different or . . . and it was just, it was nerve-wracking because I had so much to get through and like, 15 hands are up in the air that they have problems and I posted them on my blog last night, I don’t know how to make it any more constructive, because there’s nothing that you can say, like, oh look at your calculator, how do you think we’re gonna graph this, you know, I mean they have no idea, so I think it might be one of those lessons that you just have to do procedurally to get it out there and then maybe the next lesson you can do something more constructive, but I told the students, I was like, and I could tell they were bored and they’re used to my lessons being pretty interactive and it was the first time I’d ever thought of saying it but I was like, this is boring for you guys and I know it, but it’s also boring for me, cause it was terrible, my back was to them the whole time I was writing, go to STAT now go to EDIT, and I don’t, I don’t know, I mean I hated doing it, I really did. So, I don’t really know, I’m definitely up for suggestions, cause I have to teach basically the same lesson in like a week, so …
at the end yesterday, of first period, I wasn’t teaching but me and my mentor decided to give them an exit ticket and it was, they stated one thing that they’ve learnt from when I was teaching and on the back they put a positive and a negative, and, it was really neat, I really enjoyed reading through them, I mean you kinda have to have a little bit of thick skin because I mean and I told them to be like brutally honest and some are like really good like this one I have on top. I think it’s something that’s worth doing because it showed, it gave me some really good feedback on like a lot of times I know in class they’re explaining it and they’re probably explaining it right but I don’t see it and I’m sure you guys do it the way that they see it, and that’s what a lot of people put as the negative, I’m just like, I don’t understand what you’re saying, but then, so I’ll have them come up to the board or something and then they do it, but it takes a little bit longer for me to catch on, and so that was a negative so I obviously know I need to work on that, I’ll pass them around if you guys want to look at them, I don’t know, it was neat, I was just glad I did it. I guess I was expecting the negatives I was gonna use the negatives more but like I actually focused on like the positives and, on most everyone put something about my hooks or my warm-up problems so, at first when I started doing hooks I wasn’t entirely sure and me and Aubrey had this discussion cause I tried one lesson without a hook I just, one that I taught for my mentor I just didn’t do anything and I felt like I didn’t have the kids’ attention the whole time and then Aubrey did the same thing cause I tried one lesson without a hook I just, one that I taught for my mentor I just didn’t do anything and I felt like I didn’t have the kids’ attention the whole time and then Aubrey did the same thing and thing is she said it was a disaster, so, I was glad to see in here that they all said that they like and that shows that I need to keep doing it

Figure 120: Derek, 10292010, small group, lines 196-230 (L.26)

Attempt to use more wait time and have less anticipation of students’ answers. It seems that lots of the questions you ask are directed towards the entire class, but this really just makes 3 or 4 kids do all of the answering. I would suggest having kids raise their hands and giving a good 20 or 30 seconds and then calling on someone new. It also seemed like you waited for the first start of a good answer and sometimes finished their answer for them. I know this is just you being excited that the student got the answer correct, but I think if you let them talk a little longer they might surprise you in what they say. I also think you might want to ask if any other students got any other answers or can explain how they got their answer. You obviously have the intelligent kids in the class learning effectively, I am just wondering how the other kids are doing because they might just be sitting there not saying anything or they might not understand.

Figure 121: Derek, 11022010, peer critique (L.27)

She then uses a number generator to give each student a homework problem to go over. This is a very effective way at making sure she calls on different people each day. She has students take their ‘stations’ which basically means students go to the board and show their work for their homework on the board. This is a very effective way of getting all the problems shown and to start class interactively for the students. Every student has now been out of their seat at least once, I really like seeing that. She walks around and helps any students that are really struggling to show their work (these are probably the students that did not do their homework). If the students disagree with the answers on the board they are to go up and put a star by the problem that they have a different answer for. [This teacher] then goes over the problems with the stars. She asks the students to tell her what they disagree with. The students find the mistake and they move on. [This teacher] is very good at remembering which student did which problem on the board. When going over the problems she keeps checking with the student that put that problem on the board. I felt like this was good because she was really giving students the responsibility for the problems that they did on the board.

