INVESTIGATING THE LOGICS SECONDARY MATHEMATICS TEACHERS EMPLOY WHEN CREATING VERBAL MESSAGES FOR STUDENTS: AN INSTANCE FOR BRIDGING COMMUNICATION THEORY INTO MATHEMATICS EDUCATION

DISSERTATION

Presented in Partial Fulfillment of the Requirements for

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By

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* * * * *

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Teacher communication has been a central topic in mathematics education. In this investigation expert researchers and our national Standards document were used to come up with a description of the mathematics teachers’ verbal communication. The summary states it is a medium for students and teachers to create, organize, and negotiate mathematical thoughts. Further, the verbal messages created by the teacher has students’ thoughts and strategies as the context of the message, and when needed, the teacher redirects or redefines context so that students’ thoughts and strategies can be the focus. The overall goal for the teacher messages is to create messages that provide all students a chance to engage in their mathematical thoughts, in order to promote students’ individual understanding.

This description was then analyzed using communication theory, namely message design logic theory. Message design logic theory describes the construct an individual has for verbal communication. This theory informs us that depending upon the message design logic employed by an individual, a different verbal message is provided, and heard. Three known message design logics have been identified in research: expressive, conventional, and rhetorical. According to the theory, they are developmentally ordered from expressive to rhetorical.

The teacher verbal communication being described by the experts and Standard documents is similar to the rhetorical message design logic, the most advanced construct
described for verbal communication. This study was designed to investigate 1) what message design logics were being employed by secondary mathematics teachers; 2) if any factors could be identified that influence the teachers’ message design logic, for example experience, education, student population, and sex; and 3) how message design logics relate to our current literature on teacher communication.

Other disciplines have used message design logic to inform their communicative practices, for example, group dynamics, doctor-patient, management-subordinate, and organizations dealing with sexual harassment. These studies were used to guide the methods and analysis of the current study.

Fifteen secondary mathematics teachers participated in this study. They varied in experience, education, student population, and sex. Their participation meant taking part in an interview and verifying a resulting member check document. In the interview, participants were asked to respond to two hypothetical, yet realistic, classroom situations. After they gave their message, it was played back and the reasoning behind the parts of the message were provided. Following this, they were asked open ended questions, along with being asked to provide two of their own classroom situations where they felt their communication with the students was successful, as well as unsuccessful. These data, once verified by the participant, were then analyzed using the message design logic theory framework.

It was found that the secondary mathematics teachers employed all three of the message design logics identified in the communications literature: 20% expressive, 53% conventional, and 26% rhetorical. Each of the logics has very distinct characteristics, and depending upon which one the teacher employed, a very different verbal message was
created. None of the factors (experience, education, student population, and sex) listed influenced the message design logics employed by these teachers.

In summary, this study introduces mathematics educators to communication theory not previously considered in our field, message design logic theory. This perspective offers some possible explanation to the difficulties we are experiencing with getting teachers to engage in the more interactive, negotiating communication practices. The results of this study open discussion on the educational practices in the professional development of pre-service and in-service teachers, and how we talk about verbal communication in our field.
Dedicated To
Mamma min,
Hanna Olafsdottir Forrest

Thank you for believing, supporting, and nurturing me
mentally and physically throughout my life.
I love you
ACKNOWLEDGMENTS

So many wonderful people have blessed me as I have been traveling on this dissertation journey. It includes my family, my friends, my committee members, other colleagues, as well as outstanding thinkers in my field. I know I could never list all of you that I am grateful for, but there are some I would like to publicly praise.

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Finally, I want to thank the woman this document is dedicated to, my mother and dearest friend, **Hanna Olafsdottir Forrest**. You supported me when I needed support. You challenged me when I needed to be challenged. I could have NEVER done this without your love, commitment, and support.

I am so blessed to have you all in my life.
VITA

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Visual of Message Design Logics
CHAPTER 1

PART OF A JOURNEY EXPLORING
MATHEMATICS CLASSROOM COMMUNICATION

A dissertation study
Knowing, doing, learning
Sharing with others.
What do I tell?

All life is a journey, and this dissertation documents part of mine. It shares with others the chosen reflections and growth I’ve traveled in my efforts to learn more about classroom communication. In this first chapter, applicable theory and personal experiences are woven to introduce the background for this study. The research questions are presented, and a discussion is provided on the implications for finding answers to these questions. The chapter ends with a brief outline of the remaining chapters.

Background of the Problem

This study focuses on secondary mathematics teacher communication. This topic has been a curiosity of mine since the early 1980s starting in my pre-service teacher training. At first it was more a conscience reflection of my own classroom communication, figuring out how to communicate with students so they would be empowered to share their thoughts and voice. I found myself often thinking about the
influence of my words and relating it to the responses given by students, questioning whether I provided them with the freedom to communicate their thoughts, or entrapped them to respond a certain way. These reflections altered my teaching practices, and opened my mind to further thoughts and questions on how influential the words are when teachers speak to students.

These reflections and thoughts were initiated, and supported, by the publications and research throughout the 1980s and into the 21st century. Mathematics educators, responding to the widespread recognition that the quality of mathematical understanding in our students has been deteriorating, have become more focused on the cognitive and mathematical processes underlying students’ mathematical performance (National Council of Teachers of Mathematics, 1980, 1989; National Research Council, 1989). Specific catalyst documents resulting from this awareness were *An Agenda for Action* (NCTM, 1980), and later *The Curriculum and Evaluation Standards for School Mathematics* (NCTM, 1989). These documents provided new directions in research and practice, specifically in terms of classroom communication.

The first document, released by The National Council of Teachers of Mathematics (NCTM), *An Agenda for Action* (NCTM, 1980), suggested problem solving be more of the focus in school mathematics. Problem solving strategies and common misconceptions became popular in our literature (Collis, K. F., Romberg, T. A., & Jurdak, M. E., 1986; Polya, 1957; Voss, J.F., 1987). Programs were designed and implemented to enhance our students problem solving.

To assist in the problem solving, teachers were encouraged to have students use hands-on tools (manipulatives) and technology to illustrate and/or develop mathematical
concepts and skills (Argenbright, 1984; Fey, 1984). Teachers were also encouraged to have students interact more with one another. It was recognized that teachers alone cannot transfer the mathematical concepts and relationships to the minds of students by merely telling them what they need to know and be able to do. Students needed to build upon what they already understood. They needed to be their own problem solvers and construct their own mathematical understanding.

Cooperative learning/groups and teacher as facilitator also became part of the literature (Davidson, 1985; Johnson & Johnson, 1974; Sharan, 1980, 1984; Slavin, 1989). Other key notions identified were a need for a wider range of assessments, besides conventional testing, (Charles, R., Lester, Fl., & O’Daffer, P., 1987; Collis, K. F., Romberg, T. A., & Jurdak, M. E., 1986; Educational Testing Service, 1987) and educators needing to be more sensitive to our diverse population, considering varying cultures and gender in regards to their learning of mathematics (Armstrong, 1981; Becker, J., 1981; Jones, 1987).

These suggestions imply a different communication than what is traditionally thought about and experienced by most students, and mathematics teachers. Traditionally, the classroom communication has been described as the teacher standing in front of a classroom and presenting the material in a clear, organized, and efficient manner. Student communication was restricted to answering a teacher’s question or requesting clarification. Now, with the emphasis on problem solving, it was suggested that students become more engaged, incorporating their thinking into the discussion, the discussion being between teacher and student, or student and students. These recommendations would be compiled to become part of the historical blueprint.
document, *The Curriculum and Evaluation Standards for School Mathematics* (NCTM, 1989). This document, along with *Assessment Standards for School Mathematics* (NCTM, 1991), *Professional Standards for Teaching Mathematics* (NCTM, 1995), and more recently *Standards 2000* (NCTM, 2000) share a vision for teaching and learning to move our mathematics classrooms into the next century. These documents describe what topics should be taught at the different levels, as well as ideas about how teachers should be teaching these topics, organizing their classrooms, and how learning should be assessed. They became the reference guide for curriculum and instruction throughout our country. These documents also continued to influence classroom communication.

NCTM (1991) lists the following ways a teacher should facilitate conversations in the classroom. Teachers should pose questions and tasks that elicit, engage, and challenge each student’s thinking; ask students to clarify and justify their ideas orally and in writing; decide what topics to pursue in depth from the ideas that students bring up during discussion; decide when to provide information, when to clarify an issue, when to model, when to lead, and when to let a student struggle with difficulty; decide when and how to attach mathematical notation and language to students’ ideas; and monitor students’ participation in discussion and deciding when and how to encourage each student to participate.

As a secondary mathematics teacher, this validated me to keep trying to say what was needed in order to get at the students’ thoughts. It also encouraged me to try various group activities and problem solving approaches. In 1994, upon returning to graduate school, I engaged in a more theoretical understanding of classroom communication, as I continued to read and reflect on the vast amount of literature mathematics educators
produced describing more interactive communication for the classroom. The theme was consistent. Teachers needed to create a classroom of negotiation, that is, students and teachers negotiating mathematical concepts together versus students focusing on the teacher’s thinking and remembering enough to pass the next evaluation.

Research became available showing that students do indeed learn mathematics more effectively when taught in a classroom where they can explore, investigate, reason, and openly discuss their ideas (Hiebert & Carpenter, 1992). These results encouraged mathematics educators to continue to support the more interactive pedagogy. It also made them look further at the teacher role and the barriers that mired this practice.

Teacher change became a dominant discussion in the literature, addressing the particular changes that were necessary for a teacher to incorporate these ideas into their classroom (Cobb, Yackel & Wood, 1991). It was realized that it was not enough just to present teachers with the appropriate materials and methods, as initially may have been assumed. Researchers began to look directly at the impact of existing knowledge and beliefs, realizing that more emphasis needed to be placed on the core beliefs held by teachers. In particular, it was realized that beliefs about learners needed to be challenged, that is, beliefs that students were learners with pre-existing ideas and not empty vessels waiting to be filled (Cooney & Shealy, 1997). Beliefs about instruction needed to change towards developing student thought rather than covering the text; and the locus of intellectual authority needed to change from teacher and text to one that involves students (Cooney & Shealy, 1977). Teacher communication is influenced by all of these ideas. It continues to be a central topic of discussion.
Throughout the 1990s and early 2000, our literature continued to inform pre-service and practicing teachers on methods of instruction and knowledge that were consistent with this type of instruction. These ideas have been included in the teacher literature, as well as incorporated into teacher training and professional development. In summary, during the past two decades, mathematics educators have explored and explained a vast amount of data on mathematics learning and teaching. There seems to be an assumption that as long as we continue to research and inform teachers about this, eventually the communication being encouraged will take place, and it seems logical that this will be the case.

What we have learned is that teachers are hearing the messages, yet the recommended changes are not being implemented in the classrooms. This became most evident when the Third International Mathematics and Science Study (TIMSS) report was released. TIMSS has been identified as “the largest, most comprehensive, and most rigorous international study ever conducted. Students from 41 nations were tested in 30 different languages at three different education levels to compare their mathematics and science achievement” (US Dept of Education, 1997, p. 3). This study helps our country look at the “quality and effectiveness of U.S. education … [by] comparing our results with those of other countries, and thereby providing us with a solid basis for judging our performance” (US Dept of Education, 1997, p. 1).

The report indicated that our country’s eighth graders scored slightly below the international average in mathematics, ranking 25th (of the 41 countries) in mathematics content, but our 12th graders were among the lowest of the participating nations. In general, our eighth grade students correctly answered 53% of the questions asked. This is
in comparison to the top two countries, Singapore and Japan, who had students answering correctly 79% and 73% respectively.

The TIMSS study also reports that “78% of the topics covered during the eighth-grade U.S. lessons, procedures and ideas were only demonstrated or stated, not explained or developed. And 96% of the time that students were doing seatwork, they were practicing procedures they had been shown how to do” (Heibert, 1999, p. 11). This describes a pedagogy very different than the one preferred in the *Standards* documents. It describes more the teacher as dispenser of mathematical knowledge, the more traditional approach to teaching. Interestingly enough, the *NCTM Standards* recommendations closely resemble the mathematics teaching commonly found in Japan, who on average had 73% of their students figuring correctly on the international mathematics assessment (U.S. Dept of Education, 1997).

Other interesting and informing statistics coming out of this report are “Ninety-five percent of U.S. teachers stated that they were either ‘very aware’ or ‘somewhat aware’ of current ideas about teaching and learning mathematics” (Klein, 2003, 202 – 203). And, U.S. teachers actually believed that their lessons were already implementing the reform recommendations, even though the findings in this report suggest that their lessons are not. “Over 80 percent of the teachers in the study referred to something other than a focus on thinking, which is the central message of the mathematics reform movement. The majority of the teachers cited examples of hands-on math or cooperative learning, which are techniques included among the reform recommendations. However, these techniques can be used without engaging students in real mathematical thinking”
These findings suggest that teachers may not actually understand what mathematics educators have been trying to promote in the last decade.

There are instructional habits and attitudes that are moving in the right direction, but teachers are only implementing isolated techniques rather than the central message, which is to focus lessons on high-level mathematical thought. Research needs to continue addressing the difficulties, and successes, of this implementation. We currently have a clearer understanding of the many details that go into implementing such a reform and the difficulties with that change, due to the impressive, past work of many of our researchers. These explorations need to continue to inform educators, and at the same time, there is a need to step back and look in broader contexts for more explanations and understanding to why the central message of the reform is being denied in our classrooms. Are there assumptions being made about what needs to be challenged? Is there knowledge used in other disciplines that could inform, guide, and further our understanding? Teacher communication is one area where these types of questions should be asked.

Statement of the Problem

Teacher communication described by mathematics education experts is not commonly found in U.S. classrooms (Goos, Galbraith, P. & Renshaw, P., 2002). This is even after two decades of teachers being provided with research-supported explanations and tools to incorporate this type of communication. Though there are some noted signs of improvement, in general this task has not been accomplished. Not because teachers are resisting or do not believe in the ideas being promoted. They actually believe, to a large degree, that they are teaching in the desired approach. Mathematics educators need
to continue asking where does the message break down from publications to implementation? There are other questions that come to mind as well.

Is there something specifically about communication that we are overlooking? Are we assuming that teachers naturally have this ability to communicate in the manner we are describing? Is it enough that we describe it, and they can recollect and employ it as needed? We have ample evidence to suggest that existing knowledge and beliefs of mathematics, pedagogy, and learning can hinder the implementation of our suggestions, but maybe it is time to consider other perspectives and resources. For example, when it comes to communication, how can the communication literature inform us about the act of communicating? Is there knowledge in the communication literature that we can use to help us understand and investigate classroom communication? Can we clarify the constructs teachers’ hold for communication?

It turns out, there is a vast literature base in interpersonal communication that explains why and how individuals communicate. According to the published communication theory, individuals do indeed have different premises about the act of communicating, and the individual uses these thoughts to guide the process of reasoning from goals or intentions to actual messages. A message design logic is the term used in the communication literature to describe these explicit and implicit thoughts of communication (O'Keefe, 1988). Researchers in communication have identified three very different message design logics used by individuals. These message design logics describe the fundamental premise for communication, the key reason messages are produced, the relationship between context and the messages produced, how the
individual manages the interaction with the other, and finally how the interaction is evaluated as successful, or not (O’Keefe, 1988).

Could a teacher’s message design logic provide some explanation to this on-going research agenda to explain the break down from the described interactive communication to actual classroom implementation? We currently do not know about the logic mathematics teachers’ use when creating messages to students, or the impact the message design logic has on a teacher’s communication.

This study was designed to investigate these ideas. In particular, it was designed to gain insight and understanding to the thoughts, or message design logics, secondary mathematics teachers’ employ when they are asked to construct verbal messages for students. This lays the foundation for possible connections between the communications literature and mathematics education. This connection is important because there is a considerable amount of knowledge regarding the act of communicating found in the communications literature, and establishing this connection would allow mathematics educators to seek there for advice. What can we learn from their knowledge base to assist us in our current reform?

The communications literature could serve our field with a foundation that we have not considered. Other professions have considered message design logic in their field, namely in doctor-patient relationships (Lambert, B., Street, R., Cegala, D., Smith, D., Kurtz, S. & Schofield, T., 1997); management-subordinate (Peterson & Albrecht, 1996); and group dynamics (O’Keefe, 1990). These studies were used to guide in the design and implementation of this study.
Research Questions

Teacher communication is the focus of this investigation. In particular, it aims to explain the logic and thoughts secondary mathematics teachers’ employ when they create messages for students. This is a notion described in the communication literature as an individual’s message design logic. It was hoped that this information would provide mathematics education researchers with a deeper understanding of teacher communication, as well as open the door to the communications literature, which may help us explain why the more interactive pedagogy is not being found in as many mathematics classrooms. The specific research questions used in the design and implementation of this study follow.

1. What are the message design logics being employed by secondary mathematics teachers?
   a. What is the fundamental purpose for the secondary mathematics teachers’ verbal message to students?
   a. What are the key reasons teachers give for their messages to students?
   a. How do the secondary mathematics teachers take students into account in their message?
   a. How do the secondary mathematics teachers evaluate their verbal message as successful, or not?

1. What factors influence the message design logic? In particular, how does experience, education, student population, and sex of the teacher relate to the type of message design logic being used? What other factors may be influential?
1. How do these message design logics compare with the existing teacher communication literature in current mathematics education reform efforts?

Significance of the Study

The answer to these questions provides mathematics educators with a different perspective for understanding teacher communication, specifically it provides descriptive accounts of various logics used by secondary mathematics teacher’s when they create messages for students. This information extends our knowledge base in the area of teacher beliefs, teacher change, and more specifically teacher communication. It also establishes a connection between communication theory and mathematics education.

Up until now the focus has been on clarifying classroom communication and providing teachers with necessary skills and tools to incorporate these ideas in classrooms. Though these types of studies and information need to continue, it is also time to take a more in-depth look at communication and the act of communicating.

The act of communicating is described in depth in the interpersonal communication literature. Mathematics education researchers can benefit from the knowledge gained from this scholarly work; it broadens our scope of understanding, and provides some explanations that we may not otherwise consider. Integrating ideas from the field of communication and mathematics education is significant.

Providing mathematics education researchers with additional factors to take into account when informing and training teachers to implement more interactive pedagogy is important. Since an individual’s message design logic will strongly influence what is said by a teacher, this is a topic that needs to be investigated and better understood. This study lays the groundwork for this line of further research.
Researchers interested in teacher beliefs and teacher change will find this information beneficial as well. This study explains teacher beliefs about communication. I believe these beliefs, if not addressed by educators, will hinder teacher change because, as the communication literature indicates, individual’s have constructs pertaining to communication, and these influence what and how messages are created and heard by an individual. Communication is fundamental in education, some say teaching is communication (Sierpinska, 1998). We can no longer assume teachers have this natural ability to communicate in the manner being described. Recognizing the differences in communication constructs could be used to inform future professional development for in-service and pre-service teachers.

A final significance may be more personal in nature, at the moment. This study lays the groundwork for my future journey in research and practice. My hope is that the results of this study will increase scholarly discussion about classroom communication, and inspire others to continue on this research agenda. Our goal as mathematics education researchers is to constantly improve what is happening in our classrooms. Communication has a huge role in this process. The teacher’s communication plays a big part in this communication.

Organization of the Study

This chapter has presented background information leading up to the current investigation, statement of the problem, research questions, and significance of the study. In order to formally research these questions, guidance for the design and implementation was found outside our field of mathematics education, specifically in the interpersonal communication literature. This choice is further explained, supported, and validated in
the next chapter. In summary, Chapter 2 contains the framework, along with the review of related literature. A detailed explanation of the methodology and procedures used to gather data for the study are presented in Chapter 3. The results of analyses and findings that emerged are contained in Chapter 4. Chapter 5 contains a summary of the investigation and findings, along with further conclusions that can be drawn from the findings. Finally, Chapter 6 is a personal summary of this researcher’s experience, and some words of wisdom for others going through this process. Though this chapter is described as “optional”, it has proven to be just as important for my personal growth as the previous chapters. It allowed me to place many of my implicit thoughts in writing, which helped clarify this process even more. It provides a nice closure to this part of my journey.
CHAPTER 2

COMPILING SCHOLARLY RESOURCES: THEORY AND RELATED LITERATURE

Historically situated decisions.
Choosing, describing, applying
Crafting it to meaning.
Whose perspective is shared: mine, theirs, or ours?

The applicable theory to any research study, be it implicit or explicit, is limited to the knowledge base of the researcher, in other words, the mindful constructs the researcher has developed through reading, experience, and reflection that implicate to the notion being investigated. For this study, I invited message design logic into the mathematics education research literature. That is, I investigated the logics secondary mathematics teachers use to create verbal messages to students. Presenting this knowledge to mathematics education establishes a connection between communication theory and mathematics education. It allows us to begin relating teacher communication to ideas within message design logic theory.

This chapter begins with descriptions of the desired teacher communication. Afterwards, a reference model is presented that identifies key characteristics of a mathematics teacher’s verbal message to students, according to our documentation. Included in this discussion is research that has been done in mathematics education to
inform us about teacher communication. This is followed by an introduction of the interpersonal communication literature focusing on message design. The last part of the chapter bridges the two disciplines, mathematics education and interpersonal communication, specifically linking message design logic theory with the current recommendations being made for a teacher’s verbal messages. To do this, the reference model developed in the first part of this chapter is discussed in terms of the interpersonal communication literature. This discussion results in a general template for describing a mathematics teacher’s message design logic. Finally, this chapter concludes with this researcher’s reflection, making explicit limitations and assumptions noted at this time.