Figure 122: Derek, 11032010, observation reflection (L.28)
yes, exactly, they could’ve used anything, I didn’t, I never once said they have to use probability or
anything like that, and they all had some way of doing it, there was nobody that was just clueless and was
like, I don’t know, everybody had some way and three ways were the same and then there was a bunch that
were entirely different…. I didn’t, I guess I didn’t feel like I got to look at their papers as much as I was
planning on but I still think I looked at them enough to know and I had names written down on the back
that I wanted to for sure call on and in my mind I knew like three or four that had wrong ideas but I still
wanted them to say it, so, it’s definitely something worth trying and I definitely like doing the problem
solving lessons, I just want to incorporate more right into the heart of the lesson that we’re doing, and I
think they enjoyed it as it was just a problem solving day, they could relax they knew they didn’t you
know, there was no stress on them or anything, but I think it would help more if it was in the heart of the
lesson or at the end of the lesson
Figure 123: Derek, 11042010 post-conference, lines 844-855 (L.29)

During 1st period I taught my lesson. It was a problem-solving lesson that dealt with probability. It was a
unique kind of lesson and I really liked teaching it and I think the students liked working through the
lesson. They left the classroom still discussing the problem, so I think I accomplished what I was trying to
do. (11042010, lesson reflection)
I found out it is a great way to see what misconceptions students have and it is also a great technique to use
to get inside access to students’ thinking. (11072010, blog post)
Figure 124: Derek, 11042010, lesson reflection, 11072010, blog post (L.30)

They use the ABCD cards again and she asks one of the students why he chose B. He said, “because
everyone else chose that.” [The teacher] calls on another person who gives the correct reasoning. She then
calls back on the boy that didn’t know early and he explains it correctly this time. I thought this was great,
because she was holding the student accountable.
Figure 125: Derek, 11082010, observation reflection (L.31)

I have submitted my last lesson plan for this quarter and feel pretty good about most of my lessons that I
submitted. Looking back the only lesson I didn’t really like was the calculator graphing lesson. It just wasn’t
interactive and was definitely not constructively taught. (this is really funny because I just looked at the
"how my classroom will be" that we filled out in the beginning of 621 and I was as far away from
constructive teaching as I possibly could have been) I have made some drastic changes in my teaching
philosophy over the past 5 months or so. haha. I feel now that I know what my strengths are in my teaching
and I definitely know what I still need to work on. I think the biggest weakness that I need to work on is
understanding what students say the first time they say it. I'm not sure how to do this, but I constantly find
myself having students explain themselves two or three times before I get what they are saying
Figure 126: Derek, 11112010, blog post (L.32)
I guess at mine, our teaching styles are really different so I just don’t know how it’s gonna go, she’s easy going so I don’t think there will be a problem but as fast as the kids, cause they’re used to, they come in and the first five minutes they just mess around basically and two or three kids always sleep everyday unless I go over and wake them up, but, and then she lectures for 10 to 15 minutes and the last 25 minutes are always a worksheet or something like that, usually, so … that’s entirely different from what I like to do in my lessons, so I guess I just don’t know what the best approach is, I don’t know, is it best to come in and just go right with my style right away and still keep up with her pace but, do more interactive stuff and teach more the whole time period and then assign homework but she doesn’t assign homework ever because it doesn’t get turned in, yeah or they lose it, so

Figure 127: Derek, 01142011, small group, lines 210-220 (L.33)

I just don’t like the way the classroom is run. It is way too easy going and has no real structure to it. She lets kids sleep and lets some students just sit there and not do anything bc she says they aren’t going to do anything. Obviously I can’t let this happen, especially when I am being videotaped, and because I just do not tolerate it. So basically everyday I am allowed to walk around and help/motivate the students for the last 20 mins of class. I have been trying to implement some of what I am going to do with second period already. If students are trying to sleep I have been waking them up and making them at least start their work. I have also been standing over students who are not doing anything and asking them questions to get them started. Most do do their work once I get on them, but it is still taking valuable time away from class. My hope is that by the time I start teaching they will know that I don’t tolerate it, but I’m not sure if this is the right approach or not.

Figure 128: Derek, 01152011, blog post (L.34)

It is a drastic difference from [my fall placement]. I was expecting a difference in the types of students as far as motivation level and behavior, but what I wasn’t expecting was the number of ESL students that are in the classes that I teach or observe. I wasn’t really worried because I assumed that even though they were ESL students, I thought that they would still be able to speak enough English to get by. I was entirely wrong. I helped one of the ESL students on the second day of class. I began asking her questions and talking to her. She just looked at me with this confused look on her face. So I said what I had said again to her, but more slowly. As soon as I did it I wanted to kick myself because this is exactly what they tell you not to do with ESL students. So I switched game plans and grabbed a piece of paper. I wrote down everything I had said and then she was like, “Oh, yes.” Then she wrote the correct answer. I learnt a lot from this one encounter. The first thing is I need to get to know my students a lot better so that I know what techniques I need to use with the students, especially the ESL students. Some of the ESL students need a lot more explicit instruction than what I would normally give in my lessons. I like to teach constructively and let students come up with their own ideas; however, I have noticed that ESL students do not do nearly as well with this type of learning. They seem to like detailed instruction and they want to have knowledge of how the problem or concept should be done. Because of this I have been thinking how I will have to adapt my lessons. I still want to teach constructively to most of the class, but I might have to walk around and show the ESL students an example or two to get them started.

Figure 129: Derek, 01172011, first reflection (L.35)
I thought the first lesson went really well, maybe even better than planned. The brain teaser/warmup problem was a huge success, although nobody got it correct they were all working. The students all liked the warm-up problem and most of them were smiling and laughing after it was over. I will definitely continue to open classes with warm-up problems and hooks. I told the students that I would teach in a little different style than [my mentor] and several of the students groaned which made me want to prove to them that my way is just as effective. I taught the lesson as planned and got through everything I wanted to. I didn’t get any students to come to the board to write, but I definitely made progress with the situation and think I can get students up to the board within the next few lessons. I did have great participation throughout the class which was a good sign. There is really no closure to class. I really am going to have to work on this because the students are so used to lining up at the door and just leaving when class time is about over. Three of the girls that complained when I said I was going to teach a little differently than [my mentor] came up to me after and said, “You teach good, you can teach us any day.” It made me feel that I had done a successful job.

Figure 130: Derek, 01252011, lesson reflection (L.36)

Today’s lesson went pretty much as planned. The hook I used was a more difficult problem to solve so the students were not as inclined to do it. I had to motivate them a little bit more, after no one got it correct after 3 or 4 minutes I decided that I would leave it for the end of class. This turned out to be good because as a few students got done early they worked on the problem and figured it out. When I first reviewed the quadratic formula today I had students come to the board!! (I broke the ice!) I had 3 different students at the board. One reproduced the quadratic formula, one showed an example of how to use it and the third simplified a radical. I believe that all 3 enjoyed doing it as well and I liked it because it made a review much more interactive.

Figure 131: Derek, 01262011, lesson reflection (L.37)

For the class I taught today I thought it went fairly well. I used the flash assessment at the beginning which the students seemed to like. I thought the lesson was taught pretty constructively and the students responded fairly well to it. I forgot to change all the calculator modes to real numbers before second period, so one student plugged in the square root of -36 and said it is 6i. So I ran with it. I asked what was i? The students started guessing what it stood for. Eventually somebody said made-up numbers and I said kind of. From this I went back to my planned lesson. The exploration with the calculator lab worked really well. It was fairly easy for them, but they struggled making the rules for adding, subtracting, and multiplying complex numbers, which was what I wanted.

Figure 132: Derek, 01272011, lesson reflection (L.38)
Overall, I was quite pleased with the complex operations lesson. I thought I had a lot of class interaction and participation which made for a fun and fast-paced lesson that the students seemed to enjoy. I really think they had a lot of fun going to the board even if they had to ask their classmates for help. The lesson started off very well with the hook. I did like how most of the ESL students and most of the IEP students were commenting on the picture. I could tell I had their attention. The students loved the questions, especially the ones about the superhero powers and what car they would be. I had to ask them to quiet down a few times, but I think this is a good thing during a hook because they were all talking and excited about the questions I had put on the board. I will definitely take this reaction over nobody speaking. I thought something that I did really well during the hook was I called on a lot of people that don’t usually speak in class. I felt that the students with IEPs and the ESL learners could answer these questions just using their imaginations, which they did. I was glad I got most of them involved in class early and most of them were smiling which showed me that they were having fun.

As for the actual lesson I thought there were a lot more good parts than bad, however, there are always areas for improvement. First of all, I thought the number of different participants that I had at the board and speaking during the lesson was excellent, compared to the fact that on my first day of teaching I couldn’t get one student to go to the board. I wish I would have given more wait time to see if other students could have given more thorough definitions. Watching the video it seemed like I took the first two answers I got and ran with it. One part that I thought was especially good was when [one student] was at the board around the 11:55 mark in the movie. He was showing the class how to subtract complex numbers and got caught up on the minus sign in between the two numbers. He stopped and asked me and rather than answer him, I said, “Ask your classmates.” He did and they helped him. I could tell learning was taking place because several people were shouting out ideas and they were quickly debating them and then coming up with the right method. Several students also said, “Well that’s why I was messing up on the lab yesterday.” I felt this was a very good part of my lesson because without me leading him into it [the student] covered one of the key misconceptions and mistakes that students make when subtracting complex numbers. If I could change one thing about this I would maybe have another student come to the board and explain what we had just covered one more time. I feel like I went through my alternate way very fast and I might have lost some of the students. I was also disappointed at myself for not telling them that the minus sign just switches the signs of the numbers inside the parenthesis. I think this would have helped several of the students who were struggling. Going off of this I also liked how I made the students use a problem that they had done with their calculators the day before to constructively figure out what happened with the minus sign. Learning was also taking place here (about the 13:20 mark) because all of a sudden I could tell they made the connection and several said, “The minus has to go through both terms because the answer needs to be –i.” I feel like this was a demonstration that might stick in their heads.