Descriptions of Interactive Mathematics Classroom Communication

The mathematics education literature provides us with a thorough description of the desired teacher communication. In this section, I mainly focus on four sources. These sources have served as the foundation by other researchers who have studied these ideas further. The first source is the Communication Standard found in the *Principles and Standards for School Mathematics* (PSSM) (NCTM, 2000). This is followed by three descriptions of the mathematics teacher communication provided by widely known researchers in our field. These researchers are all well-published and have spent much of their time and energy providing our community with both scholarly and practical literature about what is important and needed in our mathematics classrooms. It has been both informative and valuable to our community, providing us with knowledge, skills, and tools so that more of us can implement the reform ideas in the classrooms.

The purpose for these descriptions is to identify key characteristics of a mathematics teacher’s verbal messages, as proposed by our current reform efforts. These
characteristics allow for a model of reference to be developed. This model of reference provides a framework for discussion within the communication literature. That discussion takes place after the communications literature is introduced and explained later in this chapter.

*PSSM Communication Standard*

The Communication Standard clearly states the importance of communication in the mathematics classroom, providing the following expectations. “Instructional programs from pre-kindergarten through grade 12 should enable all students to: organize and consolidate their mathematical thinking through communication; communicate their mathematical thinking coherently and clearly to peers, teachers, and others; analyze and evaluate the mathematical thinking and strategies of others; use the language of mathematics to express mathematical ideas precisely” (p. 59). PSSM goes on to further explain these expectations.

They suggest that students can organize and consolidate their mathematical thinking through communication. There needs to be ample opportunities for students to participate in whole class discussions or small group discussions and activities to practice. As part of these discussions, students should be asked to present their methods of solving problems. Included in this presentation are justifications for their reasoning, as well as questions they have if something is puzzling to them. This allows students to test their ideas on the basis of shared knowledge in the mathematical community of the classroom.

Analyzing and evaluating the mathematical thinking and strategies of other students has several benefits. Students profit from seeing possibly a different view than
their own, which may reveal a different aspect of the problem, or it can be validating for them to see their own thoughts expressed by another student. Students should actively participate in sharing and analyzing one another’s strategies in solving mathematical problems. The strategies are the objects of discussion and critique.

It is crucial for students to use the language of mathematics to express mathematical ideas precisely. But, this formalization should not be rushed. They need to have an understanding of the concept first, so they can use the proper conventional mathematical vocabulary, within their own words.

These above paragraphs summarize the Communication Standard, as stated in NCTM’s most recent standard document, PSSM. This Standard identifies the predominant reason for a teacher’s verbal communication is to get students to create, organize, and negotiate their mathematical thoughts, and it is the students’ thoughts and strategies that create the context for the verbal communication. Activities and mathematical problems are tools used to initiate and engage the mathematical thoughts of students, which then provides a theme for verbal communication. The goal for verbal communication is getting as many students as possible being able to express their mathematical thoughts, in order to promote individual understanding.

So what does this specifically mean for the verbal communication of the secondary mathematics teacher? This implies she, or he, must create messages that allow this dynamic negotiation to take place, and that she use the students’ thoughts and strategies as the context of her messages. Further, her messages serve to validate, redirect, or extend student thoughts. In summary, the goal for her messages are to inquire
about student thought, and then say what is needed to relate, build upon, and influence these thoughts. The teacher’s communication is successful when this takes place.

Next are descriptions of the reformed communication from well-known researchers in mathematics education. Their work is used to support, and enhance, the ideas recognized above from PSSM. The particular researchers are James Hiebert, Thomas Carpenter, Elizabeth Fennema, Paul Cobb, Terry Wood, Erna Yackel, and Debra Shifter. These researchers have supported mathematics educators with the knowledge and skills needed to implement this classroom communication since the beginning of this reform. They have written numerous books and articles, collectively and individually. The first two descriptions are presented as a group of these researchers since they often co-authored in the articles and books, along with other researchers and educators. They are associated with common projects, and therefore promote similar messages. The first group is Hiebert, Carpenter, and Fennema, and the second one is Cobb, Wood, and Yackel. Debra Shifter then provides the final description. These researchers will be quoted as much as possible to give these passages their voice, and not let it just be my interpretation and re-wording of their work. After this literature is shared, a reference model is presented that describes the desired characteristics of a mathematics teacher’s verbal messages.

**Educators: Hiebert, Carpenter, and Fennema**

James Hiebert, Thomas Carpenter, and Elizabeth Fennema, along with other colleagues have written books and articles individually and collectively (Peterson, Fennema, & Carpenter, 1989, 1991; Carpenter & Fennema, 1992; Hiebert & Carpenter, 1992). In one particular book they co-authored with others (Heibert, Carpenter,
Fennema, Fuson, Wearne, Murray, Olivier, & Human, 1999), they inform us how reflecting and communicating are critical features of mathematics classrooms in this reform. For them, communication involves “talking, listening, writing, demonstrating, watching, and so on. It means participating in social interaction, sharing thoughts with others and listening to others share their ideas (Heibert, J., Carpenter, T. P., Fennema, 1997, p. 5). The teacher is the one responsible for creating and establishing this classroom communication.

“The most important role for the teacher becomes creating a classroom in which all students can reflect on mathematics and communicate their thoughts and actions. Clear explanations and demonstrations from the teacher become less important than explanations and demonstrations by students. This is a different way to think about teaching” (Heibert, Carpenter, Fennema, et.al., 1997, p. 29).

Discussion plays a critical role for the teacher and student as they focus on the mathematical methods used. “No one should be tied too closely to their own method, but should be looking for ways to improve it. Engaging in open, honest, public discussions of methods is the best way to gain deeper understandings of the subject” (Heibert, Carpenter, Fennema, et.al.,1997, p. 39). The idea here is for the teacher to keep the conversation focused on the students’ methods, and when necessary redirect the conversation back to the students’ thinking. In addition, they recognize how important it is to open the dialogue and have everyone listen to multiple perceptions of whatever is being discussed.

This is beneficial for both social and intellectual reasons. “Intellectually, it is the best way of focusing students’ attention on what is mathematically important and
encouraging them to reflect on mathematical relationships. Such activity is essential for building understanding in the classroom. Socially, it establishes a common goal toward which everyone can work and to which all can contribute” (Heibert, Carpenter, Fennema, et.al., 1997, p. 39-40). A common, shared goal becomes the initiative of the conversation, and students and teacher working together to obtain that goal.

This changes the authoritative position of the teacher. Teachers in this setting are still held responsible for the safety and welfare of their students while in the classroom. They are also responsible for the managerial aspects, but as far as instruction, their responsibilities lie in establishing the tone and classroom culture where students can reflect and communicate about mathematics. Their responsibility is to take the initiative to work with students toward the shared goal.

These researchers emphasize much of the same ideas as described in the previous Standards discussion. Namely, the purpose of the teacher’s verbal communication is getting students to create, organize, and negotiate mathematical thought. They also emphasize the important role of the teacher in redefining and redirecting the conversation, when applicable. Even though it is true that the student thinking is what creates the context of the conversation, there are times when the teacher must redirect or redefine where the conversation is going.

These researchers raise the issue of authority and classroom culture, and they mention how these influence the communication in the classroom. In a classroom where there is a shared mathematical community, the teacher has a less direct role of authority, or dismisses that authority during the learning conversation. The teacher establishes the culture by her actions and words.
The next section shares the expertise of Paul Cobb, Erma Yackel & Terry Wood. They too have been widely published in our field, together and with others (Cobb, Wood, Yackel, 1990, 1993; Cobb & Yackel, 1995; Cobb, Yackel & Wood, 1992, 1993; Wood, 1995; Cobb, Wood, Yackell, & McNeal, 1992). Once again, their voices are going to be used as much as possible, so the text does not represent my interpretation of their words.

Educators: Wood, Cobb, and Yackel

This group of well-known mathematics educators and researchers, Terry Wood, Paul Cobb, and Erma Yackel, share their expertise and reflective wisdom on how to coordinate a constructivist view of learning into practice. A constructivist view implies a “view of learning mathematics in which problem solving, reasoning, and communication are essential aspects ... mathematical learning is defined as constructing relationships, and in which communicating about mathematics is of central importance, creates opportunities for learning not found in tradition classrooms for both students and teachers. In these settings, teachers have an opportunity to learn about the processes by which children construct their mathematical meanings and the ways in which they as teachers can act to guide children’s learning “(Cobb, P., Wood, T, & Yackel, E., 1990, p. 178 – 179). The student and teacher work as partners in the discourse, developing through the communication complex and sophisticated patterns of interaction.

“Participating in this form of dialogue creates opportunities to learn that occur because students are engaged in negotiating mathematical meaning (Cobb, Wood, Yackel, & McNeal, 1992; Yackel, Cobb, & Wood, 1991). In this situation, children not only engage in talk, where they construct individual ideas about mathematical relationships, but they
also participate in the communal activity of doing mathematics” (Cobb, P., Wood, T, & Yackel, E., p. 179).

Whole class discussion provides opportunities for students and teacher to “engage in discourse in which their mathematical thinking was valued. In this way, children could explain and justify their ideas and also challenge the thinking of others as they tried to make sense of each other’s solutions. This also created an opportunity for the teacher to highlight and validate mathematical ideas to constitute the taken-as-shared meaning of the culture” (Cobb, P., Wood, T, & Yackel, E., p. 185).

These researchers mention the importance of the established social setting needed in order to develop a setting in which the children would feel psychologically safe to express their mathematical thinking and to question other students’ ideas. “The mutual obligations and expectations were negotiated at the beginning of the year by the teacher and the students. These social norms were then subject to renegotiation throughout the school year as they worked to establish understanding mathematics was the goal” (Cobb, P., Wood, T, & Yackel, E., 1993, p. 186).

A particular teacher in one of their studies shares the struggle with encouraging students to make personal constructions or teaching the conventions of the wider culture. “On the one hand, she wanted to facilitate children’s construction of their mathematical meanings. On the other hand, she wanted to guide the development of taken-as-shared interpretations that fit with those of the wider society … she was in a sense, ‘walking a tightrope.’ … A highly sophisticated form of practice developed over the course of the year, as the teacher became skillful in facilitating discussion in which mathematical
meanings were negotiated while avoiding the precariousness of over direction and intervention.”

Focusing on the actual verbal messages of the teachers, these researchers reiterate a common theme, namely the focus being on the students’ thoughts and strategies, and using the verbal communication to negotiate their understanding. The teacher creates messages that orchestrate the verbal communication, redirecting and refocusing when needed. These researchers make us aware that this does not happen naturally. These researchers provide us with a critical component of the reformed teacher communication, and that is the process of creating the learning environment that enables this interaction to take place. Their work has focused on the process by which teachers and students negotiate a ‘mathematical community’ in which mathematical understanding is constructed by all the participants (Cobb, Wood, & Yackel, 1993; Cobb & Yackel, 1995; Cobb, Yackel & Wood, 1992).

For example, they discuss the importance of students feeling psychologically safe in speaking out loud their thoughts. It is important for the teacher to establish this safe place for this conversation to take place. The teacher also establishes norms for the social interaction, making sure everyone emphasizes and respects students’ mathematical thinking. These classroom norms, exercised by the teacher and students, inform the classroom culture. They also indirectly influence the teacher’s verbal messages, so this notion was noted as an umbrella idea, and will be discussed in light of the findings of this study on the actual verbal messages of teachers.

The final researcher is Debra Shifter. She has a strong reference list of books and articles, written alone and with others, that focus on implementing this reform (Schifter,
1993, 1996a, 1996b; Schifter & Bastable, 1995; Schifter & Fosnot, 1993; Schifter & Simon, 1992; Goldsmith & Schifter, 1997). She writes predominately about this reform in terms of the role of the teacher, which is why her perspective was chosen here.

**Educator: Deborah Shifter**

Deborah Shifter, a researcher and writer from the Education Development Center, Inc. has written books reinforcing the methods of instruction under this reform. Classroom communication is very much a part of her discussion. Many of her books have been written for teachers, as well as research articles for educators. As in the previous examples, I will be using their own words as much as possible so that I can accurately state their view.

“The mathematics education community is beginning to develop a radically revised picture of what kind of instruction should take place in the classroom. Teachers, together with their students, create a culture of mathematical inquiry aimed at developing deep and flexible understanding of the domain. Posing questions, making and proving conjectures, exploring puzzles, solving problems, debating ideas, describing and predicting patterns are all part of the new mathematics classroom (Goldsmith & Schifter, 1997, p. 20)…. The images of ‘reformed’ teaching vary. Our own image of this end point is a form of teaching based on deep understanding of the mathematical ideas underlying the curriculum, beliefs about knowledge as actively constructed by the learner, and the use of teaching ‘moves’ that create opportunities and challenges for students to build deeper and fuller mathematical understanding. … Classrooms are organized around students’ active explorations of mathematical topics, with an emphasis on ‘knowing why’ as well as ‘knowing how’. Instruction is informed by students’
current understandings and requires flexible lesson plans in order to respond to an unpredicted but important question, conjecture, or confusion raised in class. Conversation is discursive as well as informational as teachers and students, together, work to understand mathematical ideas” (p. 25). … In this view, the teacher’s role is to challenge students’ thinking about important mathematical connections, not to preside over mathematical ‘show and tell’ (p. 33).

Debra Shifter emphasizes the same elements as discussed by the previous researchers, encouraging the student voice as the predominant focus for the verbal communication in the classroom. She also reinforces the role of the teacher here, being one that challenges, redirects, and refocuses as needed so students make important mathematical connections. There are strong consistencies in the various descriptions of a teacher’s communication.

Descriptions of the reformed mathematics classroom have been presented according to three well-known groups of published research/educators in mathematics education and our national Standards document. These descriptions specifically note the teacher’s verbal communication aspect of the reform. Using the words of these experts and national document, key characteristics were identified. These are shared in the next section. These characteristics will later be incorporated into a reference model of the encouraged NCTM teacher communication, specifically focusing on the teachers’ verbal messages.

Summary: Key Characteristics of Mathematics Teacher’s Verbal Messages

A mathematics teacher’s verbal message that is consistent with our current reform has certain characteristics. These characteristics define the underlying purpose for verbal
Verbal communication is a medium for students and teachers to create, organize, and negotiate mathematical thoughts. Students’ thoughts and strategies create the context for the teacher’s message, and the teacher redirects or redefines context when needed, to infer students’ thoughts and strategies. The overall goal for the message is to provide all students a chance to engage their mathematical thoughts, promoting their individual understanding.

Further, it was noted by the experts in the previous section that there are other ideas that indirectly influence the teacher’s verbal message, namely

- Classroom culture. The teacher has the important job of establishing an environment, by creating social norms, negotiated with students. These norms should be focused on creating a psychologically safe environment where student thoughts are valued and respected. This environment needs to be promoted as a shared mathematical learning community, where teacher and student together discuss and validate mathematics.
- Authority. The teacher must re-position herself from being the sole informer and evaluator of knowledge, to a shared position with students.

These factors, classroom culture and authority, do indeed influence the teacher’s verbal message, and I agree these factors do provide a valid and important discussion for when this study is embedded in our current literature in chapter 5. But, for the purpose of this current investigation, the focus is on the actual verbal message. Though, a general...
assumption could be made that if the mathematics teacher’s message is one where students’ thoughts are embedded in the message, and the aim of the message is to negotiate the student’s thoughts, then the teacher is working towards creating a culture of a shared community, as well as defining a less restrictive authoritative role.

A third influential factor identified in conversation with Patricia Brosnan, and supported in our literature (Secada, 1992) is the current diversity found in our schools: physical, intellectual, emotional, and social. The research shows that instruction that is adapted to individual student performance and understanding is most beneficial for these diverse populations (Peterson, 1990). This implies the teacher having messages that focus on the individual student performance and understanding. So even though actual messages may be different in various classrooms, which they will be because of the diversity in students, the general characteristics outlined above for a teacher’s verbal messages are still applicable. That is, a teacher addressing a diverse population should create verbal messages focused on student’s thoughts, and use those thoughts to provide a negotiation of meaning to take place amongst the group. The teacher that allows every student to be engaged in this negotiation addresses the differences, and similarities, of the diverse populations in our schools.

These characteristics amplify a change from the traditional mathematics instruction. It requires changes in classroom practice, accompanied by qualitative reorganizations in various beliefs and knowledge (Goldsmith & Schifter, 1997). Hereafter is the literature that recognizes knowledge and beliefs, and the changes that need to take place for a teacher transforming from a traditional instruction to a more interactive pedagogy is presented. This literature is included in the framework for this
study because it validates the importance of knowledge and beliefs in instructional practice, and message design logic involves an individual’s knowledge and beliefs about the act of communicating. This literature will also be referenced in later discussion, when the findings of this study are placed into our existing literature.

Teacher Communication Further Discussed in Mathematics Education

Mathematics educators have documented the difficulty teachers face when trying to implement such communicative practices. The teacher knowledge and beliefs literature informs us that there is a strong connection between a teacher’s beliefs and what happens in the classroom. In particular, “the setting in which the teacher operates influences what is taught and learned in the classroom… [Where setting is] recognized not just as the physical arrangement of classrooms but of what was inside the teachers’ head about mathematics and its teaching” (Cooney, 1999, p. 19).

There is quite an extensive literature base looking at teacher beliefs, including beliefs about mathematics and about the teaching and learning of mathematics. It has been found that teachers specifically have existing knowledge and beliefs about pedagogy (Borko & Linvingston, 1989; Borko, Livingston, & Shavelson, 1990), subject matter (Ball, 1989; Thompson, 1991), and ways the subject matter should be taught (Thompson, 1994, 1997; Shulman, 1987). Pedagogical beliefs encompass beliefs about teaching, students, and learning. These beliefs effect how the teacher conducts classroom management, instructional strategies, as well as influence the classroom teaching environment created. Subject matter beliefs describe how the teacher views the nature of the subject, in this case mathematics, and what does it mean to know the subject. These knowledge and beliefs influence what teachers do in the classroom. Studies looking at
existing knowledge and beliefs have been done in both experienced and pre-service teachers (Bullough and Knowles, 1990, 1991; Cohen & Ball, 1990; Peterson, 1990).

In particular to communication, Alba Thompson found that classroom discourse was very different dependent upon the orientation teachers held for mathematics and teaching mathematics. She describes the orientations as three levels, 0, 1, and 2. Each level varies by conceptions of five characteristics. They are 1) what is mathematics; 2) what it means to learn mathematics; 3) what one teaches when teaching mathematics? 4) what the roles of the teacher and student should be; and 5) what constitutes evidence of student knowledge and criteria for judging correctness, accuracy, or acceptability of mathematical results and conclusions.

Mathematics educators are well aware of a teacher’s verbal communication being effected by a teacher’s existing knowledge and beliefs about pedagogy, subject matter, or how the subject matter should be taught. More precisely, Thompson has noted it can be influenced by the thoughts associated with the five questions outlined above. In the current study, a different angle was considered, and that was to take into account what thoughts influence the actual message teachers create in the classroom. Not the thoughts about mathematics, pedagogy, or the like, but the actual thoughts about the act of communicating. Though with that said, one cannot completely separate these ideas, they are very related and joined in thought, but the goal in this study was to look first at the thoughts about communication, and second consider them in terms of the other ideas already identified by our mathematics education researchers.

The thought associated with the act of communicating is a concept found in the interpersonal communications literature. It is referenced as an individual’s message
design logic. Research investigating message design logics of individuals has found that there are three very different design logics that are employed by individuals, and depending upon the design logic employed, a different message is created. This is described as message design logic theory. This theory is most identified with the researcher and current Dean of Communication at Northwestern University, Barbara O’Keefe, and it is discussed in the next section, along with background information leading up to the development of this theory.

Introducing Message Design Logic Theory to Mathematics Educators

To introduce message design logic theory into the mathematics education literature, I will provide a general overview of the interpersonal communication literature that is relative to message production. This information leads to the details of message design logics theory. Following that, a literature review of studies that have applied this theory is discussed. This leads to an argument for using this theory to study secondary mathematics teacher’s message design logics.

As part of this argument, a reference model for a teacher’s verbal communication will be displayed. This reference model was developed by taking the key characteristics identified earlier, and placing them with the components of a message design logic. The components of a message design logic are described in the theoretical discussion for message design logic. This chapter ends with a summary of this study’s framework for this study.

Overview of Message Production

In my quest to understand the verbal communication happening in the mathematics classroom, my search led me to the interpersonal communications literature. There is a
large body of literature that is grounded in the constructivist frame that aims to relate the
notion of cognitive complexity and/or differentiation with the production of messages.
To adequately share the researched findings of these researchers, the general assumptions
associated with the Constructivist frame in communication will first be discussed. To do
this, a general overview of Constructivism is first provided, relative to message
production. This, by no means, suffices the vast amount of literature available, but
allows a glimpse in order to appreciate the findings that are discussed afterwards. The
specific findings discussed describe the factors these researchers have identified as
significant when studying message production. This leads to a more generalized person-
centered communication, which these researchers have defined as a communication
where the individual adapts to the needs of the listener, accounts for situational
contingencies, and attends to multiple goals. This discussion describes how the above
factors are apparent in person-centered communication. This led to an early study done
by O’Keefe. The results of this study are what led O’Keefe to design another study,
which birthed message design logics theory. After message design logic theory is
presented, a literature review is provided showing how this theory has been used to
inform relationships in other fields, namely doctor-patient (Lambert & Gillespie, 1994;
Lambert, Street, Cegala, Smith, Kurtz, & Schofield, 1997), management-subordinate
(Peterson & Albrecht, 1996), and group dynamics (O’Keefe, 1988).