Figure 133: Derek, 02012011, self-critique (L.39)
One of the most frustrating parts in this lesson is when [another student] goes to the board to do the second subtraction problem and she makes a mistake and [my mentor] corrects her right away. You can actually hear [my mentor] making noises as she is writing. This is totally demolishing what I am trying to do with [this student] at the board. I am trying to let her do the problem and then give us an opportunity to talk through it and try and catch some mistakes, but [my mentor] is correcting her so fast that [the student] is not learning and neither is the rest of the class. She is simply just erasing her signs and switching them and has no idea why she is doing so. This is a perfect example in the film where LEARNING DOES NOT TAKE PLACE. It is due to the fact that [my mentor’s] teaching style is to correct a mistake as soon as it is made and a lot of times without explanation.

Another part of the lesson that I do not really like is when I have to go through the first example of multiplication with the class. Watching the video I feel like I am doing a lot more “telling them” how to do it rather than “them telling me.” If I were to teach this lesson again I would definitely want to provide more wait time because I am sure some of the more advanced kids in the class knew how to do it, I just didn’t give them enough time to speak up. However, after this example I come to one of my favorite parts in the lesson. I call [another student] to the board to do the second multiplication problem, this happens around the 28:30 mark. She was very unconfident when going to the board, but as she slowly progressed through the problem her confidence grew and grew. It was great to see. Her class was also very supportive of her and she enjoyed herself up there. One of the key moments was when she needed to replace i² with negative one, but forgot. This was another key place of learning at about the 29 minute mark. She turned to the class to ask for help and I said it was her classmates’ job to help her. They were all stumped for a second or two and then a bunch of them started yelling to replace the i². The light bulb went off in [the student’s] head along with a lot of people in their seats. Several people were smiling and it was a great part of the lesson. I know that it will stick in [the student’s] head and I hope it will stay with a few other students as well.

The lesson then goes to worksheet time, which I think is entirely too long, especially after watching the video, but my hands are tied here as [my mentor] thinks it is the most important part of the lesson. She insists that I have to give the students time to practice. I do think that I did a good job of getting to each student and when some of the faster learners got done early I gave them an “accelerated activity” which was to begin making a poster that was “all about imaginary numbers” that could be put up in the room to help them on tests and homework in the future. I thought the class stayed on task with the worksheet which I thought was very effective, I just wish I could have spent some more of the time doing interactive class activities at the board because I think the students were really gaining knowledge and confidence from it in this particular lesson.

Figure 134: Derek, 02012011, self-critique (L.40)

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I basically like to get back and let them start writing and as they write I try to kind of put myself in their shoes like if I was a student what would I be asking questions about that they wrote. So we were doing radicals today, simplifying radicals, and it was like the square root of 75 and so the student broke it down into the square root of 25 times the square root of 3 and so right away I saw that and I was like and they didn’t really say much, so I was like, why would you break it down into the square root of 25 and the square root of 3, I know like 5 times 15 is 75 why wouldn’t break down into the square root of 5, cause I know that might of confused some people and they do a good job of explaining it and the nice thing is it makes them think but it also makes their classmates think and they explain it in terms that they understand like they say break it down and they automatically know what each other’s talking about even though they’re not using math language but, I don’t know, I guess when Jacob was saying that he pre-plans for it, I don’t think I pre-plan any of my critical, well I guess I do some, but not that many, I do it more on the fly and I just try to get back and think not as a teacher but think as a student almost, I don’t know if that helps at all.

Figure 135: Derek, 02042011, small group, lines 52-65 (L.41)
I have three, one is to get every student involved in classroom activities, cause right now it seems like I have half to two-thirds the class so, and a bunch are on IEPs and a couple, three or four are ESL so it’s really difficult to get them involved, the only time I really have them involved is when hooks, it seems like they’ll tell me what they’re thinking but, to figure out how to make rote memorization lessons more interactive or applicable to real life, so imaginary numbers, I mean I don’t really know how to make that lesson interactive at all, and I really struggled with it at first but, and then for students to stay in their seats and busy until the bell rings, cause it’s driving me nuts

Figure 136: Derek, 02042011, small group, lines 83-90 (L.42)

You have great “wait time” and you also never let students off the hook with only giving you one simple answer. Several times you waited and students spoke up or you kept asking “who got a different answer?” You had to ask this like four times but you eventually got them to give in and give different answers. I thought this was great. Try to get more class participation. I know this was your first day teaching so that makes it very hard. I thought it was great that you got the one student to come to the board. See if you can get more!! Some times it seemed as if you moved on before the class had the full understanding. (I know you were crunched for time and had to move very quickly) Maybe try using a flash assessment or asking somebody to come to the board and demonstrate what you just went over. Just because you ask if everyone understands and nobody says anything, does not mean that they all understand. It usually means the opposite. (When you are crunched for time it makes it tough though). Try to get away from the board more. This may help with your classroom management as well. With your large class it may help to teach from the back of the class some if you can (but this requires student participation). I’m not sure if you have a wireless smart board pad, but if you do this is a great way to get away from the board.

Figure 137: Derek, 02082011, peer critique of Jacob (L.43)
My two main goals for the quarter were to get all students involved equally in class and to come up with effective ways of promoting learning with the ELL students that I have in my second period class. I think the first one is a lot easier of a goal to accomplish and I have started to make progress on it already. The first thing that I wanted to do was to see what students I was calling on the most so I began carrying around a class list and marked who I called on. I did this for 2 days in a row and found that I called on every student in class except for five. I had not called on the same five students either day. This kind of shocked me, and was really ironic to me. I knew that I was keeping track and yet I still had not managed to call on these students. Two of the students are ELL students and the other 3 students are lower-level thinking students who are absent a lot. I tried to come up with a reason of why I wasn’t calling on these students. The best thing that I could come up with was that I thought they were too shy or that they were behind from absences and wouldn’t know the answer. Both of these reasons are terrible excuses for not calling on these students. So I began to try and call on these students more, but they refused to give answers or participate in interactive class activities. Often when I called on them they acted as if it was punishment, which was exactly the opposite of what I wanted them to think. I tried to put myself in their shoes and understand their feelings. I then realized that maybe I need to start getting them involved more with the reviews at the beginning of class and the hooks, where we are using information they have already learnt and are more comfortable with it or the answers are just opinions. I think the big problem is they feel that their answers are going to be wrong and would rather just sit there then say something and “look stupid.” I have been doing this for about a week now and they seem to be slowly participating more. I can almost always get two of them 2 say something either during the beginning of class review or the hook. I am going to continue to keep trying to have these students participate, but it is a very slow process. When I have my own class I will definitely make sure I am getting everyone involved in class from the very beginning because then it will be expected by the students, but if students are struggling to get involved I know that I need to start the participation with easier stuff such as hook answers or review questions so that the students feel confident in their answers. I still need to work on this but hopefully by the end of the next four weeks I can say that I have all my students participating equally.

The second main goal was to promote the learning of the ELL students in my second period math class. I knew going into teaching the class that I was going to have to differentiate my lessons so that the ELL students could learn just as effectively as the other students, I just didn’t really know how. It seemed so easy when I was thinking how I would do it, but have found out the hard way it is much more difficult than what I assumed and requires tons of patience. It is really frustrating because the ELL students are actually very smart it is just the fact that the language barrier is preventing them from displaying their true talents and knowledge. I realized that I needed more help and offered the question of what to do to help these ELL students to my classmates. None of them really had an answer so I talked to [a resource at the university that Jenny suggested] who had a lot of really good ideas. I have not had a lot of time to try and implement many of these yet, but I plan to within the next few weeks. One of her ideas was to use group work and to make the ELL students be the speakers for the group or to just assign roles to the group to make the ELL students accountable. She also suggested letting the ELL students make a vocabulary journal with their own way of defining certain math objects or symbols. She said that word walls are not effective for ELL students because they are just words that they don’t know hanging on the wall. I think this is a common misconception because this is one idea that [my mentor] suggested I do. [The university resource] also said any type of manipulative or hands-on action that they can use is greatly beneficial to the ELL students. I plan to use all of [the university resource’s] ideas in my upcoming lessons. I am really trying to experiment with a lot of techniques so I can figure out what works best because I know I am going to be teaching ELL students a lot in the future. I still fear that without a lot of one on one individual instruction these students are going to keep falling farther and farther behind. I think if I could start this quarter over again I would spend some time each class period that I was observing with the ELL learners to figure out what methods worked best for them and to ask them what I could do to help them. For instance, one student told me that it really helps her if I talk a lot slower and repeat myself. Because of this I often give the class instructions and then walk by her and repeat them much slower. I also realize that I need a lot more practice of working with these students before I can consider myself “effective” at promoting ELL student learning. When I have my own classroom I will definitely try and talk with my ELL students, their parents, and prior teachers to get an idea of what learning methods work best for that student. In four weeks hopefully I can
My classroom is a classroom in which every student participates regularly and often. Secondly, I found many effective ways of promoting learning in ELL students.