Constructivism in communication

Communications researchers endorsing the constructivist frame assume that
“individuals interpret and act according to conceptual categories of the mind. Reality
does not present itself in raw form, but must be filtered through the person’s own way of
seeing things” (Littlejohn, 2002, p. 116). It is through this process that an individual creates and understands the messages produced and heard in conversation. According to constructivists,

“social interaction is the vehicle through which conversationalists create and modify their individual interpretations of their social world. Meaning, in short, is constructed via social interaction. Interaction, however, is not equated to communication. Interaction is conceptualized as a negotiation process in which participants present their own views and coordinate their individual actions” (Stamp, Vangelists, Knapp, 1994, p. 194).

Communication is seen as a particular, strategic type of interaction.

Constructivism in the area of interpersonal communication has represented perhaps the most coherent research program in interpersonal communication since the 1970s (Miller, 2002). It has been mostly influenced by the work of Jess Delia (1977) and his colleagues. The particular researchers who have influenced my thinking are Jess Delia, along with Barbara O’Keefe, James Applegate, and Susan Kline. These researchers offer insight into understanding communicative practices of individuals. They also provide us with methods for studying this notion.

Underlying assumptions

According to these constructivist researchers, there are two cognitive tools individuals use to create meaning in a situation: interpretive principles and organizing schemes. Interpretive principles are the assumptions used to coordinate the person’s knowledge of the social rules, and guide them with the observations concerning a specific interaction. For example, in a situation an individual may tell herself to “be relevant”, “be polite”, “be cooperative” (Grice, 1975). And, organizing schemes help the individual to make connections between particular sorts of acts. These cognitive tools are in
alignment with the theories of George Kelly (1955) and Heinz Werner (1957), which communication theorists identify as their foundation for constructivism.

**Personal construct psychology**

Kelly authored a personal construct psychology (1955). He proposes that persons create cognitive structures, called personal constructs, which serve in the organization, evaluation, interpretation, and anticipation of events. Constructs can be thought of as filters, files, templates, or interpretive schemas that are domain specific, and change over time.

Constructs are experiences that are grouped together according to similarities and are distinguished between things by their differences. They are organized into interpretive schemes, and when individuals identify something in their experience, they place the situation/object in a category or categories, and this is what individuals use to make sense out of the particular event.

Simply stated, individuals classify an experience using bi-polar categories (i.e. large-small, happy-sad, good-bad). And, constructs are the things that are grouped together because of similarities and are what guide an individual in the organization, evaluation, interpretation, and anticipation of events. These constructs or interpretive schemes are developed as a person matures. Young children might place all people into two types: good or bad, whereas adults would have an immense number of constructs with which to distinguish between different people.

**Werner’s structural development theory**

The second theory, Werner’s structural developmental theory, states “wherever development occurs, it proceeds from a state of relative globality and lack of
differentiation to states of increasing differentiation, articulation, and hierarchic integration” (Werner, 1957, p. 126). Using this view of development, constructivists predict that “children’s personal constructs will become more differentiated, articulated, and integrated as they reach adulthood (e.g. Clark & Delia, 1977; Delia, Kline & Burleson, 1979). Furthermore, since individual development varies from person to person, constructivist researchers suggest that people will systematically differ in terms of the complexity of their personal construct systems. Also, different parts of the construct system of a single individual can differ in complexity, meaning an individual can have elaborate thoughts in one context, but simple ideas in another. For example, someone may have a complex system of thought in music, but only simple ideas about international relations. Cognitive differentiation is a term that describes the number of constructs used by an individual. The more cognitively sophisticated an individual is, the more distinctions he or she will be able to make of the situation.

*Constructivism in Communication Summarized*

These theories have served as the foundation for the constructivist communication theorists. Along with the assumptions particular to communication, that an individual creates and understands the messages produced and heard in conversation based on the constructs they have developed. Meaning is then further constructed by social interactions, allowing a chance to create and modify their individual interpretations of the social world. We need to keep in mind though that social interaction does not only include conversation. Communication is just one strategic example of social interaction. “Interaction is conceptualized as a negotiation process in which participants present their own views and coordinate their individual actions” (Stamp, Vangelists, Knapp, 1994, p.
This foundation has opened up vast amounts of research and has provided influential scholarly knowledge. One line of research it has greatly influenced is message production, for example what is the relationship between cognitive complexity and the production of listener-adapted messages. Constructivist Communications researchers have tried to identify traits of individuals and how they are correlated with various message behaviors, the effects of a situation on message behavior, and the actual processes of producing messages.

These theories focus predominantly on the individual, and the studies investigating this have the individual as the primary unit of study. There are more recent references to other perspectives, for example social, interpretive, and critical, but throughout the 20th century, emphasis in the human sciences has mainly been on the individual and apparent cognitive factors. Though in response to the other perspectives, these researchers acknowledge that communication does have both a social and an individual component, but they state that the individual is involved in the process, and therefore must be studied. Focusing on the individual does not negate the value of social theories. Communication is social in nature, but everything that happens is filtered through and generated by the separate minds of the individuals involved.

**Research on Message Production**

It has been found that in many communication situations, no matter what, individuals produce similar and uniform-looking messages, for example when asked to describe the layout of an apartment (Linde & Labov, 1975). There is substantial variation in the kinds of messages individuals produce when they are in conflict situations (Sillars, 1980), managerial situations (Husband, 1981), or in comfort situations (Burleson, 1982,
1983, 1984). Messages differ in terms of content and organization, as well as how they are perceived and implemented (Husband, 1981; O’Keefe & Shepherd, 1987; Samter, Burleson & Basden, 1986). Particular situations that have been investigated involve the act of influencing, informing, or comforting others, resolving conflicts, as well as reaching consensus through discussion (Kline & Delia, 1990, p. 128). Coupled with that, researchers have considered with whom the conversation is taking place, in situations between friends, family, colleagues, or strangers (Kline & Delia, 1990).

**Person-centered communication**

Person-centered communication has been the converging notion within the communication theorists’ constructivist framework. Person-centered messages reflect an awareness of and adaptation to the subjective, affective, and relational aspects of communicative contexts. A person-centered message is one that adapts to the needs of the listener, accounts for situational contingencies, and attends to multiple goals. Below is a summary of the general findings these theorists have identified regarding message production and the skills associated with being a skilled message producer.

A general finding in communication literature has been that in order to be a skilled, or person-centered, communicator, one must have relatively detailed knowledge of the activities that are trying to be accomplished in the discourse, as well as consideration towards the audience. For example, the communicator must be able to differentiate between what purposes the discourse serves, his/her social role, as well as be aware of the conventional meanings and actions associated with a particular situation. The degree that the communicator is able to apply these ideas in his/her communication is relative to his/her ability to be understood by others and impel listeners to respond or
act in specific ways. In addition, skilled communicators are cognizant of the interactional history with the individual(s), and s/he uses such knowledge when designing his/her messages (Kline & Delia, 1990).

Communication theorists have also noted the importance of the individual being cognizant of the multi-functionality of communication and the ability to pursue multiple goals in dealing with others (Kline & Delia, 1990). The skilled communicator “must acquire a sophisticated theory of communication as to how to talk to accomplish their goals [in conversation]. Speakers produce messages for multiple reasons. Typically, speakers want to be clear and efficient as they accomplish an instrumental goal (like informing someone about something). And, accomplishing their primary goal typically involves developing a consensus as to the who, what, and why of the communicative encounter; therefore, speakers frequently have subsidiary goals as well, such as creating a desirable identity for, and relationship with, their listener (p. 179).

Constructivist research in communication has studied the relationship of social cognition to communication. It has been shown that there is an important link between the kinds of interpersonal impressions people form and the kinds of messages they produce when undertaking a wide variety of communication tasks. Focus on this line of research has been on assessing the generality and dependability of the relation between message production and the development of impression formation processes (Applegate 1980a, 1980b; Burleson, 1982; Delia, Kline, & Burleson, 1979). Barbara O’Keefe’s research in the mid 1980s began extending these ideas to consider the mechanism or process through which characteristics of the message producer’s interpersonal construct system influences the features of messages produced.
The approach taken was to consider the degree to which messages address multiple aims and objectives, that is, how construct differentiation and abstractness influenced message production. O’Keefe focused primarily on the kind and number of goals a communicator construes as relevant in a situation because people who represent social situations in a more multidimensional fashion, design messages addressing more goals simultaneously.

After getting participants to share their views on certain topics, pairs were chosen that had conflicting views. O’Keefe argues that when individuals are confronted with an overt opposition situation, they will either acknowledge explicitly that conflict has arisen or acknowledge implicitly that the conflict has arisen by addressing something other than conflict. If they address it explicitly, they will either address the needs of the other person, address their own needs, or a combination of both of their needs. To Communication theorists, this is part of “managing face”.

The concept of face, or “managing face”, is a metaphor the communication researchers use to describe identity of self and the other. In particular, Miller shares face as the “self-presentation of identity in interaction, and it depends on the self, the situation, and others involved in the interaction. As such, face is something that can be lost, maintained, or enhanced during interaction” (Miller, 2002, p. 287). To address face-wants in discussion, it has been found that individuals will use a strategy of selection, separation, or integration. Selection is when the individual decides which goal to pursue without considering the other. Separation refers to addressing objectives separately, though within an integrated action sequence. Integration implies a true reconciliation of competing aims.
Research supports with little doubt that measures of interpersonal construct system development are at least moderately associated with measures tapping the person-centered quality of communication (Miller, 2002, p. 327). Relationships have been documented across diverse populations of research participants; for different communicative goals, regardless of the specific assessments used within the coding schemes; and across both oral and written communication. Ample evidence is available that supports the claim of the constructivist research program, that construct-differentiation is associated with the production of person-centered messages.

Barbara O’Keefe (1988) began to question whether different message strategies could involve more than mere differences in goal constructs. O’Keefe argues that researchers in the constructivist program who have aimed to identify the most effective messages in varying contexts, have to realize that there is an assumption being made that such an ability has been developed by all, and is available for them to recollect it when needed. She argues that maybe individuals may have not developed, or reflected upon, these communication constructs. She designed another study to help further understand and explain why individuals can come to have such differing ways of approaching similar communication situations. As a result of her investigations, message design logics theory began to develop.

Message design logics theory

In her study, O’Keefe had 90 undergraduate students who were enrolled in a communication course to imagine they were in a class where a group project counted heavily toward the final grade. The participant was assigned to be the group leader of
this project and was asked to deal with one of the group members, Ron, who was causing some problems for the group. In particular they were given this prompt.

Imagine that you have been assigned to a group project in one of your classes. The class is in your field of concentration (major) and it is important to you to get a good grade in this class. Your final grade will depend to a great extent on how well the group project turns out. You were assigned to your group by the instructor, who also designated you to be the leader of your group. Each person will receive two grades for the project: an overall grade to the group based on the overall quality of the project report and an individual grade based on each person’s contribution to the group effort. Your duties as group leader will include telling the instructor what grade you think each individual in the group deserves based on their individual contributions.

One group member (whose name is Ron) has been causing some problems. Ron seldom makes it to group meetings on time and entirely skipped one meeting without even calling anyone in advance to let the group know. When Ron missed that meeting, two of the group members wanted you to have the instructor remove Ron from your group, although another member persuaded the group to give him another chance. At the next meeting Ron arrived late but apologized for missing the previous meeting and mentioned something about family problems. Ron did volunteer to do all the background research on one important aspect of the group’s topic, saying he had a special interest in that part of the project.

The group project is due next week. The group planned to put together the final draft of its report at a meeting scheduled for tomorrow afternoon. Ron calls you up today and says he doesn’t have his library research done and can’t get it finished before the meeting. He says he just needs more time.

Participants were asked to respond to this hypothetical situation by writing exactly what they would say to Ron. This scenario, referred to as “The Ron situation”, is also included as Appendix A so it can be referenced later on in this paper.

What O’Keefe found is that individuals do indeed have different premises about the act of communicating, and these thoughts are used to guide the process of reasoning from goals to messages. A message design logic is the term she uses to describe these implicit thoughts or beliefs of communication, and O’Keefe has found that there are at
least three very different message design logics used by individuals. She defines them as expressive, conventional, and rhetorical message design logics.

For each message design logic, O’Keefe (1988) identified a key premise for communication, along with a set of related beliefs that dictate the function of a message. She also investigated how messages are organized, how they relate to the issue at hand, and whether they are coherent with the rest of the discussion. Finally, she identified how the message design logic used by the individual would guide the individual in determining the success, or not, of a conversation.

It is important to note that the situation in O’Keefe’s study is identified as a regulative communication situation. A regulative communication situation is one where there are demands on the situation which include attaining one’s own wants and objectives, or getting the person to whom the message is targeted to perform a certain way. At the same time, in a regulative communication situation, these individuals try and satisfy relative norms of civility and politeness according to the social situation. The “Ron” situation is categorized as a regulative communication since the group is trying to get Ron to act accordingly and do his part in the project.

According to O’Keefe, there are two main features of this scenario that make it useful for detecting differences in design logic. First, there is a presence of important but irrelevant and negatively laced beliefs about Ron’s past behavior and second, the desirability of reorganizing the situation. In particular, Ron has been represented in such a way as having repeatedly failed to conform to the group’s decisions and procedures. This leads subjects to have a negative impression of Ron and allows for them to develop beliefs about his past conduct that are not particularly relevant for dealing with the
present situation. The group is portrayed as having a particular organization and set of commitments that might or might not be subject to renegotiation, but are relevant to dealing with Ron’s failure to perform. There are various ways in which the group’s arrangements might be altered to secure a good outcome.

O’Keefe’s study showed that individuals do have differing ways of approaching regulative communication situations. O’Keefe also found that the message design logic employed could vary independently to the goal structure of a message. That is, the complexity of the set of goals being pursued in a message can vary independently of the kind of message design logic used in reasoning from goals to messages. Each of the message design logics can generate essentially goalless messages or messages designed to pursue single goals or simple sets of mutually compatible goals. So, individuals may believe they are all achieving the same goal, yet they go about it in different ways and they judge their success of achieving the goals differently as well. Each of the message design logics will be described below by first defining the primary premise of communication and the related beliefs associated with that design logic. Second, example messages from the participants in O’Keefe’s study will be shared and discussed.

Expressive message design logic. The expressive design logic reflects a view that communication is a straightforward process for individuals to express and receive their thoughts and feelings, and they assume everyone produces their messages the same way. An expressive communicator believes that the listeners will understand his/her utterances just as long as s/he talks openly, directly, and clearly (Kline & Delia, 1990). If the listener does not understand when the speaker is open, direct, and clear, it is the listener’s fault, some how. The conversation is usually organized as reactions to immediately prior
events or thoughts. And, messages tend to be reactions to the current circumstance, this means they are very literal, not distinguishing between issues that are objectively relevant and those that are only subjectively relevant. Their messages include all the thoughts that are evoked by a particular action.

Two key identifiable global properties of expressive messages are a lack of editing and a failure to engage the immediate task to be accomplished in the situation. That is, messages seem to focus exclusively on past transgressions rather than present problems or they perform some action that is emotionally satisfying but interferes with the task to be accomplished (O’Keefe, 1990). Below are two examples from O’Keefe’s study that display these properties.

Ron, I can’t believe you haven’t finished your research. You have been inconsiderate to the group all along. Several members even suggested that you be taken out of the group but we decided to give you a chance. Now what are we supposed to do? It was your responsibility and you backed out. I’m afraid that I’m going to tell the T.A that you haven’t done your share. I will be so mad at you if we get a bad grade on this – I need an A in this course.

Ron, I am going to have to suggest to Professor Jones that you receive a D or E on your individual part of the presentation. Not only did you come late to the meetings but you completely skipped one of them, and now not finishing the part of the project you volunteered to do shows how immature and irresponsible you really are. Do you think you can bring me what you have done and I’ll see if the rest of us can finish it? (O’Keefe, 1990, p. 94-95).

The focus of these messages is clearly on past aggressions towards Ron. They seem to be exact utterances of thought and feeling, with little to no attention to the real problem at hand, Ron not completing his part of the project. O’Keefe (1990) found that 22% of her participants gave messages that fit into this category.

Conventional message design logic. A conventional communicator sees communication as a cooperative game to be played using conventional rules and
procedures. Messages are organized for the purpose of getting a particular response from the person(s) receiving the message. Thus, everyone is expected to play the “game” by listening to the communication context and inferring the speaker’s intention. These speakers design messages that they believe are appropriate, coherent, and meaningful, and they use conventionally defined actions that count as an appropriate way to obligate the hearer. Unfortunately, these messages have shown to be coherent and meaningful only when all parties involved follow the same rules and norms governing the context. Communication is judged as successful when the involved individuals all behave “appropriately”, that is, everyone behaves within established parameters defined by the individuals as well as the particular situation.

According to O’Keefe, 42% of her participants responded in a conventional design logic. Below are two examples of such responses from her study.

Ron, you idiot, this speech is due next week and you are not getting anything done. Now, number one you owe it to other people in the group who have spent a great deal of time and energy working on this to at least do your part. Number two, you have been slacking off altogether on this project. I hope you realize you will be getting an individual grade – and at this point I seriously doubt that it will be a high one. There is no excuse for this laziness, and I really don’t appreciate it, so get going now, and have that material prepared by tomorrow.

Well, Ron, I’m sorry you don’t have your part of the project done. We have given you several breaks thus far and I don’t see how we can give you any more. The whole group is depending on you so I would suggest to you to get it done or at the most bring in what you have got done. If you don’t get this done I’m going to have to give you an F for the project. If you can’t hold up your responsibility with this group even under these adverse conditions (family problems) how are you going to make it in life. (O’Keefe, 1990, p 86).

These messages have some coherence in the message that predicates a future goal-related action. They incorporate contextual conditions that are either prerequisite to the
performance of the desired action or backing for the leader’s demand that the action be performed.

*Rhetorical message design logic.* The final message design logic O’Keefe has identified has the belief that “communication is the creation and negotiation of social selves and situations” (O’Keefe, 1988, p. 87). The individual employing this message design logic realizes that the meanings of his/her messages are not fixed, but are part of the social reality being created. Their messages explicitly are designed toward the achievement of goals, rather than merely reactions or conventional responses to situations. In addition, this communicator will distinguish their use of language style to define the speaker’s symbolic reality in ways so the listener can make an acceptable interpretation and be motivated to give an acceptable response. Success is marked by communication that is smooth and coherent. But, according to O’Keefe, few individuals have developed this individual theory of communication. In her particular study, only 32% of her adult participants used this logic (O’Keefe, 1988). Below are two participant responses who were identified as using a rhetorical message design logic.

Ron, I’m sorry you won’t have everything ready by tonight. Can you give me some good reasons I can tell the group? I know you’ve been having problems all along and that’s obvious to the rest of the group too. You need to be able to see how your personal problems have interfered in the group’s completion of the project. I’ll be the first to sympathize with you but now we’ll have to come up with some concrete solutions. You can’t expect someone else to take over your research workload.

Well, Ron, it’s due next week, and we have to get it all to the typist. OK, if it’s not done it’s not. Tell you what. Why don’t you jot down your main ideas so that we can include them in the introduction and conclusion. Also tell me when you think your section should come in the whole project. Then get it to my apartment by 10:00 the next day because I have to get it to the typist by 2:00. Is this okay? I’ll just explain to the group that you’ll have it done but not by meeting time. We all want a good grade, so if you need the time to make your part better, go ahead.
But if I can’t get it to the typist in time, you’ll have to type it. Alright, take it easy. (O’Keefe, 1990, p. 88)

These messages are consistent with the rhetorical design logic because the message is produced in such a way as to reconstitute some important set of features of the situation, including for example the speakers identity, Ron’s identity, Ron’s motives, and the group’s procedures. Materials contained in the scenario were treated not as givens, but as resources that can be called on in transforming the situation to facilitate goal attainment. These communicators used language to transform the situation to be more motivational, give explicit re-descriptions of the context, again so goal attainment can be achieved.

In summary, the difference between an expressive and conventional message design logic is, in large part, the difference between a system that simply reacts to circumstances and a system that responds to exigencies with some appropriate remedy. The difference between a conventional and a rhetorical system is the difference between a system that is limited in its response by historically evolved structures and a system that draws on a wider range of resources by changing structures. The contrasting logics consider “(a) selection, in which individuals choose between competing goals; (b) separation, in which competing goals are dealt with in different parts of a particular message; and (c) integration, in which the individual attempts to reconcile competing goals and remove obstacles within the message” (Miller, 2002, p. 100).

Table 2.1 summarizes the three message design logics. It is a table adapted from O’Keefe (1988) as presented in Miller (2002). It describes how each logic considers the fundamental premise for communication, the key reason messages are produced, the
relationship between context and the messages produced, how the individual manages face in the interaction, and finally how the interaction is evaluated as successful or not. Maintenance of face is a metaphor for describing how face, “the self presentation of identity in interaction, and it depends on the self, the situation, and others involved in the interaction” (Miller, 2002, p. 287).