Figure 138: Derek, 02152011, goals reflection (L.44)

[My mentor] and I both taught my lesson together to first period. It did not go real well because [my mentor] and I have very different styles of teaching. There were several times where I was giving the class time to think and [my mentor] would jump in and give hints making the students not have to think much at all. We only had like 25 minutes to teach so that was like 12 minutes for each of us to talk and demonstrate stuff. I stayed at the back of the room most of the time and [my mentor] was at the board writing. I seemed to be asking more questions to the class than what [my mentor] wanted at times. This co-teaching experience was very different from the co-teaching experience I had in fall. This could have been because we were not very prepared since we just came up with the plan this morning.

Figure 139: Derek, 02222011, lesson reflection, (L.45)

Last week of school was a great week for me. Two days I didn’t have my class do worksheets and I think both classes went very well and I think the students liked it much better. They were actually shocked when I said, you get graded on participation today and not on any worksheet. I have also had several new students coming to the board. I think that only five students have not been to the board at all.

Figure 140: Derek, 02272011, blog post (L.46)

Today’s lesson on applying Pascal’s triangle to the binomial expansion went pretty well. The students had a great review session at the beginning of class which they pretty much conducted on their own. I thought this was great because they were asking good questions of each other and at one point they had a debate as to what to do when it was (x−y)³ instead of (x+y)³ which was great because that was the topic for today. They were really confused but I ran with it. I used (x + 2)³ as an example and asked how this would relate to (x−y). The class easily saw that they can just replace 2 with negative y. They also saw that at the end the negative sign alternates and they found the majority of this without much help from me.

Figure 141: Derek, 03012011, lesson reflection (L.47)
I had something really annoying in placement the other day, half of my class was out the day before when I was teaching synthetic division because they had a senior class meeting during second period, so, I went ahead and taught my lesson anyways, and then cause the next day they were just supposed to practice it, but so then I ended up teaching it again, but my goal was to let the kids teach the lesson basically that I had done the day before and so I went over a couple examples to get everybody refreshed and then, I was like who wants more examples and of course all the kids that weren’t there raised their hand and I was like that’s fine we’ll go over more examples, we’ll even go over some on your worksheet but, I’m not gonna talk, the students have to do all the talking, so I just went to the back and sat on a desk and was letting them do the talking, so the first example went through and it was perfectly fine, there was four students that walked everybody through it, and then the second one was a little bit harder, I don’t know if there was a minus sign or something, but something was given them problem, and the inclusion teacher was in there with me and my mentor, and my mentor has this tendency, and I talked to Jenny about it, and maybe I’ve told you guys, but she automatically corrects people when they’re at the board so, one of the examples is like if there’s a minus sign that needs distributed through, as soon as they don’t distribute and they write plus and it should be minus, she goes, EH!, so then real quick they erase it and put minus, but they don’t learn anything, there’s absolutely no learning going on they just switch it because she made a stupid noise, literally, and so, we talked about it and she hadn’t done it in a long time and I told Jenny it was gone, she quit doing it, I’m like yes you know, so, they start struggling yesterday and she starts talking, and I’m like, only the students can talk, so she kind of was quiet again, I didn’t say it in a bad way I was just reminding her you know, and so then she was quiet and the students started talking again and what the students were saying, one student was saying it wrong and the other student was saying it right, and they were debating and working it out, and it was getting somewhere it was just taking a little bit, and she was too impatient, right away she’s like, [this student’s] right, that’s not right for this reason, and the inclusion teacher was even like, only the students can talk, and my mentor was like, well I’m a student in this case, so then the rest of the class she acted as if she was a student and walked the students through the problems, I was so fed up, I didn’t even say, I didn’t say a word to her afterwards and she didn’t say anything to me about it either but it was, because it’s just so obvious that the students aren’t learning anything when she’s just telling them exactly what to do, yeah, she teaches all at the board, her back’s to the class most of the time, it’s real traditional and just, she goes through it and, I didn’t notice it until I started teaching and I like to just step back and let the students make mistakes and then, not embarrass them but a lot of times even let them go to their seat and then okay let’s talk about this, like, what do you think is wrong, you know we all learn by making mistakes and I think that’s one of the best ways is to point out a common misconception in front of the entire class, you know cause if she’s doing it, chances are, 15, 16, other people in the class are doing it, but, they don’t get any opportunity to look at their mistake when she goes, EH, first of all that degrades them, and second of all they don’t learn anything, so, all of sudden she just felt the urge to, she’s just very, she had a real hard time at the beginning, giving her classroom over to me, cause she, it was her first time working with the program, so, she constantly, I always say she wanted to touch stuff, she constantly wanted to you know, make sure everything was good and she really struggled to give me some freedom, and then once she saw that I could do it, she kind of gave up, but yeah, in the last few lessons, she’s really, and I think it’s because she knows she’s gonna go back to teaching the way she taught, not the way I taught, so, and the last three lessons I wasn’t allowed to use the worksheets that I made, I had to use hers, and I can see kind of why because it was for grading purposes but, the questioning was entirely different from my worksheets to hers.