<table>
<thead>
<tr>
<th></th>
<th>Expressive</th>
<th>Conventional</th>
<th>Rhetorical</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fundamental premise</strong></td>
<td>Language is a medium for expressing thoughts and feelings.</td>
<td>Communication is a game played cooperatively by social rules.</td>
<td>Communication is the creation and negotiation of social selves and situations.</td>
</tr>
<tr>
<td><strong>Key message function</strong></td>
<td>Self-expression</td>
<td>Secure desired response</td>
<td>Negotiate social consensus</td>
</tr>
<tr>
<td><strong>Message/context relationship</strong></td>
<td>Little attention to context</td>
<td>Action and meaning determined by context</td>
<td>Communication process creates context</td>
</tr>
<tr>
<td><strong>Method of managing face</strong></td>
<td>Editing</td>
<td>Politeness forms</td>
<td>Context redefinition</td>
</tr>
<tr>
<td><strong>Evaluation of communication</strong></td>
<td>Expressive clarity, openness and honesty, unimpeded signaling</td>
<td>Appropriateness, control of resources, cooperativeness</td>
<td>Flexibility, symbolic sophistication, depth of interpretation.</td>
</tr>
</tbody>
</table>

Table 2.1: Characteristics of Message Design Logics

*Message Design Logic and Effective Communication*

Six months after the study just discussed, O’Keefe (1990) designed another study where she took the various responses and asked subjects to respond to the effectiveness of the message. She had 204 cases in her sample to base her analysis on. Her participants were undergraduate students enrolled in introductory-level speech communication courses. They were asked to read the background story of Ron and then asked to evaluate and rate the regulative message and form an impression of the message producer. Half the subjects were told that the message producer was a female named Diane and the other half that it was David, a male.
The effectiveness of the message was ranked using 15 questions and a 9-point scale (1=negative to 9=positive). Categories that were assessed were 1) the likelihood of task completion by Ron; 2) the likelihood of the task completion by the group; 3) Ron being satisfied with the message, and 4) of the group being satisfied with the leader’s performance. Ratings on these four categories where not seen as highly interrelated, each was analyzed individually.

Using this questionnaire, O’Keefe determined whether message design logic and goal structure influenced perceptions of message quality and of the message producer. She found in this investigation that as the design logic differed, so do the produced messages differ in effectiveness. Message design logic had significant effect on the predictions of success in working with Ron, satisfaction in the group, and getting Ron to complete the task at hand, though it did not influence judgments of the likelihood that the group would successfully complete its task on time. Greatest perceived effectiveness was perceived with the rhetorical message design logic, and the least with the expressive.

In reporting her findings, O’Keefe (1990) notes that these evaluations are elicited from subjects that were placed in a depersonalized context. It is possible that if the messages were directed to them personally, the message producers and receivers may respond differently than did the participants. Though, “one would expect message design logic to have similar effects on both involved message targets and uninvolved observers”, it is more the message goal structure that might operate differently depending on whether self-interest is involved in the evaluation.

Simple messages focus on one goal, more complex messages separate goals and deal with each in turn, and the most sophisticated messages actually integrates several
goals in one message. Rhetorical communicators seem to allow for multiple objectives to be met when creating messages in conversation.

Empirical work using the message design logics framework is just beginning to develop, but several studies suggest that it holds some promise (Lambert & Gillespie, 1994; O’Keefe & McCormack, 1987; O’Keefe & Shepherd, 1987).

Studies framed in message design logics theory will now be described. The first one comes out of the doctor-patient literature, specifically explaining how to get pharmacists to be more patient-centered in their communication. The second one looks at the relationship between message design logic and factors such as job satisfaction in management-subordinate situations, specifically supervisor nurses and staff nurses assigned to them. The third relates message design logic notions as an aid for business managers when having to deal with sexual harassment issues. All three of these studies used message design logic theory to inform their field in more effective communication strategies and practices.

Because the doctor-patient study correlates with similar ideas currently being discussed in mathematics education, it will be described in detail. The other two studies on management-subordinate relations and managers dealing with sexual harassment were included to assist in further clarifying the differences in the varying message design logics. These two studies’ findings do not directly relate to mathematics education; therefore, the details of these studies and findings will be briefly summarized, and emphasis will predominantly be on the message design logic messages. The details for these latter two studies are included as Appendix B.
Lambert, Street, Cegala, Smith, Kurtz, and Schofield (1997) made a case for using communication theory, specifically message design logics theory, to study notions in patient-centered care (PCC). PCC describes an approach that consciously adopts the patient’s perspective. Emphasis is to focus on the patient’s experience of illness and health care and how that systems works, and doesn’t work, to meet patients’ needs, as they define them. PCC has seven primary dimensions: respect for patients’ values, preferences, and needs; coordination and integration of care; information, communication, and education; physical comfort; emotional support and alleviation of fear and anxiety; involvement of family and friends; and transition and continuity. Emphasis is on patient involvement, mutual participation in decision-making, interpersonal relationships, and trust.

Providers have been trained using a 70-plus skills guide which is organized around such patient-centered tasks as understanding the patient’s perspective, building relationship, incorporating the patient’s perspective in explanations and planning, and negotiation and shared decision making (Kurtz & Silverman, 1996). It emphasizes effective communication skills training in health care, and the importance of requiring that training be offered at many points during the undergraduate, postgraduate, and continuing education process. They state that research needs to be done to see how best to coordinate these efforts so they build systematically and logically on each other, focusing on knowledge (do you know it?), competence (can you do it?), performance (do you do it?) and results (what happens to the people involved?) (Miller, 1990).
Lambert, et al. (1997) argue that in the past, most programs focus on knowledge and competence, with little focus on performance and results. Also, most existing research on patient training focuses on improved question asking. Little or no attention has been given to patients’ relational skills.

Lambert, et al. (1997) discuss an inspired promise for PCC, but they identify principled and practical problems with the idea. PCC has not been easy to implement. Organization inertia, resource constraints, professional dominance, conflicting interpretations, and resistance from providers and patients have all been cited as barriers to change efforts. Lambert et. al (1997) discuss the need to overcome these limitations by adopting a new strategy toward the study of communication.

O’Keefe’s (1988) theory of message design logic is the guiding framework used to explain message variation and effects in the context of pharmacist-patient counseling. The doctor-patient study was designed to replicate O’Keefe (1988) by using a hypothetical small group problem-solving scenario. Eighty-five doctor of pharmacy students were asked to produce messages to the scenario, which dealt with a patient, Ed, with high blood pressure. Ed is notoriously late in obtaining refill prescriptions for his antihypertensive medication. Ed complains that the medication is ineffective and expensive and that he has unpleasant side effects when taking it. Messages were produced by the pharmacy students and then coded as reflecting either an expressive, conventional, or rhetorical message design logic according to a system developed for this investigation. Twenty-five of the responses were coded by two independent coders, and they were in exact agreement in 88% of the cases (Lambert et. al, 1997, p. 314).
For this situation, the expressive design logic messages focus predominately on the feelings experienced in the situation. Here is a patient who has feelings of “frustration, exasperation, resignation, and even resentment on the part of the pharmacist. (Lambert et. al, 1997, p. 314). Sixteen percent were classified as expressive. An example of a message coded as expressive follows.

Ed, the drug would work if you use it correctly. Every time I see you get a refill you are overdue, now tell me how the medication is going to work. The medication is not ineffective Ed, you just think it is. If you use it correctly Ed, I bet you are going to feel better and like the drug better too.

The conventional messages were the ones that focus primarily on educating the patient on the rights and obligations of practitioners and patients. They also talk about “the drug use process, the drug, the disease, the benefits of compliance, and the risks on noncompliance” (Lambert et. al, 1997, p. 314). There is little attempt to focus on the individual side of the patient; the message is dictated about outside authority and using this to gain compliance. Forty-seven percent of the pharmacist’s messages were coded as conventional messages. One example of this follows.

Mr. Johnson, hypertension is a very difficult disease to keep under control. Even though it doesn’t have many noticeable symptoms, it is very important to continue to take the medication to keep it under control. Without the medication, more serious conditions can result.

This is a different focus than on the rhetorical messages. In the rhetorical messages, the situation is used as an occasion to reaffirm and restructure the therapeutic relationship between the pharmacist and patient. Their advice for taking the medication takes into account the long-standing relationship. Thirty-six percent of the messages were coded as rhetorical.
Mr. Johnson, I know it’s hard to remember to take the medication, especially when you physically feel fine, but in the long run, these drugs do have an effect, and this is a small price to pay to avoid future complications. Please understand that it is your health that I am concerned with, and your doctor and I want to help you help yourself.

The collected and coded messages were then evaluated by 85 patients, each patient receiving one and only one response to evaluate. A Likert scale from 1 to 9 was used. 1 meaning not good at all and 9 meaning very good.

The patients were asked the following 14 questions to evaluate the message given to them.

1. Overall, how well did the pharmacist handle this situation?
1. How likely do you think it is that Ed will start to take his medication like the doctor told him to?
1. How likely do you think it is that Ed will get his next refill on time?
1. When the pharmacist responded to Ed, how kind was he toward Ed?
1. When the pharmacist responded to Ed, how understanding was he toward Ed?
1. How good was the pharmacist in motivating Ed to take his medication as directed?
1. How likely is it that Ed will successfully get his hypertension under control?
1. How likely is it that Ed will be satisfied with the pharmacist’s response?
1. How good is the pharmacist as a pharmacist?
1. How good is the pharmacist as a communicator?
1. How much would you like to meet and talk casually to the pharmacist?
1. How much would you like to have the pharmacist as a friend?
1. How much would you like to have the pharmacist as your pharmacist?
1. Overall, how much did you like this pharmacist?

The general findings were that the level of the message design logic used had a clear positive effect on participants’ ratings of message quality. As the level of design logic increased, so did the patient’s ratings of overall quality and effectiveness. The researchers talk about that the individual questions (1 – 14 above) may not show the effectiveness, but when they looked at it globally, summing up the responses, there was a clear distinction.
Lambert, et.al. (1997) study supports the findings initially described by O’Keefe (1990) in her study, that messages that for example reference future orientation, concern for the relationship, flexibility with respect to roles and goals, are favorable over messages that include content that is offensive, pragmatically pointless, incoherent, and irrelevant. The difficulty is in translating this information to practical advice. The researchers explain

“It is not very helpful to suggest that student pharmacists focus on the future, be concerned with the relationship, and be flexible about goals and roles. Also, it is not fruitful to tell students to avoid offensive content or to be relevant and coherent. Students inevitably have a difficult time putting such advice to work in concrete situations, which should not be surprising. We have yet to meet a pharmacy student who chose to be incoherent, irrelevant, or offensive in his or her contact with patients. Similarly, the only students who truly know what is meant by the advice ‘focus on the future’ and the like are the students who already do so. It has been our experience that students need examples of exactly what to say. Abstract descriptions, phrased in the analyst’s vocabulary, are of little or no use to practitioners (Lambert et. al, 1997, p. 316 – 317).

Lambert, et.al. (1997) followed up with another study to try and gain more insight into this problem, a way to present this information in practice. In the later study, Lambert, et.al. (1997) took the 85 messages and segmented them into idea units, identified as a subject and a verb. A classification scheme was developed to group synonymous elements, 58 idea units were identified, from these 11 content themes were identified. Content theme examples are: take medication, dangerous disease, doctor communication, express understanding, express concern, describe alternatives, be patient, cost/benefits, describe experience, patient problems, gather information, and then an omitted category that had low frequency. These content themes were analyzed in reference to each of the message design logics.
The results from this part of the study gave more practical advice for clinicians. Specifically, when patients report medication problems, pharmacists should express understanding and concern, discuss alternative treatment options, and encourage further consultation with the patient’s physician. Specific examples were provided to show the pharmacist students different ways to handle such situations, emphasizing the rhetorical characteristics.

Lambert, et.al. (1997) findings support other research that may not directly relate to message design logic, but relative to patient satisfaction. For example (Hall, Roter, & Katz, 1998) and Street (1992) state that patient satisfaction and doctor-patient relationships are positively associated with the amount of information provided, the number of partnership-building utterances spoken by a physician, and the frequency of positive socio-emotional behaviors. This gives more credibility to message design logics theory, showing that it is supported from other, yet similar, angles.

This doctor-patient study correlates message design logic and the desire to make doctors be more patient-centered. This is a similar theme in mathematics education, that is, having teachers be more student-centered. The doctor-patient study raises question and issues we have not previously considered. The next two studies shared in this literature review are less related to the current mathematics education discussions, but are included to clarify the difference in the varying message design logics.

The first study (Peterson & Albrecht, 1996) uses message design logic theory as a theoretical framework for looking at the social relationship between management and employees, specifically in a hospital with superiors’ and their subordinate nurses. Their aim was to explore whether relational patterns in design logics would allow them to
identify and predict variables such as relational social support, trust, discussion of
innovation, personal control, expected performance ratings, and burnout.

The other study (Bingham, 1991) used message design logic theory to inform
approaches for managing sexual harassment in organizations. Bingham had found in a
previous study with Burleson (Bingham & Burleson, 1989) that those having a more
advanced design logic may be more effective at managing some aspects of sexual
harassment situations.

Further details for both of these studies can be found in Appendix B. This detail
is not included here because much of it is irrelevant to mathematics education. The
purpose for including the studies here is more to help clarify the differences in each of the
message design logics.

To summarize this section on message design logics, two tables were created.
Table 2.2 shows sample messages collected in the two studies, manager-subordinate and
sexual harassment. These messages, along with the previous ones mentioned from
O’Keefe (1990) and Lambert et.al. (1997) allow one to appreciate the differences in the
three message design logics. The second table, Table 2.3, compiles a collection of the
distinguishing characteristics for each of the message design logics that have been
identified by the studies discussed in this section.
<table>
<thead>
<tr>
<th>Message Design Logic Sample Messages</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Expressive</strong></td>
</tr>
<tr>
<td><strong>Peterson &amp; Albrecht (1996)</strong></td>
</tr>
<tr>
<td>Rhonda, you are taking advantage of this situation, and of your co-workers and this stinks.</td>
</tr>
<tr>
<td><strong>Bingham (1991)</strong></td>
</tr>
<tr>
<td>This is the third time today that you have made sexual comments to me and you have been making similar comments every day since I started working here. I’ve never had to put up with this from an employer before. You’re going to live to regret that last remark. I’m going to tell your supervisor about this and get you fired. You jerk. You’re really sick in the head. Working here is becoming more and more stressful for me. I don’t k now how much more I can take.</td>
</tr>
</tbody>
</table>

Table 2.2: Message Design Logic Sample Messages
<table>
<thead>
<tr>
<th>Message Design Logics Distinguishing Characteristics</th>
<th><strong>Expressive</strong></th>
<th><strong>Conventional</strong></th>
<th><strong>Rhetorical</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication is straight-forward, an expression of thoughts and feelings.</td>
<td>Communication is a cooperative game played by conventional rules and procedures.</td>
<td>Communication is the creation and negotiation of social selves and situations.</td>
<td></td>
</tr>
<tr>
<td>Message organized around being open, clear, and direct. Self expression</td>
<td>Message organized around securing a desired response from the person(s) receiving the message.</td>
<td>Meaning of message is not fixed, but are part of the social reality being created.</td>
<td></td>
</tr>
<tr>
<td>Little attention to context</td>
<td>Action and meaning determine by context.</td>
<td>Communication creates context</td>
<td></td>
</tr>
<tr>
<td>Selection, choose between competing goals</td>
<td>Separation, deals with competing goals individually</td>
<td>Integration, reconcile competing goals and remove obstacles</td>
<td></td>
</tr>
<tr>
<td>Reaction to prior events or thoughts.</td>
<td>Conventional responses defined by self, or dictated by outside authorities.</td>
<td>Message is occasion to reaffirm and restructure the speaker-hearer relationship.</td>
<td></td>
</tr>
<tr>
<td>Threat or sanctions</td>
<td>Task relevant, focus on rules and regulations</td>
<td>Message explicitly designed toward the achievement of goals.</td>
<td></td>
</tr>
<tr>
<td>Focused on past transgressions rather than present situation.</td>
<td>A need to educate listener on what is right.</td>
<td>Uses language to define reality so the listener can respond, and respond in the communication.</td>
<td></td>
</tr>
<tr>
<td>Successful when speaker has been clear and organized.</td>
<td>Little attempt to focus on hearer’s side of situation.</td>
<td>Message transforms situation to be more motivational, redirect the context so the goal can be achieved.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Messages are appropriate, coherent, and meaningful.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Successful when all involved individuals follow same rules and norms.</td>
<td>Successful when communication is smooth and coherent.</td>
<td></td>
</tr>
</tbody>
</table>

Table 2.3 Message Design Logics Distinguishing Characteristics
Bridging Communication Theory and Mathematics Education

Message design logics theory has been explained, and studies have been presented to show this theory does provide insight into an individual’s verbal communication. As discussed earlier, mathematics educators have been trying to get teachers to be more student-centered in their communication. Though there are some noted signs of improvement, in general this task has not been accomplished; and not because teachers are resisting or don’t believe in the idea of being more student-centered. They actually believe, to a large degree, they are teaching in a student-centered approach. A thought discussed in the patient-centered discussion caught my attention:

“It is not very helpful to suggest that student pharmacists focus on the future, be concerned with the relationship, and be flexible about goals and roles. Also, it is not fruitful to tell students to avoid offensive content or to be relevant and coherent. Students inevitably have a difficult time putting such advice to work in concrete situations, which should not be surprising. We have yet to meet a pharmacy student who chose to be incoherent, irrelevant, or offensive in his or her contact with patients. Similarly, the only students who truly know what is meant by the advice ‘focus on the future’ and the like are the students who already do so. It has been our experience that students need examples of exactly what to say. Abstract descriptions, phrased in the analyst’s vocabulary, are of little or no use to practitioners” (Lambert, Street, Cegala, Smith, Kurtz, & Schofield, 1997, p. 316 – 317).

The same could possibly be said about teachers, it may not be enough for educators to suggest certain advice for a student-centered, interactive pedagogy. The advice and ideas suggested may have been understood, but they are implemented in the mindset of the teacher. No teacher I ever met truly intends not be student-centered. The student is the focus of the majority of teachers. Maybe the only teacher who truly knows what is meant by the advice given, are the teachers who already teach in a student-
centered manner. Message design logic theory opens up more ideas about the communication in the mathematics classroom.

Communication has up until now been addressed more peripherally. It has been linked to the constructs teachers own regarding knowledge and beliefs of pedagogy, or subject matter, but a direct look at communication constructs has not be published in our literature. This study looks directly at the verbal communication patterns secondary mathematics teachers’ employ when they are creating messages for students. These are looked at using a theoretical communication lens.

As Goldsmith & Shifter (1997) point out it is “important for researchers to work closely and collaboratively with teachers …. The researcher brings a unique perspective to this process – a theoretical and analytic stance and the opportunity to observe the phenomenon across a large number of individuals. Each individual teacher brings to such collaboration the living of the phenomenon itself – the important particulars of his or her own case and insights about the process that help to keep inquiry firmly grounded in the realities of the experience. We stand to learn the most about the ways teachers reconstruct their mathematics practice through the thoughtful and respectful interplay of these two perspective” (p. 49).

The current investigation had secondary mathematics teachers providing their realities and insights into the process of creating message for students. These realities and insights were then theoretically looked at using a communication lens, but analytically applied within the mathematics education frame. This adds another interplay of yet another perspective, which is believed to benefit our knowledge and practice base further.
In order to fully discuss secondary mathematics teacher’s message design logics, it was decided to develop a message design logic that would be consistent with the current reform suggestions. To do this, the characteristics previously identified were re-written using categories associated with a message design logic. Table 2.4 is a model message design logic for the desired teacher communication. It describes the fundamental premise for communication, key message function, message/context relationship, method of managing face, and evaluation of communication.

<table>
<thead>
<tr>
<th>Mathematics teachers desired message design logic</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fundamental premise</strong></td>
</tr>
<tr>
<td><strong>Key message function</strong></td>
</tr>
<tr>
<td><strong>Message/context relationship</strong></td>
</tr>
<tr>
<td><strong>Method of managing face</strong></td>
</tr>
<tr>
<td><strong>Evaluation of communication</strong></td>
</tr>
</tbody>
</table>

Table 2.4: The mathematics teacher’s message design logic in our reform

When we compare this design logic to the ones identified by O'Keefe, it is most consistent with the rhetorical message design logic. See Table 2.1 for a description of the three message design logics.

According to O’Keefe (1988) few individuals have developed this individual theory of communication. In her particular study, only 32% of her adult participants used this logic, and in the other studies, 36% of the pharmacist (Lambert, Street, Cegala, Smith, Kurtz, & Schofield, 1997) and 48% of the nurses and/or nurse managers (Peterson & Albrecht, 1997). This should make mathematics educators question, as well, whether we are assuming our teachers have developed this higher-level theory of communication. Message design logic theory allows us to investigate this huge assumption, and will open
the door for more ideas on training teachers, and seeing how to get them to develop this theory of communication. Ultimately, the goal is to get more teachers implementing this form of communication in the classroom.

Message design logic theory is not only a valid idea to study for these stated benefits, but theoretically this theory is fundamentally grounded in constructivist theory, the same theory our reform efforts are founded upon. In education, this theory has caused us to place more focus on the interactions between teacher and students in the classroom. Teaching and learning are no longer conceived as a stimulus-response phenomena where students are trained to retrieve “right” answers. Constructivism informs educators that “learning is constructed, not only in an individual’s head, but in the interactions among individuals or between individuals and materials as these occur over time” (Marshall, 1994, p. 7). Learning consists of building on what the learner brings to the situation and restructuring initial knowledge in widening and intersecting spirals of increasingly complex, more differentiated, understanding. In summary, what the students are thinking, collectively each student’s reality/truth is what needs to inform instruction.

It is important to note though, that in the education literature, constructivism is an outgrowth of Piaget’s model of cognitive structures, represented as a collection of “schemes” or “schema.” (Piaget, 1972). And, in the communication literature, constructivism is grounded in George Kelly’s (1957) psychology of personal constructs and Werner’s (1957) structural development theory. Science educator’s have noted how Kelly’s model would be beneficial for the education community to consider (Bodner, Klobuchar & Geelan, 2001).
George Kelly’s (1957) initial audience was for the training of clinical psychologists; whereas Piaget’s emphasis is learning. Both models recognize the active role the individual has in the construction of knowledge. Both discuss the notion of constructs or schemas to represent what is known from the individual’s experiences; and how these constructs are referenced in order to interpret and act in his/her world.

I have made an argument for the mathematics education community to accept message design logics theory as a means for understanding the teacher’s verbal communication. I have indicated how this theory has been informative for other professional situations that have similarities found in our own field. For example, a person-centered approach in the doctor-patient relationship and the student-centered approach in the teacher-student form of instruction. This formal theory was now used to inform mathematics educators as well.

In order to establish the connection for bringing message design logic theory into mathematics education, the studies mentioned here were used as a guide. Method from the shared studies was replicated and then additional information was gathered about teachers’ communication in general. In the next chapter the methods used in the current study are described and validated.
CHAPTER 3

DEFINING METHODOLOGIES:
FOR DATA COLLECTION AND ANALYSIS

Getting the data,
Deciding, gathering, analyzing
Limited, yet unlimited.
When is enough, enough?

This investigation was designed to gain insight and understanding to the thoughts secondary mathematics teacher’s employ when constructing verbal messages for students. The term used to describe these thoughts is called an individual’s message design logic. This is a notion initially referenced in the interpersonal communication literature, but has been used to inform researchers in other fields about their participant’s verbal exchanges. For example, doctor-patient (Lambert et.al, 1997), management-subordinate (Peterson & Albrecht, 1996), peer groups (O’Keefe, 1988). In the current study, it is used to inform mathematics educators about secondary mathematics teachers’ message design logic. It is assumed that this would provide a new perspective on understanding further the miscommunication between what is being written about a teacher’s communication and what is actually being done.

Because this is a new consideration in mathematics education, other message design logic studies were referenced and used as a guide in this study. Since those
studies were viewed as valid and reliable, it was assumed that the validity and reliability would be transferred to this study as well. In addition, current expertise in qualitative methods and analysis were incorporated.

Hereafter the methods used to gather, analyze, and interpret data are presented. I begin by providing design specifics as far as the participants, instruments and methods of data collection and data management. To summarize this section, I provide a rationale for the quality of these choices and describe my role in this phase of data gathering. The second part of the methods presentation focuses on the data analysis. Here I describe how the data were analyzed and why I believe the chosen procedure adequately enables the research questions to be addressed. This is followed by an overview of the methods used to further organize the data for presentation, which provides in some sense a summary of the next chapter.

Design Specifics

Participants

Purposeful sampling (Patton, 1990) was used to get the participants for this study, since this would allow for the richest data in a most efficient manner. In order to select the participants, a list of twenty-six secondary mathematics teachers, known by the researcher, was written down, along with an estimate of their years of teaching, education/highest degree, recent courses taught, and school district. Eight teachers were first selected, two representing each of the categories: less than 5 years experience, 5 – 12 years experience, 12 to 25 years, and greater than 25 years of experience. One of the teachers chosen was male, the other a female. The logic for using this division is explained below in the experience descriptions.
These teachers were called on the phone, or talked to in person, and were told about the study and asked whether they would be willing to participate. Six of the initial eight agreed. A second list of nine teachers was generated from the original list to call upon. These teachers again had varying experience, but were also chosen to represent differences in school districts and education. Five of these teachers agreed to participate. The final four participants were found by calling on some the remaining teachers on the original list.

Collectively these teachers represent several high schools, urban and suburban, in the Midwest portion of the US. They represent a range in teaching experience and degrees obtained, from bachelors to doctorate. Their course loads range from pre-algebra to calculus instruction. In our initial conversations, and again later in the interview, all the teachers indicated they were very aware of the Standards documents, and they believed they taught in a manner that was at least somewhat consistent with these documents.

The differences in school, degrees, experience, and coarse load were included in the design so this researcher could consider possible factors that may possibly be tied to message design logic. Though this researcher clearly acknowledges that the small number of teachers in the study make such findings inconclusive, and can only be used as discussion and to spark thoughts for further investigations.

It is also important to note that in no way does this study aim to compare, contrast, or judge individual teachers on their verbal communication. No teacher will be explicitly talked about. This is not a case study. The units of study are the individual messages collected and the related thoughts that go with the message. There will be
some discussion on what factors these teachers believe influence their message production, but nowhere will you see a comparison that is purposefully judgmental or evaluative of the teacher and his or her communication style. It is assumed that every one of the teachers chosen for this study are teachers who care about their students, do their best in the classroom, and believe their messages are directed towards helping students learn and be motivated to learn.

Even though individual teachers will not be compared, it was thought that the chosen categories would allow for good discussion. These categories are experience, courses taught, education (by degrees obtained), and sex. One of the research questions concerned whether these factors contributed to the message logics patterns. Each of these categories is described below.

*Experience*

Experience was divided in the categories: less than 5 years, 5 to 12 years, and greater than 12 years experience, but less than 25, and finally greater or equal to 25 years. The decision to divide it in that way was due a number of key ideas. First, according to the development model by Berliner (1986, 1994), it takes approximately five years to become a competent teacher. Second the reform efforts for a student-centered approach have been part of the formal teacher education in the last 12 years (from data collection), and third teachers trained 12–25 years ago had some formal instruction, though limited, on the importance of engaging students. It was during this time period that constructivist notions were part of the discussion, for example problem solving, and student needs and how to address them were among the key themes. Finally, it was believed that greater than 25 years ago, the formal education focused predominately on the teacher. Of the
secondary teachers in this study, 4 (27%) had 5 years or less in experience, 4 (27%) had between 5 and 12 years experience, 5 (33%) had greater that 12 and less than or equal to 25 years of experience, and 2 (13%) had greater than 25 years of experience. Table 3.1 later in this chapter shows this distribution compared to the factors.

Education

Teachers were also categorized by their education, relative to their highest degree obtained: bachelors, masters, or doctorate. It is important to note that the highest degrees were all obtained within the last 12 year period, which means every participant had some college instruction during this reform period. Two (13%) of the teachers had a bachelors degree, 11 (73%) had master degrees, and 2 (13%) had a doctorate degree. Refer to table 3.1 to see how this distribution is in relation to the other factors.

It is important to note that the majority of these teachers have masters degrees. This can be explained because of the continuing education encouraged by many school districts and the Holmes Program. The Holmes Program is a national program designed to have individuals take an undergraduate degree in education, psychology, or subject specific area, followed by a fifth year of work at the graduate level. Our university has agreed to part of this program.

Predominant courses taught

Predominant courses taught was a category added after the first couple interviews because the first few participants mentioned how their messages were different depending upon the student population in the different courses. I decided to add this category to test my assumption that even though the contents of the message may be different, the characteristics for the verbal message would be consistent. That is, I would
test whether the messages from the different classes did indeed have the same characteristics, for example if both messages were driven by student thoughts and involving a negotiation of meanings. Classes were identified as PreAlgebra or lower, Algebra/Geometry, College prep above Geometry, Remedial courses above Geometry, and any Honors-Advanced course.

The initial teachers interviewed thought the student population varied more in the PreAlgebra and lower courses relative to mathematical ability, maturity, and motivation. They felt the teacher in these classrooms needed to address this wider diversity in their verbal messages. Different course loads was directly addressed in all but the first two interviews. This was done by first, having teachers write down all the courses they have taught and then staring those courses they taught in the last 3 years. Second, once teachers gave their message and reasoning, they were asked how this message would be different, for example, for their PreCalculus class. The first two participants were asked to provide this information as part of the member check.

The teachers in this study had a wide range of experience. In summary, 33% (5) of them taught predominately PreAlgebra or lower and Algebra/Geometry, 40% (6) of them taught predominately upper level courses, that is college bound beyond Geometry, and 27% (4) taught a combination of remedial courses above Geometry and upper level college bound courses.

Sex

Sex is the final category under consideration here. It has been discussed in the communications literature that in some cases, there seems to be a difference in the sexes and the way they communicate with others, yet O’Keefe (1988) in her study refutes this
notion. This category was included to see if, in this sample, there seems to be any differences. There were six (40%) males and nine (60%) females. See Table 3.1 to see how this relates to the factors.

**Demographics summarized**

The next table summarizes the teacher’s characteristics, except course load, relative to years of experience. As seen by the table, the selection of participant provided various combinations of teacher characteristics. Course load was not included because of the difficulty in separating them into categories, since the teachers with the most experience had taught pretty much every course, and the teachers with less experience had taught only two or three.

<table>
<thead>
<tr>
<th>Summary of teacher characteristics</th>
<th>y ≤ 5</th>
<th>5 &lt; y ≤ 12</th>
<th>12 &lt; y ≤ 25</th>
<th>&gt; 25</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>F</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bachelors</td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Masters</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Ph.D.</td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Table 3.1: Summary of teacher characteristics relative to years experience

Every participant was over the age of 18. They were guaranteed their anonymity to all, except to the researcher. To achieve this, a letter was assigned to each of them, given in no certain order. All data pertaining to each participant was then filed under the assigned letter, as well as any printed documentation referencing the participant was written as Teacher A, Teacher B, etc. No names are provided anywhere except in my personal log where there is a table assigning a letter to an individual.
The teachers’ participation involved meeting for an interview, which lasted from 1 to 2 hours; on average they lasted a little over 1.5 hours. We met at various locations determined by the participant. These locations can be summarized as meeting at schools, coffee shops, or at the participant’s home. During the interview, teachers were provided with scenarios having the same characteristics as the Ron situation (see Appendix A). They gave responses and reasons for those responses, along with answering some general questions regarding mathematics teacher communication. The specific details pertaining to the interview are included in the next section.

Following the interview, they were asked to respond to and validate a member check, provided electronically by e-mail. In this e-mail their messages were stated, as well as any reasons they cited for stating this message. Participants were permitted to change any of the contents contained in the member check, and were asked to electronically respond with this information. A few of the participants later engaged in informal discussions with the researcher; some of these data became part of the researcher’s log.

In return for their time and efforts, besides some of them receiving a good cup of coffee and snacks, a later draft of an article will be sent to those accepting that invitation. All, but two, accepted this invitation. Every participant also received a thank you note following the interview.

**Instruments and Methods for Data Collection**

This section identifies the instruments and methods used for data collection. Each instrument will first be described independently, and then their dependency will be discussed. Strategies implemented for data trustworthiness, and justification for choosing
these methods is presented. This section concludes with a rationale for not including other available methods.

*Researcher’s log*

This instrument documents this researcher’s constructed experience, including the thoughts and reflections throughout this process. It also serves as the organization tool. It is found in two medias, both electronic and written. Both were used equally depending upon availability and convenience.

Dated entries contain details of what research tasks were being completed and any reflections/thoughts on the implementation of these tasks. Specifically after each interview, field notes were produced documenting the overall impression of how the interview went; the rapport (level of connection made); responsiveness (amount said, willingness to elaborate); candor (ease with which they spoke, apparent honesty); and interesting comments (unusual or unexpected information) (Jones, 1996).

Finally, there are numerous dated entries of just free-writing on thoughts and reflections. These are especially more apparent during the analysis and write up of this research study. This is mainly due to the fact that a laptop computer was purchased during the analysis phase of this research and computer accessibility increased. These texts will serve as a source of spontaneous analytic reflection giving information that can be used for triangulation of data, along with interview transcripts and the final interpretation.

*Interviews*

The interviews were focused conversations. They lasted on average an hour and a half. The shortest interview lasted one hour and 10 minutes. The longest one lasted 2
hours and 15 minutes. They were held either at a school (3), coffee shop (5), or the participant’s home (7). The participants chose the location. For each interview, 3 tape recorders were brought along, a digital recorder, at least 3 blank tapes, extra batteries, a set of documents (questionnaire requesting the above category information, vignettes, interview guide, and blank paper), a hard copy of the researcher’s log, and writing utensils. A copy of the blank paperwork taken to each interview is included as Appendix C. This includes an information sheet, vignettes, lesson transcript, and questions for the semi-structured part of the interview. The interviews entailed 5 parts: an introduction, presenting and reconstruction of two vignettes, critique of a lesson transcript, semi-structured interview questions, and closure.

Interview part 1: Introduction. This included thanking the participant for agreeing to be part of this study, giving them some general information about the study and how long the interview is expected to take, as well as informing them that I can guarantee their anonymity. This information was repeated here, but was also part of our initial conversation when we set up the interview. It was during the introduction that the participants were also told that a narrative synopsis would be provided as a result of the interview, and they would be asked to validate the narrative by agreeing to or changing the text. They were then asked whether they had any questions at this time. Finally, this part of the interview concluded with me asking for permission to audiotape our conversation and giving them an information sheet to fill out.

Interview part 2: Vignettes and Reconstruction. A hypothetical, yet realistic situation, has been a part of every study involving the message design logic. O’Keefe (1988) in her original study, created a scenario that contained two main features. First,
there was a presence of important but irrelevant and negative past behavior and there was a desire to reorganize the situation. Second, the participant has a leadership role and should be instrumental in reorganizing the situation.

In her study, she asked participants to imagine they were in a class where a group project counted heavily toward the final grade. The participant was the group leader and one of the group members, named Ron, was causing some problem by not doing his share, showing up late to meetings, or not at all. Now the project is almost due, and Ron has once again failed to do what he said he would. The participants were asked to describe exactly what they would say to Ron. See Appendix A for the exact prompt O’Keefe used. Similar prompts meeting the same criteria were produced in the other studies.

During the interview for this study, the secondary mathematics teachers were asked to respond to 2 hypothetical, yet realistic situations. The situations were designed according to O’Keefe’s description. Three key factors were addressed: 1) the scenario could be responded to in various ways; 2) there was a negative presence which allows for beliefs to be developed, but they are not particularly relevant to the present situation; and 3) the participant is assigned a role with “power” in the group, for example the group leader. The last criteria was easily met in this study, since teachers are the assumed leaders in the classroom. The other two factors were incorporated into each of the scenarios.

The two vignettes were designed with the help of two secondary mathematics teachers and a communication’s professor proficient in message design logic theory.
Three drafts were created until the final version was settled upon for each of the vignettes.

The first vignette is situated in the beginning of a class period where the teacher has a problem on the board for students to engage in so a class discussion can take place. The students are to be working on the problem while the teacher walks around checking the homework from the night before. The teacher notices that many of the students had not completed the homework assignment and were now socializing instead of working on the problem. After a few minutes, the teacher reminds the students to get to work and a couple of students respond with complaints about doing the problem. Here is the exact vignette as presented to the secondary teacher participants.

Vignette #1: The bell has rung, you asked students to get out last night’s homework and while you go around and check to see if they have it done, students are to work on a problem you’ve written on the board to start the day’s lesson.

If the value of \(-7abc^2\) is negative, what do you know about the signs (positive or negative) of \(a\), \(b\), and \(c\)?

As you walk around, you notice there are many of them who had not completed the homework assignment, and even more are taking this time to socialize instead of work on the problem. You remind them to work on the board problem.

Some students begin working on the problem, others just sit there, and Max, a student on the other side of the room says “Why do we have to do this?” Another student, sitting right next to you adds, “This problem is stupid.”

Describe exactly what you would say.

As O’Keefe (1988) indicates, there are a variety of ways teachers can respond to this situation. In addition, there are many negative behaviors in this vignette, many of which are commonly found in the classroom: students aren’t engaged in the problem, students are not getting homework done, and talking out in class. Students are criticizing
the problem as well as asking the infamous question so many teachers hear, “why do we have to do this”, or “when will I ever have to use this in life?” Teachers have developed beliefs about these situations, since the majority of teachers have been faced with these episodes at various times in their career or training. Every teacher agreed that this vignette does represent a realistic situation, at least at some time in his/her career.

The second vignette has the secondary mathematics teacher participants creating messages to the class relative to student understanding and curriculum. In this vignette, the majority of students do not understand the concept at hand, and there are other demands needing to be met. Students have just performed miserably on the test, and the teacher needs to decide how to address this, as well as continue with the curriculum to meet time demands. The teacher is asked to address the students about the situation.

Vignette #2: Your students have just taken a test on factoring quadratic equations, and 70% of the class failed. Your review before the test had gone really well. You and the students felt they understood this concept. But it is clear, based on the scores, that many of them still do not understand this concept.

There are only three more weeks of school left, and you still have another chapter to cover. Quadratic functions and this last chapter are both topics that will be included in the department final exam. In addition, quadratic functions have been identified by your department as one of those key concepts students must know for the next course.

Describe exactly what you would say to your students the next class period.

As in the first vignette, there are many negative influences in this vignette: students not understanding, students not doing well on the test even though the review went well, a departmental final exam, teachers covering the needed curriculum in a given period of time. These will all be possible factors in the message the teachers create.

The participant teachers agreed that this situation does arise in the mathematics classroom. There was some hesitation on the 70%, so in the later interviews, the 70% of
the class failed was changed to over 50% of the class failed. With that change, there were no additional comments made regarding that number, and most of the teachers agreed this is a realistic situation in mathematics classrooms.

Once the teachers read each situation, they were asked whether they believed the situation was realistic and then asked to proceed with their exact response. After giving their response, cued-recall (Waldron & Applegate, 1994) was used to get the teachers to self-report on their thinking at the time of the statement.

Cued-recall implies playing back the response and stopping intermittently to get the participant to share the thoughts that were relevant to the specific statement. This method has been used in a number of communication studies (Waldron & Applegate, 1994; Waldron, 1990; Waldron & Cegala, 1992; Waldron, Cegala, Sharkey, & Teboul, 1990; Ickes, Robertson, Took & Teng, 1986), and it was suggested by a communications professor that it be used in this study as well. This is different than O’Keefe (1988) study where she had participants write down their responses, and those were the units of analysis. Because this study wanted to get more information on the logic behind the statement, the cued-recall methodology seemed more appropriate.

In the cued-recall, participants were given these instructions: “I am going to play back your response. I will stop after every couple of sentences. You will be asked to respond to three questions about your thoughts during this period of the conversation. It is important that you describe as best you can, what you were thinking. If you cannot remember, do not try to guess, just indicate that you don’t remember. At each stop of the tape, you will be asked to answer these particular questions. Question 1: Why were you saying the things you were during this period of the conversation? Question 2: What (if
any) actions you were planning during this period. In other words, were you “thinking ahead” about what you might do or say in the near future or later in the conversation?

Question 3: What do you think students are thinking when you say this part of your message? Please state any reasons you decided to respond in this way.” At the end of the cued-recall for that message, participants were asked Question 4: What is the most important thing needing responded to in this situation? Question 5: Overall, how do you think students will respond to your message? Question 6: What do you think will happen next?

Each message was played back and participants responded to the above questions. This was possible because two audio tape recorders as well as a digital recorder were used to record the interview. One of the recorders was used to play back the messages. The other two recorders recorded the entire interview. This strategy gave further insight into the logics the teachers used as they thought and talked to the situations. Most teachers were also asked how this message would be different in another class, usually a specific class was mentioned.

This part of the interview created the richest data for this study. The play back was instrumental because it allowed the participant to articulate the thoughts that influenced the message, and to determine the overall goal of the message. In future studies, I will include having the teachers first write down their message to the class and then read it for the cued-recall portion of the interview. I say this because the teachers had to be often reminded to directly state what they would say to the students. Teachers had a tendency to describe more what they would say instead of stating the exact message. For many of the interviews, the message had to be constructed using the words
and thoughts discussed during the actual interview. The teachers were then given the chance to edit and validate the message during the member check.

Interview part 3: Classroom dialogue critique. A transcript of a classroom dialogue was presented. The dialogue was taken from Thompson’s (1997) study, and it represents a teacher that has conceptions of mathematics teaching that are grounded in a common use of arithmetic skills in daily situations. Mathematics is viewed as being hierarchical, which is common to most textbooks, where each topic and skill is a prerequisite for the next and all of them are equally important. The goal of instructional practice is to progress through a sequence of topics and skills specified by the textbook. And, emphasis is placed on developing a collection of skills (facts, rules, formulas, and procedures), mainly through memorization. There is little, or no consideration, to where the information comes from, the validity of it or even the logical relationship it has in practice or theory.

“Demonstrator” is the metaphor Thompson uses to describe the teacher at this level. The teacher demonstrates well-established procedures, believed to constitute the core of the needed mathematical knowledge. Students are to imitate the procedures and practice them until they become habituated. The goal is to obtain accurate answers, using the prescribed procedures, with little to no consideration of the mental process. Accuracy and correctness are important, and are judged by experts, most often the teacher, or the textbook.