Figure 142: Derek, 03112011, small group, lines 134-213 (L.48)
I would like to know is every, like the videos that I remember, they’re always just in their seats, she’s up there asking questions, she calls on one person, they answer the question, I mean, obviously that’s fun and that’s really pressure-filled and but, I just feel like there’s so many more ways that you can get class involvement and class participation without, I mean, get them up out of their seats and okay, so if that person’s at the board or working on a poster or whatever, if they get stuck let them call on a student and then, everybody wants to help that student or, I don’t know, I think she can do a lot more, I mean I think she’s a good teacher but I think she can do more to make her class more participatory.

Figure 143: Derek, 03112011, small group, lines 384-394 (L.49)

part of learning, or part of a students’ learning, or a lot of a students’ learning is set up through classroom management, and if your classroom management is set up on a lot of group, or group/student participation in front of the class then you have to hold them to that standard, if they’re expected to talk in front of the class then you need to stick with your guns and say that everybody is, because if you let just that one student go, there goes a bunch of your classroom participation for the rest of the quarter, because in a typical class you’re probably gonna have 6 or 7 students that like to volunteer, you’re gonna have 7 or 8 students that will volunteer if you call on them and then you’re gonna have those 3 or 4 students that don’t want to do anything, like they don’t wanna do it, but if you let one of those 3 or 4 not do it, then those 6 or 7 that used to volunteer when you called on them and made them, now they know that all they gotta do is sit there and go, I don’t know.

Figure 144: Derek, 03112011, small group, lines 505-523 (L.50)

The winter quarter [placement] was a great experience. I got the opportunity to work with a ton of diverse students. I really liked getting experience teaching the "lower-level" class that I taught 2nd period. It had several IEP and ELL students and gave me a lot of needed experience in how to adapt my teaching to make it the most effective for those students.

I had originally thought that I was going to have a problem with classroom management since I didn't have much of a discipline routine that I could use as giving detentions and other things like that was frowned upon. But I really had no discipline problems and the students really respected me and my authority. I will still make sure in "my classroom" that I have some type of discipline guide that I can use to make students be held responsible for their actions. I didnt really like the way that my teacher's classroom was ran and I worked hard to make my classroom have "my own feel to it" and I think I successfully did this and turned a very non-constructive teaching classroom into a constructive, student-centered classroom. Overall it was a great experience, but i dont think it would be my ideal teaching place. For the spring quarter, back at [my fall placement] I really want to focus on getting maximum participation out of ALL of my students. I know this is probably not quite possible, but I still want to work towards it. I also want to try to use more informal assessments and pre-tests/quizzes as I havent had much experience working with those yet.

Figure 145: Derek, 03192011, blog post (L.51)
The Honors lesson went really good. I was glad that I made it into a problem solving lesson because the kids worked really hard to find the answer rather than just taking notes. The students liked having the freedom to find the surface area using whatever tools and methods they wanted. I was also glad that I anticipated students saying “length times width times height” and had a cylinder ready to hold up to ask ‘what is the width of this?’ It got the point through that we needed to use something other than l times w times h.