Problem solving means getting answers to assigned story problems, using the prescribed methods. For the teacher, problem solving means making sure students can identify the procedure(s) to get the correct answer. Instructing problem solving, teachers
will address the problem’s quantitative relationships and appropriate mathematical operations and procedures in light of those relationships. In addition, the teacher may remind students of “key words”, “rules of thumb” focusing on what is needed for the desired procedure(s).

This part was included to see how the teacher viewed the dialogue, what characteristics they pointed out as being positive and/or negative. Participants were given these instructions: “Now I am going to give you a transcript from an actual lesson. Please read through it and when you are done, explain your overall impression of this classroom conversation.” Based on the comments given by the participant, further questions were designed on the spot for further understanding. At the conclusion, teachers were asked “What would you have done differently, if anything in this situation? Explain and give specific examples from the text and your own experiences.”

For the purposes of the current investigation, this part of the interview did not give much input to the particular research questions, though it complemented some of the earlier ideas and thoughts these teachers had shared when discussing their own messages. It also gave a glimpse of possible messages this teacher would, or would not create in an instructional setting. Finally, this data also provided some, though limited, connections between Thompson’s (1997) research on the different levels of mathematics teaching and this study with message design logic. This connection will be discussed in chapter 5.

*Interview part 4: Semi-structured interview.* A set of open-ended questions were created and presented to sum up the interview. The goal was to gain further understanding of the teachers’ interpretation of his/her verbal communication when talking to students. These questions would provide insight into whether these teachers
even thought they were good communicators in the classroom, as well as give them a chance to provide their own scenarios where they had evaluated their message as successful, and unsuccessful. Since evaluation of communication is one of the characteristics defined in a message design logic, these self-defined scenarios would provide further insight into the teacher message design logic when they are talking to students. The conversations around that would also provide more support, or challenge, the design logic identified in their message from the first two vignettes.

For this part of the interview, participants were told the following “We have been talking about particular messages you would create in the classroom, based on specific situations. Now I’d like to step back and ask some general questions about this.” The following interview guide was used for this part of the conversation.

- On a scale of 1 – 5, one being lowest and five highest, how would you rank your classroom communication and tell me why.
- Can you remember a time when it was higher than this number and describe that situation to me?
- What made that situation “better”?
- Can you remember a time when it was lower than this number and describe that situation to me?
- What made that situation “worse”?
- What is your role in classroom communication?
- What is the students’ role?
- What factors do you think effect your verbal communication in the classroom?
- What messages to you use the first day of school, can you give me an example?
These key questions served to guide the interview and keep it focused, though most of the interviews went off on tangents to discuss points that were brought up by the teachers, especially when more clarification was needed. The last question was added after the second interview because both of the teachers talked about how important the first day is when establishing the communication roles with students. The response to these key questions were the ones addressed in the member check. The important tangent topics were also included in the follow-up. The final part of this interview was the closure.

If this study were repeated, I would eliminate the questions on the different roles and even the first day of school because this data really did not alter, or in any way define, the findings of this study. I realize they were put in as a just in case. I felt I only had this one interview with them, I had to get everything I could possibly need. As I gain experience, I think it will become easier to decipher what questions, and direction, I need to stream the open ended part of the interview.

*Interview part 5: Closure.* To conclude the interview, each participant was asked if there were any additional things they wished to share. There were usually no additional comments. A few of the teachers asked general questions about the research process in general and wondered what I was going to do after all this was said and done. Each participant was thanked and again informed of the member check that would be e-mailed to them. My contact information was given to them also, for if they have any questions and/or comments they would like to further discuss. The conversation ended with me saying my intent was to write some form of literature on verbal communication
and mathematics teaching. Each participant was asked if they would like to receive a draft version, expected in the Summer of 2005.

**Member-check.**

Upon the completion of each interview, the tapes were transcribed and a member check document was created. This document was then sent to the teacher participant for validation. On average, it took about 2.5 weeks from the interview for the participant to receive this document. I usually received the response back within 2 to 3 days, though 5 of the participants took longer. One was on vacation, the others did not check their e-mail regularly.

The member check included four main parts. First, the interview location and time was disclosed, as well as a summary of their information they had provided on the questionnaire relative to experience, education, etc. This part concluded with a statement that they agreed to be audio taped, their anonymity was promised, and whether they accepted the future literature invitation.

The next part contained their messages in response to each of the vignettes, followed by some of the logic they provided for their message. This was followed by their critique of the classroom vignette and the general discussion. These last two sections were written in paragraph form, with their exact quotes highlighted in a certain color. Each member check ended with general comments of thanks and to please make necessary changes so that their message and thoughts are adequately presented.

**Data Management**

A plastic folder was created for each participant in this study. On the outside of the folder is the title Mr/Ms and the assigned letter for the particular participant. Each
envelope contains the audio tapes of the interview, forms filled out from the participant, transcript of the interview, final member check document, and a correspondence log specifying whenever correspondence was made with the participant, when it happened and a summary of the correspondence. The set of plastic folders were kept in a locked file cabinet in my home.

After each interview, a transcript was made. From the transcript, a member check document was created and sent to the participant. Once revisions were made, two copies of the final member check document were made. One copy went into the participant’s folder, the other into a data analysis folder. The data analysis folder held the collected member check documents. This became the focal source for data analysis. This folder, along with the researcher’s log, was the sole sources of data used in the analysis.

The majority of the data collection was completed by Winter of 2003. The only exception to that were the informal conversations that I had with participants, which later became part of the researcher’s log. These informal conversations continued through the Fall of 2004.

In summary, verbal messages, along with the thoughts and logics used to create them were collected from secondary mathematics teachers. This was gathered during an interview that included vignettes of hypothetical, yet realistic, classroom situations. This information was then summarized into a member check document, which was then validated by the secondary mathematics teachers. The member check documents, along with the researcher’s log, were the sources for data analysis.

The chosen techniques used to gather data are consistent with previous studies of message design logic that is, presenting a situation for participants’ consideration, though
in the other studies the participant messages were provided in written form. I chose the verbal response because I wanted to then use the play back technique to gain more insight into the logics they actually use to create the specific message. As mentioned earlier, in future studies, I may have them write the message and then read it into the tape. I believe that may alleviate them from wanting to describe the message instead of actually stating the message.

Some may argue that video taping actual classroom conversations would allow for a more accurate account of the teacher messages. I argue against this suggestion for the current investigation. This investigation is influenced by previous message design logic studies where messages are created with respect to a specific scenario. The messages reflect exactly how the participant thinks it’s best to respond to the specific situation, which makes it easier to account for the logic they use to create their message. There are no obvious additional factors to account for. One could argue that, for example in an actual classroom, there are numerous other factors that would need to be taken into account. Providing the hypothetical, yet realistic, situation enables us to capture how the teacher thinks is best to respond to the situation, providing us with more a sense of the logic the teacher uses to create their messages to the situation. In the future, once patterns of logic have been established, it would be beneficial to video tape actual lessons and see whether the message design logics are as apparent in mathematics classrooms.

At this phase of the investigation, it is beneficial to investigate the types of logics teachers use to create messages in the classroom, and the hypothetical scenarios have been shown as a means to accomplish that task.
As a final note on the data collection, I acknowledge my role as the investigator is central to this type of research. The interviewer creates the context and actively manipulates the flow of the discussion as long as the respondent is willing to comply with the direction that is taken. At the time of the data collection, I had 5 years experience of being a secondary mathematics teacher and 5 years of teaching mathematics at the university and supervising student teachers. I feel I understand the language and culture of this profession. This should be valuable in the understanding, but could have been conflicting during the process. Fontana and Frey (1998) caution that the presentation of self casts the context of an interview and seriously influences the dynamic of the interaction. I was cognizant of this during each interview, I refrained from any attempt to critique participants on the basis of their comments, or add my voice to their words. The interview guide and vignettes served the purpose of me not disclosing my views and helped in organizing the interview.

During the next section, I describe how the data was analyzed and why I believe the chosen procedure adequately enables the research questions to be addressed. This is followed by an overview of the methods used to further organize the data for presentation, which provides in some sense a summary of the next chapter.

Methods of Data Analysis

In hindsight, this process was much more difficult than I initially imagined. It felt like I spent months just looking at the data, hoping themes would jump out and just happen. I went through various iterations of reading the member checks and creating common themes. Though this was helpful to understanding the data, it wasn’t until I
went back to my theoretical frame and re-read some of my books on analysis, that this part of the investigation began to progress.

First, each of the teacher’s messages were read and coded as reflecting either an expressive, conventional, or rhetorical message design logic. To help in this coding, a chart was developed displaying the characteristics of each of the message design logics that had been found in previous studies. Then, to establish the reliability of the coding system, another coder independently coded the messages for each of the vignettes. The two of us achieved exact agreement 100% of the time.

Once the messages were coded, the thought patterns and reasons for the messages were recorded on colored index cards (each message design logic having its own color). These cards were then manipulated and patterns emerged reflecting each of the message design logics. The emerged patterns of thought were then compared across message design logics looking for themes of commonalities and differences (Denzin & Lincoln, 1998). Tables were developed throughout the process. The researcher did these procedures, solely.

Once the patterns were configured, the researcher’s log was read through to further validate what had been found. The researcher’s log continued to be a reflection tool capturing discussion ideas, questions for further investigation, and a place to record areas of self improvement as a researcher. In addition, the member check was revisited focusing on the last part of the interview, the general conversation. An analysis of this discussion further supported the themes that had emerged, and generated further insight, and question to classroom communication.
Once this part of the message design analysis was complete, comparisons were made with the cited factors: experience, sex, education, and course load. This was a matter of manipulating the information, creating a table, and looking for any commonalities and/or differences.

The above process took over a year to complete, largely due to the time limitations of this researcher. Six months after that, the data and findings were revisited. At that time, the comparison of these message design logics were made to the reference model that demonstrates the communication desired by mathematics educators. This comparison, and final write up for this study took place in January - July, 2005. In the next chapter, each of the research questions are cited and answered in light of the findings that were generated by my thoughts and knowledge with the collected and analyzed data.
CHAPTER 4

REPORTING FINDINGS

Research findings
Revealing, displaying, discussing
Sharing my knowledge and thoughts to THE questions.
What to include, or dismiss?

Research defined, data collected, hours spent analyzing to get to this point of sharing the results. Let me say in advance, this has not been an easy process. Presentation is so critical. How I write the results, or design the table informs, or confuses, those who have taken the time to read this document. What to include? What to dismiss? Being that this is a paper involving communication, I take this very seriously! It gets to the point where I just have to say, “Well, here it is”. It makes sense to me, but I realize more importantly it needs to make sense to others. My hope is that those who read this converse with me about their interpretations and understandings of what I am trying to say. Then I can validate, question, reflect, and rewrite once again. My life’s work is becoming an expert in classroom communication, and I thank those in advance who take the time to discuss this with me so I can move along that journey.
The aim of this study was to better understand the logic secondary mathematics teachers use to create their verbal messages to students, and then to identify any patterns of logic that exist in secondary mathematics teachers’ messages. The interpersonal communication literature provided much of the theoretical base for considering this idea, namely message design logics theory. The findings presented here describe the message design logic found amongst secondary mathematics teachers and the characteristics associated with each of them that could be identified. Even though much of this discussion centers on the secondary mathematics teachers message design logic, which is a communication concept, in the final research question, it is related back to the current affairs in mathematics education. That is, in the final question these found logics are compared to the reference model created in Chapter 2. After that, in Chapter 5, the mathematics education literature remains the focus. In Chapter 5, the findings are discussed in terms of our own literature. Future studies in need of investigating are also proposed at that time. In order to have these later conversations, it is first necessary to focus, and respect, the knowledge gained by considering the communication concept of a secondary mathematics teachers’ message design logic. In particular, the following research questions were studied.

2. What are the message design logics being employed by secondary mathematics teachers?
   a. What is the fundamental purpose for the secondary mathematics teachers’ verbal message to students?
   b. What are the key reasons teachers give for their messages to students?
c. How do the secondary mathematics teachers take students into account in their message?

d. How do the secondary mathematics teachers evaluate their verbal message as successful, or not?

3. What factors influence the message design logic? In particular, how does experience, education, student population, and sex of the teacher relate to the type of message design logic being used? What other factors may be influential?

4. How do these message design logics compare with the existing teacher communication literature in current mathematics education reform efforts?

In order to fully interpret the findings presented here, a summary of the message design logics will first be presented. For a more detailed explanation of the message design logics, refer to Chapter 2. Following the summary of the logics, the research findings to these particular questions are presented.

Message Design Logics

Message design logics are descriptors for the different ways that individuals translate thoughts into message form. There are three distinct message design logics that have been identified: expressive, conventional, and rhetorical. Depending on the logic an individual employs will result in different messages in an individual’s verbal communication. The different logics represent varying views of the purpose and function of an individual’s verbal communication, what context should be included in the messages, how the hearer of the message is viewed and respected, and whether the communication is successful or not. Each of the logics is summarized below.
Expressive design logic

An individual employing an expressive design logic sees communication and language as a vehicle for expressing thoughts and feelings. Expressive communicators devote little attention to the social context that surrounds a situation. They say whatever is on their mind at the time. Their aim is to convey information as honestly and accurately as possible. An expressive communicator believes if I am clear and organized in my presentation, and I understand me, so should you. Most young children use this type of logic when they communicate. A teacher who lectures to her students can be employing this type of logic as well. The presentation is focused on being clear and organized.

Conventional design logic.

The conventional design logic is employed by those who see communication as a cooperative game played according to rules dictated by social norms. These communicators strive to achieve social appropriateness, fulfill normative expectations, and obtain specific responses from the conversation. They say things in order to get a certain specific response, or action, from the other person. Communication is successful when the parties share the same rules, otherwise the communication is judged unsuccessful.

Rhetorical design logic.

The most developed message design logic is identified as a rhetorical design logic. This message design sees communication as the negotiating of social selves and situations. Rhetorical communicators are motivated to create social consensus and interpersonal harmony within interaction. When discord is present in a conversation,
persons using a rhetorical design typically reconcile the competing desires of those involved by redefining the situation. Rhetorical communicators realize that meaning is being created by the communication.

Research Questions Answered

The current investigator wanted to see whether these different logics could be found amongst secondary mathematics teachers. It was hypothesized that if there are varying logics being used by secondary mathematics teachers, then that may inform educators of another angle in understanding why communication has not been interpreted and implemented as desired in the current reform efforts.

Findings

Research Question #1

What are the message design logics being employed by secondary mathematics teachers?

a. What is the fundamental purpose for secondary mathematics teachers’ verbal communication to students?

b. What are the key reasons teachers give for their messages for the classroom?

c. How do the secondary mathematics teachers take students into account in their message?

d. How do the secondary mathematics teachers evaluate classroom communication as successful, or not?

All three message design logics were found to exist amongst these secondary mathematics teachers in their responses to the vignettes. The two vignettes dealt first with student mis(behavior) and second, poor performance and meeting curriculum
demands. Specifically in the first vignette, 20% (3) were coded as expressive, 53% (8) were coded as conventional, and 26% (4) were coded as rhetorical. In the second vignette, 13% (2) were coded as expressive, 53% (8) were coded as conventional, and 31% (5) were coded as rhetorical. All, but two, secondary mathematics teachers were consistent in their message design logic between these two scenarios. One teacher who was coded as having an expressive design logic in the first vignette gave a message that was more conventional in the second vignette. And, a teacher who gave a message in the first vignette that was coded as conventional gave a rhetorical message in the second vignette. A possible explanation could be the difference in designing messages that confront (mis)behavior of students, versus one where the teacher needs to discuss poor performance on a test and upcoming curriculum demands.

The data used to answer these questions came predominantly from the responses to the two vignettes. This included a sample message the teacher would give to students when presented with a similar classroom scenario, as well as the reasons the teacher gave for the contents of the message when it was played back. The general interview responses further validated these findings.

Table 4.1 summarizes the findings to this question. For each of the message design logics, it describes the main focus for the teacher’s message, how the teacher talked about the reasons for their message, reasons for the message, themes for the fundamental purpose of the teacher messages, what the teachers thought would happen next, how the teachers thought students would react to their message, and how they evaluated the communication as successful. Following the table is sample messages for each of the logics, along with details on why it was coded as that message design logic.
Once these messages are shared, the table will be revisited, and each of the message design logics is further discussed, along with the specific emerging themes for these teachers.

<table>
<thead>
<tr>
<th>Message:</th>
<th>Expressive</th>
<th>Conventional</th>
<th>Rhetorical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher focuses on the present situation, along with additional personal thoughts and feelings.</td>
<td>Teacher stays focused on the present situation, explaining and validating using outside informative resources.</td>
<td>Teacher focuses on student ideas to redirect and move them toward social consensus.</td>
<td></td>
</tr>
<tr>
<td>When discussing reasons for message</td>
<td>Teacher talks about the problems in the scenario, and more</td>
<td>Teacher talks about the problems.</td>
<td>Teacher talks about finding a solution</td>
</tr>
<tr>
<td>Reasons:</td>
<td>Being honest and open with students</td>
<td>Telling students what is appropriate, provide consequences</td>
<td>Getting student input is major part of solution</td>
</tr>
<tr>
<td>Themes: Fundamental purpose</td>
<td>Teacher clarity</td>
<td>Student cooperativeness</td>
<td>Flexibility to teacher and student</td>
</tr>
<tr>
<td>Explain student thinking</td>
<td>Guide student thinking</td>
<td>Re-direct student thinking</td>
<td></td>
</tr>
<tr>
<td>What next?</td>
<td>Hope students will understand and begin working</td>
<td>Get students on task</td>
<td>Depends on conversation</td>
</tr>
<tr>
<td>Students’ reaction?</td>
<td>General assumptions, i.e. students know I care, students know I’m just doing my job, hopefully they’ll see what teacher means.</td>
<td>Assume student reaction based on past experiences, i.e. teachers say things to get students on task, depends on the student.</td>
<td>List some possible student affirmations and realities, focuses on student voice being heard in the classroom.</td>
</tr>
<tr>
<td>Successful, or not</td>
<td>When teacher feels like they have been heard, and students understand.</td>
<td>When students act in a manner consistent with the teacher’s plan.</td>
<td>When common ground is found by teacher and students.</td>
</tr>
</tbody>
</table>

Table 4.1: Mathematics teacher message design logic themes

Vignette #1

Appendix C contains a copy of this vignette. It had to do with the teacher walking around checking homework while the students were to be working on an open ended problem. The teachers responded to this situation as if they were talking to
PreAlgebra or Algebra students. This is because of the particular mathematics problem that is being addressed by the students in this situation.

Expressive design logic.

Three, or 20% of the responses were coded as expressive. Characteristics that defined this message logic were if it seemed the teacher was merely expressing themselves to the students, there is little attention to context and includes pointless ideas not relative to the real situation at hand, which is that the students are disengaged. It is merely a reaction to the situation. Other clues were if the response contained messages that were predominantly past oriented, incoherent, and/or failed to engage the immediate problem at-hand, that is if for example threats were made without explanation of the undesirable behavior. Two sample messages coded as expressive follow. The brackets at the beginning of the message serve as a reference. Specifically the first part states which message design logic (Expressive, Conventional, or Rhetorical), followed by whether it was Vignette 1 or 2, and finally the Teacher Reference Letter A – O.

[Exp, V1, F] “Class I see a lot of you don’t have the homework done for today, can we talk a little about that because we’re not going to make much progress on understanding the concepts if we’re not trying and doing the homework.

Remember, math is not something you just absorb by just listening to me. A really important phase is where you go home and practice. When you don’t do the homework you’re kind of digging a hole for yourself that’s going to be very difficult to get out of. You really need to try harder on a daily basis and do this homework.

Because, of course, if you continue to not have your work done, it will most likely lead to poor performance on tests and quizzes, and you’re putting yourself in jeopardy of not passing the course. Think about that. I hope this makes sense to you.” then proceed to look at the problem on the board.
“Folks, we need to get on task here, we need to get this done. I’m seeing that a lot of you have not got your homework done. If this continues then I’m going to start grading all the problems. Now, let’s get cracking on this problem, go, get to work. If I have to, I’ll make it worth points, you’ve got 5 minutes, now go.”

These two messages are instances where the teacher feels s/he needs to react to the situation. They seem to say the first thing that comes to their head, with little attempt to really reorganize the situation. There is some irrelevant threat to the message, the first being the idea if they keep it up they will flunk the course and the second the threat to start grading all the homework assignments. It is interesting to note that teachers who gave these expressive messages, when asked what they thought students would think when hearing this message, all three discussed how they would hope the students would know they were serious about the work they ask them to do and they will, as the teacher, do what they need to get them to do it. In particular, the teacher providing the first message said he thought students would think, “he’s right, I need to practice. I’m not going to get that much out of this class if I just listen. I might do OK and maybe I’m smart enough to pull off a C, but I really could do so much better.”

These teachers truly had a genuine desire to get students to learn, so in some sense, they are saying things to guarantee a response, which is consistent with the conventional message design logic, but the difference is in the conventional design the message focuses on what is appropriate for students to think about and act on, without a discrete element of threat. In summary, the teachers are aiming to get students to think about or do their homework and problem on the board. They just seem to think the best way to address this situation is to share with students their direct thoughts on ‘OK, what I can I say to change this behavior right now.’ Even though, if the teacher reflected upon it
further, they noted most students already know much of the information being conveyed and it really will not satisfy their wants and needs. And, the complaints that are part of the message, the students can really do nothing about it at this point in time. They are put in a position to merely listen to the teacher say his/her speech. These teachers aren’t thinking about this point of view, their thinking is “I think they know I’m trying to say or push the right buttons for them. Hopefully they know teachers want them to be successful and get a lot out of their schooling.”

*Conventional design logic.*

Eight of the responses were coded as conventional, or 53%. These messages focused on what is appropriate in the current situation. The teacher’s main purpose is to secure a desired response from the students, getting control of the situation, and having the students cooperate. The context of the message is centered on what action and meaning the students should respond with, along with an education of why. Samples of two conventional messages follow.

[Conv, V1, B] *Walk over to Max* “oh, you know this problem isn’t stupid now don’t you?” *Address whole class,* “OK, it’s time to move on, let’s do this problem together and we’ll talk about the thinking I am asking you to do and why this might be valuable” *After working on problem together* “This problem involved using some critical thinking which is something that you often have to do on the standardized tests. Looks to me like we need to think about and work out more problems like this”. *Make up several other problems that are similar.*

[Conv, V1, A] “Alright, you all know that every problem we do in here may not be used later on in your life, but we still need to do them so that you can better understand the concepts we’re working on. So let’s get working on this. I’ll make it worth 3 points, based on whether you attempt it or not, so for some of you, now you have a reason (chuckle)”. *After going over the problem with the students, make a point to tell them* “Good job, I think it’s important that we keep in mind how important it is to participate and do these problems. It’s also important that we all speak in such a way that you and your peers feel like what
they have to say is important and valuable. There is no reason to put down other people, or the work we’re doing in here.”

These messages are grounded in the conventional premise: “Communication is a game played cooperatively, according to socially conventional rules and procedures.” (O’Keefe, 1988, p. 86). This view subsumes the expressive concepts discussed above, but the difference is the conventional message specifies the social effect one wants to achieve rather than the thoughts the teacher happens to have at the moment. Teachers may want students to know their beliefs and feelings about the situation, which consumes the expressive stance, but with the conventional there is usually an additional comment about why students should feel obligated to do what is being asked, what is appropriate to do in this situation, and a notion of being cooperative, following the defined rules.

When these teachers are asked why they chose to say this message, responses were consistent with O’Keefe’s (1988) interpretation, “that this is the normal and appropriate thing to say under the circumstances (either (1) the speaker said this now because he or she wants X and saying this is a normal way to obtain X in this situation; or (2) the speaker is responding to prior message M, and the relevant response to M is such-and-so, so this is the appropriate thing to say to accomplish the speaker’s purposes)” (p. 87). Teacher A commented the most important part of her message was “for students to understand that it’s important to do things even though they may not see a need for them right away. That it’s OK to ask why to do a problem, but not necessarily to attack it and call it stupid or dumb. To ask the question is one thing, but put something down because they don’t know the reason, I’d try to get that across to them. … [When students misbehave like this, the teacher needs] to address it immediately, to let them know that
it’s not going to be tolerated or allowed, try to model it myself, give students praise for behaving the right way, for example it could be a homework pass … just to say, you guys have been so well behaved and you’re showing all the things of a good listener, good communicator, please keep it up. You need to praise them immediately in class before they leave, let them know.”

This exemplifies the latter remark by O’Keefe (1988), that this teacher says this because s/he is responding to prior message M, and the relevant response to M is such-and-so, so this is the appropriate thing to say to accomplish this purpose. Another example provided by a teacher whose message was coded as conventional, when asked to clarify why she gave her message, she stated,

“a lot of times my general response is what I said, that is if a student looks like they have an inkling they might want to know something about these answers, I want them to think about the logic, the problem solving; it’s going through a situation where something is given to you, here’s a problem, now what do you do, and they have to realistically think through it, think about what are the things I need in order to solve this problem, do I need to converse with someone else about it, do I need to get input, do I not, do I have the material in front of me, what are my resources, you know, there are three different variables here and so I go through that with them, I say ‘OK those are the kind of things you need to be thinking about in this’. And then after that, then they start to understand….. But, I think it depends on the type of students you have, which students are saying it, that’s how you know how to react. If it’s a student you think is really trying to get some attention or distraction, then I’d go one way, but if it’s a student that is just saying it to say it and it has no relevance, then I go another way. I think a lot of times students say those things and it has no relevance. They don’t really care if they’re ever going to use this. I mean ‘this problems stupid.” OK, what do you really think they want you to say about that? They don’t want you to say “yea, you’re right, I agree with you”, and they also don’t want you to actually sit down and tell them when they’re going to use this in life. In reality, they don’t want that.”

Teachers develop appropriate messages to accomplish specific purposes.

Interestingly enough, when these teachers were asked what they believed students
thought about their messages, it was usually one of three responses, “she’s just saying that so we’ll get to work”, or “Some of them do sit there and they think through that, depends on the age of the student. Like if I have juniors and seniors, they do start to think about things like that because in reality that’s going to happen.”, or “I haven’t really thought about that.”

These teacher thoughts about possible student reactions to their message further support the conventional design logic. The teacher in this situation has created a conventional response, and she believes students will hear it and realize it is a means to get them back to work, as in the first case. In the second one, it is believed that older students will handle the conventional response better, and the last statement reflects more the teacher having an idea of what to say in this situation, but has not thought it through, or is not experienced enough, to think about how students will react to it.

*Rhetorical message design logic*

The rhetorical message design logic was found in four of the responses, or 26%. These messages clearly created a negotiation with the students, valuing their input and interpretation of the situation. There is some flexibility involved because of the input from the students, but in the end a social consensus is the aim of the communication. The teacher tries to manage the situation and strategically get the communication moving towards a desired context. Below are two samples coded as rhetorical message design logics.

[Rhet, V1, H]“Hey, we need to take a temperature reading here and see what’s going on.” Teacher moves to front of class, and makes sure everyone is paying attention. Books closed, overhead off. “Is there something going on that I need to know about, is there stuff going on outside of school, or tell me about your other classes, are you getting hit with a lot of assignments? Talk to me.” *Listen to*
responses and depending upon what was said, make a decision about the work and problem.

[Rhet, V1, G] “OK, class let’s talk about this, why do you think we have to do this?” Let class give reasons since students believe peers over the teacher at times. At some point teacher may add to the discussion, “I took speech in high school. At the time, I said I would never use this because I will be working behind a desk the rest of my life. I had to teach in grad school and all of a sudden I found myself wishing I would have paid more attention back then. You have to realize that this is an opportunity and you might as well take advantage of it. You have to be here, you’re required to be here. You can waste your time, or you might as well learn while you’re here. Later on in life, you may be glad you put the effort in. Once students see value, proceed with the problem.

These messages allow for all individuals involved to be part of the communication, that is, everyone is provided with a chance to create and negotiate in the situation. The rhetorical design logic contains within it the knowledge of conventional social forms and relations, but the situation is more mutable rather than fixed. Rather than seeing selves and situations as givens in a conventional system of rules, or seeing meaning as fixed in messages by their form and context, “meaning is instead treated as a matter of dramaturgical enactment and social negotiation” (O’Keefe, 1988, p. 87). In other words, “the relation of message and context is reversed from the conventional to the rhetorical view: In the conventional view, context is given and the relevant features of the context anchor meaning; in the rhetorical view, “context” is created by the message, or at least by the process of communication, and only the interactionally achieved [anchors meaning] ... Communication becomes the medium within which people exist and there is no other process that can be employed as a criterion against which to test its success” (p. 87).

The teachers are very cognizant of these ideas when they share why they gave their particular message. “I have some ideas about what’s going on in this situation, but
it’s always good to get the students’ input first, you know, it could be something I haven’t thought of at the time. I don’t just want to assume I have all the facts.”

Rhetorical message producers place importance on harmony and consensus. “They tend to ignore power and resource control as means of conflict resolution; they persistently underestimate the force of social convention and routine and overestimate the individuality and creativity of themselves and others” (O’Keefe, 1988, p. 88). This was also evident when these teachers were clarifying their messages, “Students should be given a voice in the classroom, it’s so easy to answer and speak for them and move on, when in fact they have a lot to say and contribute, and if we just listen, we learn a lot from them.” These messages are not a reaction to some prior condition, or a taken-for-granted feature of the world, and rather than being a conventional response to some prior state of affairs, they are instead forward-looking and often are connected to goals. (O’Keefe, 1988, p. 88).

Vignette #2

All three message design logics were also found to exist in the second vignette amongst these secondary mathematics teachers. It is repeated in Appendix C for reference. It pertained to the teacher talking to the students after a majority of them had failed a test on quadratic functions.

Expressive message design logic.

As previously noted, characteristics that defined this message logic were if it seemed the teacher was merely expressing themselves to the students, there is little attention to context and the message includes some pointless ideas that can be interpreted as irrelative to the real situation at hand. Other clues were if the response contained
messages that were predominantly past oriented, incoherent, and/or failed to engage the immediate problem at-hand, that is if for example threats were made without explanation of the undesirable behavior. Two sample messages coded as expressive follow.

[Exp, V2, F] “Class, I graded the test, and it’s obvious that many of you didn’t study. How do you expect to do well when you don’t take time to study for the test? This is something you need to do, especially if you plan on doing well in college, which I’m assuming most of you intend to do. Tests count so much more than they do in high school, and you need to study for them. Well, enough said, let’s go over this test. Hopefully you’ll think about studying more for the next one.”

[Exp, V2, M] “Class, it’s frustrating when a teacher gives a test and students do as poorly as you did, especially when I know the review went well. I’ve taught this material for enough years to know you had everything you needed in order to do well. You just chose not to study, pay attention, or something. I’m going to go over the test now and give you a second chance in two days. You need to go back and look through your notes, study your mistakes on this test. I suggest you pay better attention this time.”

When asked to clarify the message, teacher M mentioned

“maybe I didn’t do a good enough job of showing them, but maybe I did. I mean, I know that if I’m teaching quadratic equations I’m going to show them how to use their calculator to check their answers, store values and variables, so they might be coming up with answers, but they might be repeatedly making mistakes they’re not figuring out because they’re not taking the time to check the answers.”

This teacher hoped that upon hearing the message, students would

“think more deeply about the ramifications of not doing well, why am I not able to demonstrate what I know. I did this homework, I thought I understood. So many students, unfortunately, get a bad test score back and think, ‘oh well’. I want them to think that is not really acceptable, just to throw it in the trash can on the way out and not look back and find out why. I want them to think was I really clueless or did I make mistakes, do I have some answers wrong? I want them to think it is important to look back and figure out why.”

The message and reasons that support the message focus predominantly on the past. There are no steps taken to deal with the problems the students may be having in the situation. Even though the message could be read quite negatively, as well as this
researcher’s comments, I must add the affective tone in this teacher’s voice is sincerity. But, as O’Keefe (1988) points out, these messages may “lack the abusive content and negative affective tone found in other expressive messages: they may contain little more than vague confused thoughts about the problem presented by the situation (but, significantly, no one clear directive to the message target)” (p. 101).

Conventional message design logic

Eight of the responses were coded as conventional, or 53%. The “messages contain some content designed to correct the hearer’s error; they predicate a future, task-relevant, action of the hearer” (p. 101). The action suggested is task-relevant, in the sense, it specifies some action which the receiver could do in order to successfully meet his or her obligations in the situation. This future action is generally backed up by mentions of an existing structure of rights and obligations. Samples of three conventional messages follow.

[Conv, V2, N] “Our test scores on our last test did not go very well, on average. We need to do something in that area, but the problem is we still have to cover another concept and both will be part of your final exam. What I’m going to do is, being that we already covered this topic, I’m going to give you nightly review sheets to work on. Once you show proficiency in working with quadratic equations, we’ll stop doing those extra things at night. I’ll let you retake the test in a week or so, and if you do well enough, then we can forget about the review copies. For now we need to move on.”

[Conv, V2, J] “You know, I graded your test and I was disappointed in the scores. I think we need to analyze whether it’s you that doesn’t understand, or if it was the test, maybe you didn’t have enough time, too many problems, or whatever. These are all possibilities. So, for now, I’m going to put you in pairs and I’m going to give you your test back. You need to make sure you know how to do all the problems on your test because when there’s 15 – 20 minutes left in class, I’ll pick one of those problems and say for example OK Aaron you come up to the board and explain to the class how to do this problem and you’ll need to know how to do it. So, it’s important that you understand how to do every problem on this test in the next half hour. Tomorrow we’ll be starting the next section, and
then next week when we have our first quiz, there will be problems like these on it, so again you need to make sure you understand this.”

[Conv, V2, K] “It’s obvious you didn’t do as well as you should have because we did cover this in class, and the review went well. I’m going to take a few minutes and go over the major mistakes, but then we’re going to move on.” Teacher goes over the major mistakes made by the students along with reminders like remember when we did this … This would take a good 10 minutes, then the teacher would continue. “We’re going to go on now. Those of you who still feel like you don’t understand, I’ll help you outside of class. You know where I can be reach at 7 a.m. every morning. We can look over your test and talk about why you missed this or that. But in the next three weeks, we have to cover the next section. Because if I don’t get through this next chapter, then next year when you are expected to know this, you’re going to start out behind, and that’s unfair to you and your new teacher.”

The teachers employing this message design logic in their message clearly emphasize the need for students to redo the test, find their errors and correct them in order to be identified as proficient. That seems to be the appropriate thing to do in this situation. Even though the expressive messages state that idea, these messages here include the specific actions students can do in order to improve their learning. In particular teacher J comments, “I think when they are actually responsible and they feel I really have to understand this and yes I’m putting them on the spot so to speak, but at the same time it’s making them take ownership for what they’re going to do during that class period, and take ownership in understanding what’s really going on in the concepts.” The emphasis is on the task of correcting this mistake, and often they include in the message why they need to take these steps.

All the teachers having this message design logic did not agree on whether to move on or not, “I would definitely not go on until they got it. I mean you just can’t, now whether I would spend, if let’s see if the average was 60% and half of them failed, those who really failed, I would have them come in extra and I would go over the test
with them individually and possibly give them a re-take. I’m not fond of retakes but when scores are that low, then obviously they didn’t understand the concepts.”

*Rhetorical message design logic.*

The rhetorical message design logic was found in five of the responses, or 31%. These messages clearly created a negotiation with the students, valuing their input and interpretation of the situation. There is some flexibility involved because of the input from the students, but in the end a social consensus is the aim of the communication. The teacher tries to manage the situation and strategically get the communication moving towards a desired context. Below are two samples coded as rhetorical message design logics.

[Rhet, V2, L] “To make a long story short, this is not one of our better test scores. We need to figure out what went wrong here, and figure out where the misunderstanding is. What I’d like to do is give each group a copy of the test, and I want you to retake the test as a group. You should talk about the problems and ask each other to clarify anything you aren’t sure about. Also, as a group talk about why you think students did so poorly on this test and write me a note on the back page. I’m going to be walking around and listening to the conversations and hopefully we’ll figure out where the confusion lies. By the end of the time, the goal is that you will have a clearer understanding about what you personally misunderstood on the test and all of us some idea what went wrong here. Near the end of the period, you will turn in the group test with comments, and I will return your test and tonight you will do an error analysis and explain to me your errors in thinking on this test. As far as your grade, I’ll make a decision once I better understand what happened here. Any questions before we get started?”

[Rhet, V2, C] I was kind of surprised by the results of the tests. You can see for yourself how you individually did, but in general I wasn’t expecting the results that happened. I’m interested in knowing why you think you got the grade you got, do you think we need more practice, do you feel like you haven’t seen these problems before, is it something new? Or did you forget? I thought you were prepared and ready, or I wouldn’t have given the test in the first place, so please help me out. Take out a sheet of paper and write me a note specifically stating what your situation is. Also, include what you think we should do in this situation? I’ll read them tonight and we’ll talk about it more tomorrow.”
As emphasized in the first vignette, the messages here allow students a chance to provide input into the situation as to what they believe the problem. Nowhere does the teacher directly assume they know what the problems are, even if they have some idea in the back of their mind, they choose to wait and hear from the students. They aim to resolve the situation by verbally negotiating and reorganizing the specific situation. “I want students to think that I’m concerned and I want them to do better in the future, I want them to succeed at factoring, even though they haven’t yet … and I need to figure out what happened, that’s really important them communicating to me because I apparently can’t figure it out from what I did already by giving them the test; I need their input to truly understand.”

*Summary of Question 1*

These two vignettes gave a chance for the secondary mathematics teachers to create a possible message they would say to students given each of the situations. The situations were designed after previous message design logics theory studies, ones that focus on problem situations. It was found that at least in these situations, secondary mathematics teachers do employ different logics when they create their messages to students. The teachers created messages to resolve and improve the conditions of the current situation, though the message they created in order to do that focused on different aspects of the situation. The expressive design logic teachers reacted to the situation by telling students anything they could think of to change what the students were doing and thinking in the situation; whereas, the teacher employing a conventional design logic focused on validating and informing students what is necessary and appropriate in order to move forward. Finally the teachers employing a rhetorical message design focused on
the students ideas and together they analyzed and solved the current situation. In all three messages, the aim was to make the situation better for the students, and move on with the agenda, but in the first two logics, the teachers assumes they already know what is needed in order to do this. With experience, teachers gain more insight into the needs of students and these insights become part of their messages.

When the teachers were asked to do the instant recall to their message, another pattern was noticed. Those teachers who were identified as expressive continued to talk more about the problems in the current situation and often went off on tangents sharing other stories and problems that came to mind. For example, teacher M started sharing instances where something similar had happened in the classroom, Stories were shared about students in the class during the last two years.

The conventional design logic teachers focused on validating their response to the problem, sharing specific stories about when this had happened in their classroom and how that played out in that situation. The teachers using rhetorical message design logics talked more about creating social consensus, or finding a solution with the students involved in the resolution.

When it came to the student, the expressive message design logic teachers talked about having to explain things to the student, where the conventional design logic teachers seemed to be more wanting to guide student thought and rhetorical re-direct the student thought. The difference in the last two is the rhetorical starts with the expression of student thought, where the conventional assumes they are aware of the student thought.
The teachers who gave expressive and conventional messages focused their conversation predominately on the student, and in some sense fixing what is wrong in the current situation. The teachers providing the more rhetorical message at some point emphasized the need to hear the student voice before responding further to the situation.

Research Question #2

This question considered whether experience, education, course load, or sex played a part in the message design logic employed. The particular research question was:

What factors influence the message design logic? In particular, how does experience, education, or sex of the teacher relate to the type of message design logic being used?

What other factors may be influential?

Experience and message design logic

Experience was divided in the categories: less than 5 years, 5 to 12 years, and greater than 12 years experience, but less than 25, and finally greater or equal to 25 years. The decision to divide it in that way was due to four ideas. The reasoning for these divisions is discussed in Chapter 3, but in summary Berliner (1986, 1994) discussed five years as the time a teacher begins to be competent so that gave the first division. Second, the reform efforts for a student-centered approach have been part of the formal teacher education in the last 12 years (from data collection), and third, teachers trained 12 – 25 years ago had some formal instruction, though limited, on the importance of engaging students. It was during this time period that constructivist notions were part of the discussion, for example problem solving, and student needs and how to address them were among the key themes. The fourth idea was it was believed that greater than 25 years ago, the formal education focused predominately on the teacher. The experience
ranges of these participants were 4 (27%) with 5 years or less experience, 4 (27%) had between 5 and 12 years inclusive, 5 (33%) had between 12 and 25 years inclusive, and 2 (13%) had more than 25 years of teaching experience.

Table 4.2 shares the number of messages created for each of the message design logics in each vignette and then the total messages created in both vignettes are shared.

<table>
<thead>
<tr>
<th>VIGNETTE 1</th>
<th>Expressive</th>
<th>Conventional</th>
<th>Rhetorical</th>
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<tbody>
<tr>
<td>years ≤ 5</td>
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<td>1</td>
</tr>
<tr>
<td>5 &lt; years ≤ 12</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>12 &lt; years ≤ 25</td>
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</tr>
<tr>
<td>Years &gt; 25</td>
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<td>5 &lt; years ≤ 12</td>
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<td>Years &gt; 25</td>
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<tr>
<td>Years &gt; 25</td>
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</table>

| TOTAL            | 5          | 16           | 9          |

Table 4.2: Message design logic findings by experience

These numbers suggest that experience does not directly influence message design logic. The distribution of message design logics is fairly consistent across the rows at each of the experience levels. Once again, these numbers cannot be used as a generalization, though I do claim that it gives evidence that the different message design logics do exist in secondary mathematics teachers, and the differences are not necessarily directly tied to experience. Next message design logic is related to education, or the highest degree attained.
**Education and message design logic.**

Teachers were also categorized by their highest degree obtained: bachelors, masters, or doctorate. It is important to note that the highest degrees were all obtained within the last 12 year period, which means every participant had some college instruction during this reform period. Of the teachers in the study, 2 (13%) had bachelor degrees, 11 (73%) had master degrees, and 2(13%) had doctorate degrees.

Once again, the number of messages created for each message design logic in each of the vignettes is first presented separately, and then a table looking at the two combined.