Figure 146: Derek, 04132011, lesson reflection (L.52)

Honors 7 lesson was a great lesson today. The kids loved trying to figure out how to manipulate the odd shapes to make them into a shape that they know how to find the volume. I was glad I didn’t just give the students the formulas and made them work for them because it kept them busy and interested the whole period. I also had a great tangram warm-up that the students really liked and connected very well with today’s lesson. Lastly, I was glad that I didn’t just give the trapezoid formula because we ran out of time and instead let the students try and figure it out for homework. (05182011, lesson reflection)

The honors lesson was a little bit slow paced today. The review section at the beginning took longer than I expected and we had a lengthy discussion about how to find the area of a trapezoid. I think students were struggling to visualize this so I had them draw trapezoids on their paper and gave them scissors to cut it out and trace it and prove it. I think this really helped students. The geogebra once again helped students visualize this even better. (05192011, lesson reflection)

Figure 147: Derek, 0519/05182011, lesson reflection (L.53)

The lesson was not a good lesson. I thought that the students had a better idea of how to make equations based off of information given, but they definitely did not. I had to stop the group activity to have more of a class “discussion lesson” because so many groups were struggling with the activity and were not making any progress. I had to make all groups fill in their table first because they couldn’t make an equation based off of the information given. Once groups did this they were much better at finding the equation, but it set us back quite a bit and made me decide to not make it a group project as the students needed more practice. If I changed something with this lesson I think I would have pushed it back a day and given students one more day of coming up with equations.

Figure 148: Derek, 04132011, lesson reflection (L.54)

The calculator review was kind of frustrating. I wasn’t really teaching much, but it was something that had to be reviewed. The Pythagorean theorem went okay, but I taught it very methodically and formula based which I do not like doing. I would much rather have students figure the theorem out through constructive thinking. Also, because we were crammed for time I had very little student interaction and it was basically a lecture. I do not like this style of teaching, but under the circumstances it was what had to be done. (04252011, lesson reflection)

Honors 7’s lesson was not constructive at all and was boring for the students, but I couldn’t really think of a better way of doing it. So I was glad that I made a deal with the students. I told them that today’s lesson was going to be a lot of notes and lecturing, but if they paid close attention today we would do much more interactive stuff the next few days. This seemed to help them keep their interest. I also was glad I had a lot of students come to the board to get them out of their seats and moving around a little bit. (05122011, lesson reflection)

Figure 149: Derek, 0425/05122011, lesson reflection (L.55)
This lesson went really well and the students responded to it very well. I thought this was one of my lessons where I was most effective at using several different teaching strategies to get my teaching points through to the students. I allowed them to use manipulatives (of different sizes), they were allowed to work individually, they were required to work as a group, students were asked to go to the board, students had to answer “call-out” questions, when problems were tough they went back to their groups for more support, and they had to review what was learnt at the end of class. I was really proud of the way that I incorporated all of these different techniques into one class.

The one thing that I liked most about this lesson was that I got the students to answer the question why. Why does length multiplied with width multiplied with height give us the volume of rectangular prisms? I didn’t allow the students to use this until they came up with a strategy that did not use length, width, and height directly. I had to remain very persistent with the students and had to allow them numerous amounts of time for discussion and group work, but they eventually got the “layers” idea that I was going for. I was also really glad I used this idea. I think once the students started to grasp it, it turned out to be a very visual way for the students to look at volume.

Figure 150: Derek, 05092011, lesson reflection (L.56)

my mentor both quarters doesn’t put a big emphasis on homework, and at first I was little caught up in the air about it but, just the fact that, and she has homework every night it’s just not graded, which was really strange to me cause I didn’t know what would motivate the kids to do it and mine might be graded next year I don’t know yet but, just seeing how you can have a couple problems and the kids can get more out of two to three problems than they can get out of doing 20 that are exactly the same, that definitely showed me that I don’t need to put that great of an emphasis on homework, I need to put emphasis on the two problems or three problems that I pick and let them go from there, the last fifteen minutes of class would be used for them to do homework, I, my lessons just don’t, I can’t fit everything I want to and still have that time, so that kinda changed as I made my lessons, but group work didn’t change at all, which I’m still a pretty big fan of that, I have to lecture at the front, I remember stopping in the middle of the class and saying I know this is boring believe it or not it’s boring for me too, I don’t like doing this, so I think just having two lessons where I actually had to lecture, I was like god I don’t want to do that anymore, so I think mainly just by doing it and getting in the room a lot of that stuff changed.

Figure 151: Derek, Final Interview, lines 2129-2148 (L.57)