<table>
<thead>
<tr>
<th>VIGNETTE 1</th>
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<th>Rhetorical</th>
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<tr>
<td>Doctorate</td>
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<td>TOTAL</td>
</tr>
</tbody>
</table>

**Table 4.3: Message design logic findings by education**

The participant teachers in this study that have a bachelor’s degree as their highest degree obtained all gave conventional responses to the situations. The Masters level teachers’ distribution is pretty consistent with the overall percentages, and the Doctorate level distribution is split between rhetorical and expressive. Being that there were only two participants in the bachelors and doctorate categories each, these data aren’t as
telling, though I do claim that since both the expressive and rhetorical message design logics are present in the doctorate level participants, it seems that formal education, as it is, has not influenced the individual’s message design logic. This would be further supported since the category with most of the numbers, Masters, is distributed similar to the overall percentages. Predominant course load was the next factor considered.

Course load and message design logic.

Predominant course load was a category added after the first couple interviews because participants mentioned how their messages were different depending upon the student population in the different courses. It was decided to categorize predominant course load as PreAlgebra or lower, Algebra/Geometry, College prep above Geometry, Remedial courses above Geometry, and any Honors-Advanced course. The initial teachers interviewed thought the student population varied more in the courses in the PreAlgebra or lower, Algebra/Geometry and Remedial courses compared to the other college prep courses and honors. This was due to the student’s mathematical ability, maturity, and motivation. A teacher in these classrooms may need to address this wider diversity in their verbal messages. This category was directly addressed in all but the first two interviews. Those two participants were later asked to provide this information as part of the member check.

It is more difficult to portray this category in a table form, since the teachers who had more experience had taught most, if not all of the courses, and those with less experience had taught few. To address this question, the teachers were specifically asked if their message would be any different for students in for example an Algebra course. The researcher would refer to a course they had previously taught, if possible.
Teachers talked about how their verbal communication varies depending upon the students they are teaching, “It depends on who my students are, if I’m talking to my Algebra kids, I won’t even address it because they are just saying it to get me off task, but my Pre-Calc kids I don’t think they would make such a comment unless they really did want to see some relevance, so I would take some time to address it” [teacher response to V1]. I still contend my assumption to be true, that maybe the content of their message changes depending upon the students involved, but their logic for creating the messages does not change. This is supported in my own reflections and the few responses I did get in this category when teachers were asked how their messages would be different in different classrooms. The thoughts used to create the message were consistent with those used in the original message. Next the sex of the teacher is considered, that is, whether the sex of the participant reflects a tendency towards a particular message design logic.

*Sex and message design.*

Sex is the final category under consideration here. It has been discussed in the communications literature that in some cases, there seems to be a difference in the sexes and the way they communicate with others, yet O’Keefe (1988) in her study refutes this notion. This category was included to see if, in this sample, there seems to be any differences.

It is important to note that this study did not investigate social gender issues relative to message design logic, only biological differences in sex. There may have been different findings had factors such as a masculine or feminine approach to communication had been studied. This is particularly interesting in mathematics.
education because of the strong masculine correlation in our field. This should be something to consider further in both education and communication research.

In this study, 6 (40%) were male and 9 (60%) were female. Table 4.4 shows the distribution of the message design logics used.

<table>
<thead>
<tr>
<th>VIGNETTE 1</th>
<th>Expressive</th>
<th>Conventional</th>
<th>Rhetorical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Female</td>
<td>1</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>VIGNETTE 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Female</td>
<td>1</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>CUMULATIVE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>3</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Female</td>
<td>2</td>
<td>11</td>
<td>5</td>
</tr>
<tr>
<td>TOTAL</td>
<td>5</td>
<td>16</td>
<td>9</td>
</tr>
</tbody>
</table>

Table 4.4: Message design logic findings by sex

Once again, with these participants in mind, message design logic does not seem to be influenced by the sex of the individual. This is a finding consistent with O’Keefe (1988). Both the female and male teachers employed each of the three message design logics. As with all of the factors discussed here, a larger study would need to be done with more numbers to see whether these findings can be generalized, but in the mean time, it seems that none of these greatly effect the message design logic employed. And, it seems that message design logic is merely related to the individual teacher’s constructs that have been created for verbal communication.

Additional factors considered for message design logic

It came up in the data analysis to also consider the type of school district in which the teacher is employed at: rural, suburban, or urban. In this sample of teachers, no teacher is employed in a rural district, and only 2 of the 15 are in an urban setting. The
remaining teachers, 13, work in suburb districts. So even though the settings are not represented adequately, the following distribution of message design logics is noted as Table 4.5.

<table>
<thead>
<tr>
<th>VIGNETTE 1</th>
<th>Expressive</th>
<th>Conventional</th>
<th>Rhetorical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Suburban</td>
<td>2</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>VIGNETTE 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Suburban</td>
<td>1</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>CUMULATIVE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Suburban</td>
<td>3</td>
<td>14</td>
<td>9</td>
</tr>
</tbody>
</table>

Table 4.5: Message design logic findings by community

No additional factors were considered that may influence message design logic. Though in the general conversation part of the interview, teachers who were coded as having a rhetorical message design logic talked about having instances where they were directly asked to be more reflective in their communication. For example one teacher said, “I took a communications course in my undergrad, and it made me realize how the way you say things really matters. I still think about the things I learned in that class today in my teaching. It influenced me a lot.” Another teacher took courses in counseling, and she gave credit to that course for influencing the way she talks to students.

Neither of these teachers felt their teacher education directly influenced this as much. “In our education courses, we learned how to communicate concepts, or ask certain types of questions, when to ask, wait time, those kind of things …. These are very different ideas than the ones we talked about in my counseling class.” When asked in what way they were different, “I don’t know, I guess it was more what to do in the
education class, and how to do it in my counseling class. It’s not that clear cut to communicate (chuckle), but I guess I’d say we looked more in depth at the actual conversation in counseling, we talked about what could happen next, what it felt like to be the person you were talking to, what our goals would be for talking to the person, those kind of things.” This teacher provides us as some valuable insight to consider when organizing teacher development and training programs.

This is compared to the other teachers who were coded as conventional or expressive. It was common for them to talk about the only way you really learn to communicate in the classroom is through experience. “You learn what works in certain situations, you become better and quicker at realizing things to say and do.”

So, if an additional factor would be noted, it would be that secondary mathematics teachers who were provided an opportunity of looking more in depth at the communication process were more likely to create a rhetorical message design logic. This is consistent with my own experiences. I was fortunate enough to have an instructor in my undergrad who made us role play various scenarios. We had to play the role of student, teacher, administrator, or parent dealing with a specific situation. Following the role play, we had a group discussion on what happened and each of the perspectives were accounted for. I have always realized that those experiences were influential in my communicative practices in and out of the classroom, but after talking with these teachers in my study, I realize even more how powerful that experience was.

To summarize these findings for the first two questions, this investigation did find evidence that secondary mathematics teachers do employ any one of the three logics that have been identified in the interpersonal communications literature: expressive,
conventional, and rhetorical, though obviously no single investigation can tell all. Not only was this evident in the specific messages the teachers created for the situations presented to them, but it was also consistently found in the reasons they gave for creating the messages.

Since message design logic refers to a type of knowledge organization, it should be considered stable across situations, that is, as indicated by Barbara O’Keefe (1988), if a person has the knowledge in one situation, then he or she has the knowledge in other situations as well. In this study, the message design logics were consistent for 13 of the 15 teachers, two of teachers in the second situation gave a message that was coded as one level higher. The table below shares the relation between how message 1 and message 2 were coded for the fifteen teachers.

<table>
<thead>
<tr>
<th></th>
<th>Expressive</th>
<th>Conventional</th>
<th>Rhetorical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expressive</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Conventional</td>
<td>1</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>Rhetorical</td>
<td>0</td>
<td>1</td>
<td>4</td>
</tr>
</tbody>
</table>

Table 4.6: Consistency of message design logic between vignettes

Looking at the diagonal E-E, C-C, and R-R and comparing them to the other cells, it does suggest that the message design logic used in one situation will more than likely be used in other situations. Because no one teacher gave both the expressive and rhetorical messages, it does indicate that there is some developmental factor involved as suggested by O’Keefe (1988). She states in her paper “The only predictor known to relate to the use of Rhetorical as opposed to Conventional or Expressive message designs is interpersonal construct differentiation” (p. 85). The development meaning that some
teachers have developed more elaborate constructs for their classroom communication than others.

The identifiable patterns found in these secondary mathematics teachers are consistent with the general patterns associated with each of the message design logics. Though in summary, those teachers employing more an expressive logic will create messages to students as a reaction to prior events, the context of their messages will generally be what is foremost in their mind at the time of the verbal exchange. They say things hoping to make an impact on the students and push the right buttons. It seems teachers learn through time what buttons students most identify with in given situations. The experienced teacher employing this logic incorporated more ideas into the message, whereas the beginning teacher merely gave a reaction to the situation at hand. It was not directly studied how these teachers would create messages during classroom discussion, but when these teachers were given a transcript of a teacher who seemed to be creating messages that were of the expressive classification, both teachers identified with the teacher saying he asked good questions and addressed each of the students who asked or needed information. A later study will have to be done looking at message design logics specifically during classroom instruction.

The teachers employing a more conventional design logic focus on what is appropriate and right in the situation. A conventional design logic sees communication as a game played by rules. These teachers have created numerous rules for what the communication should and will look like, and they say and do what is necessary in order to create that communication. And, they become very good at it. With experience, the conventional communicator integrates the student’s needs and wants into their rules for
the classroom. Whereas at the beginning of their career, they may make more threatening remarks, like focus on grades or punishment for not following their rules, but in time they eliminate those more threatening messages and create more complex and student-sensitive messages. They become more sensitive to how the students are feeling and include statements that they feel students are in need of hearing in certain situations. But, they decide what is appropriate and right, and they inform students of this. Their messages are created in order to secure a specific result in the hearer.

The teachers who employ a rhetorical message design see their verbal communication as more a negotiation with their students. They create messages that allow students to very much be a part of the conversation, where the students’ input into the situation is as valuable as the teacher’s thoughts and input. Social consensus is an important notion to the rhetorical message producer. For the teacher, this means that in order to achieve their desired result, they get the students involved in the negotiation so that everyone is on the same page and the aim is for the teacher and student to come to some solution to the existing situation.

This study suggests that factors, such as sex, education, experience, or course load cannot be used to indicate the message design logic a teacher will likely employ. We did consider the type of community the teacher was employed at, and for the suburban district, it seemed the numbers were similar to the overall distribution. Since there were only two urban teachers and no rural teachers, later studies would need to consider this factor in more depth.

The only possible factor identified was a previous exposure to an in-depth look at communication, in this study it was through a college course, usually not in education.
Though, it is strongly reiterated that the small number of participants does not give much reliability to these claims. A greater number of teachers would need to be studied. The third question related these findings to the current mathematics education reform.

Research Question #3

In Chapter 2, a reference model was designed that describes the communication practices that are being recommended in our current reform efforts. It describes the fundamental premise for communication, key message function, message/context relationship, method of managing face, and evaluation of communication.

<table>
<thead>
<tr>
<th>Mathematics teachers desired message design logic</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fundamental premise</strong></td>
</tr>
<tr>
<td><strong>Key message function</strong></td>
</tr>
<tr>
<td><strong>Message/context relationship</strong></td>
</tr>
<tr>
<td><strong>Method of managing face</strong></td>
</tr>
<tr>
<td><strong>Evaluation of communication</strong></td>
</tr>
</tbody>
</table>

Table 4.7: Mathematics teachers desired message design logic

This model was used to compare the message design logics that surfaced in this investigation. This allowed me to answer the third research question: How do these message design logics compare with the existing teacher communication literature in current reform efforts?

The message design logic most consistent with the above desired message design logic is the rhetorical message design logic, which was only employed at most by 31% of the participants in this study. If we assume that a similar logic is being used in the
classroom to create messages to students, then this finding may help us explain a possible reason for teachers not implementing the encouraged communication. The table of findings showing the identified characteristics of each message design logic is reprinted below to assist further in this discussion.

<table>
<thead>
<tr>
<th>Message:</th>
<th>Expressive</th>
<th>Conventional</th>
<th>Rhetorical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher focuses on the present situation, along with additional personal thoughts and feelings.</td>
<td>Teacher stays focused on the present situation, explaining and validating using outside informative resources.</td>
<td>Teacher focuses on student ideas to redirect and move them toward social consensus.</td>
<td></td>
</tr>
<tr>
<td>Teacher talks about the problems in the scenario, and more</td>
<td>Teacher talks about the problems.</td>
<td>Teacher talks about finding a solution</td>
<td></td>
</tr>
</tbody>
</table>

| When discussing reasons for message | Teacher talks about the problems in the scenario, and more | Teacher talks about the problems. | Teacher talks about finding a solution |

| Reasons: | Teacher talks about the problems in the scenario, and more | Teacher talks about the problems. | Teacher talks about finding a solution |

| Themes: Fundamental purpose | Teacher talks about the problems in the scenario, and more | Teacher talks about the problems. | Teacher talks about finding a solution |

| What next? | Teacher talks about the problems in the scenario, and more | Teacher talks about the problems. | Teacher talks about finding a solution |

| Students’ reaction? | Teacher talks about the problems in the scenario, and more | Teacher talks about the problems. | Teacher talks about finding a solution |

| Successful, or not | Teacher talks about the problems in the scenario, and more | Teacher talks about the problems. | Teacher talks about finding a solution |

<table>
<thead>
<tr>
<th>Expressive</th>
<th>Conventional</th>
<th>Rhetorical</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Message:</strong></td>
<td>Teacher stays focused on the present situation, explaining and validating using outside informative resources.</td>
<td>Teacher focuses on student ideas to redirect and move them toward social consensus.</td>
</tr>
<tr>
<td><strong>When discussing reasons for message</strong></td>
<td>Teacher talks about the problems.</td>
<td>Teacher talks about finding a solution</td>
</tr>
<tr>
<td><strong>Reasons:</strong></td>
<td>Teacher stays focused on the present situation, explaining and validating using outside informative resources.</td>
<td>Teacher focuses on student ideas to redirect and move them toward social consensus.</td>
</tr>
<tr>
<td><strong>Themes:</strong></td>
<td>Teacher stays focused on the present situation, explaining and validating using outside informative resources.</td>
<td>Teacher focuses on student ideas to redirect and move them toward social consensus.</td>
</tr>
<tr>
<td><strong>What next?</strong></td>
<td>Teacher stays focused on the present situation, explaining and validating using outside informative resources.</td>
<td>Teacher focuses on student ideas to redirect and move them toward social consensus.</td>
</tr>
<tr>
<td><strong>Students’ reaction?</strong></td>
<td>Teacher stays focused on the present situation, explaining and validating using outside informative resources.</td>
<td>Teacher focuses on student ideas to redirect and move them toward social consensus.</td>
</tr>
<tr>
<td><strong>Successful, or not</strong></td>
<td>Teacher stays focused on the present situation, explaining and validating using outside informative resources.</td>
<td>Teacher focuses on student ideas to redirect and move them toward social consensus.</td>
</tr>
</tbody>
</table>

Table 4.8: Mathematics teacher message design logics themes

Looking at each of these characteristics and comparing them to the characteristics of the encouraged message design logic, it is the rhetorical message design logic that is most consistent. The messages created by the teachers using a rhetorical message design
logic focused on negotiating with the students, redirecting their thoughts, and having students very much involved in the conversation. These teachers use the students’ thoughts to create the context for conversation in the situations presented in the vignettes.

This is in comparison to the teachers who employed a conventional or expressive message design logic. They used their message to inform students of necessary thoughts to guide, or tell them of, their thinking towards a desired outcome, as defined by the teacher or some outside authority, such as our Standard documents. Teachers using this logic think less about getting students to express their thinking and contribute to the conversation, but if and when it is done, it needs to be done appropriately, which is defined by the teacher. These teachers are open about using group work and having classroom conversations, but they use these methods because outside authorities, our Standards, and others have documented the appropriateness of using such methods in the mathematics classroom; or as in the expressive communicator’s manner, when it seemed like the right thing to do.

When asked about using these methods, these teachers did not focus on talking about the student learning in these situations, the emphasis was on the method as a way to get students towards an end result. It seems these teachers become very good at this, efficiently being sensitive to students, and moving them towards the end result. These teachers do seem to incorporate student thought into the discussion, it is just that the thought is judged as appropriate, or not. This is different that the person using a rhetorical logic, which focuses on the student thought provided.

If the teachers employ similar message design logics while in the classroom, that would help explain why they are not implementing reform suggestions to the degree
expected. Granted in this study, and what has been shared so far, are the teachers responding to hypothetical situations, and the classroom experience is very different.

Later in the interview these teachers were asked to share scenarios in their own classroom where they felt their verbal messages were successful, as well as unsuccessful. Though this is not as telling as if the teacher were actually being video taped in her classroom, it does seem to indicate there are some consistencies. Below different classroom scenarios are shared according to the message design logics the teacher employed in the hypothetical situation. The scenario is only shared if the teacher used that logic in both of the hypothetical situations. First the positive classroom experience is shared, and then the same teacher’s negative experience. The brackets used to identify the message are PCE for Positive Classroom Experience, NCE for Negative Classroom Experience, and the participants letter.

Expressive message design logic

[PCE, F] “[Most of my classroom experiences are positive because] I work hard to prepare how I’m going to explain things, and the kids that are listening and really trying to get the lesson, they’re successful at it because I think I do work pretty hard at trying to, here’s this, what makes sense next, and things like that. Even though we do kind of use a text book and curriculum guides, there is still what you put into the lesson, in terms of your own knowledge and how you make these connections for them.”

[NCE, F] “Well, certain topics are hard, for example proofs in geometry. This is something we know we understand, and it’s difficult thinking how can we get them to understand. So, I guess the communication during that lesson maybe seem to go ok, but it’s clear after they’re working on it for a while, they still really don’t get it. Maybe it just seemed ok, but it really wasn’t. In particular, when you are showing geometry students why SSA is not an appropriate way to judge that two triangles are congruent to each other, and we’ve gone through the business of our compass and straight edge, stating if segment A is this long and segment B is this long, and this angle is approximately this size, what happens? Well, there are two different triangles formed. And, they have done this with me on their compass, in class. I have them do the same question in their Geometry
portfolios, and there would be a lot of students who just left it blank. So, it’s like, I thought it’s one of those classic cases where I know I taught it, [but] obviously he didn’t get out of it what the intention was … and I guess, there is always times where you allow situations to escalate when they shouldn’t, and the students get to you. That type of situation is not good, because there are students who just try to get to you and you let them.”

Conventional message design logic

[PCE, A] “We were doing a lesson on parametric equations and we actually were trying to look at a certain interval stopping and starting. I wanted them to go backwards and come up with the equation in the other direction [as a function on the x-y plane]. And, it was pretty much the students led the discussion back and forth as to how we can come up with an exact equation that I wanted between the certain interval, as opposed to me just giving them random equations, where we have to change our interval so that it would work. What made it so good is that the students did most of the talking, using correct mathematical terms and everything, and [my department chair’s name] was there to witness it!

[NCE, A] “it’s just when they get their attitude within themselves, they don’t treat each other with the kind of respect that they should, and there were many days where we had quiet days of me lecturing and they sit and listen because they couldn’t handle the situation in a group setting, or they would get out of control. I would have to break up the groups, go to formal lecture, they take notes, they do homework, see you tomorrow.”

[PCE, B] “I was influenced a lot by my advisor [at the university I attended], and he was a discovery teacher. I think I learned a lot of my questioning techniques, lot of my teaching stuff from him. I do remember actually using my master’s project with my geometry students [6 years ago] and it was discovering all the formulas for the areas of all these different figures, the trapezoid and whatever. I didn’t give the students the formulas, but they worked in groups and had to figure them out for themselves. “I remember that going really well and thinking that’s they way I wanted to teach.” But, I have found that is difficult to do because of the demands of the standardized tests, but still it is important to take the time, when we can, to do some of the discovery lessons.

[NCE, B] Early in my career, I had difficulty with unmotivated, talented boys. I think that’s the group I feel least confident and successful with. They are wasting their ability, don’t have interest to use that ability and they come to class everyday unprepared and just be a spot. I’ve never dealt well with that kind of student. I don’t seem to have as many of them these days, but there were a number of years where it seemed like every year I had two or three that I’d have a major conflict with. I would tell them you can’t come to my class and be a sponge, you have to bring a book. You have to take part in the discussion, you have to do some
homework, not every problem maybe, just something. And, they would say I have no right to expect that”.

Rhetorical message design logic

[PCE, L] “Oh (long pause) let me see, well I guess it was a positive experience for my students and me when we had this great discussion on what it actually means to find the area of something. The students were all asked to individually brainstorm on that idea first, then they paired up with someone and talked about it some more. Then we had a nice discussion where students shared various perspectives. Some of them had thought of area as length times width, you know focusing just on that formula they learned back in elementary school. Some of them had no idea what a square measurement meant. I remember thinking afterwards, wow I think we cleared up some limiting thoughts in that class discussion. I guess that one sticks with me because some of them really had such limiting thoughts about this concept that they’ve been dealing [visual quotes when saying dealing] since elementary school.”

[NCE, L] “Oh man, OK, uuuuh. Well, there are those days when you cannot get much out of the students, no matter how you try, even if you ask them what’s going on, why is everyone only here in body, not mind? (pause) Let me think about this a different way. I know. I hate it when for example we were having a good discussion on some topic, and right in the middle, a fire drill. So, 10, 15 minutes gets taken out of our class period. There have been times where I just have to rush through and make a point because we only have a couple minutes left when we get back to class. Though actually, we usually end up finishing the discussion the next day anyways. Not as many students grasp it when you just rush to the point.”

[PCE, G] “You know the one that comes to mind is not even instructional. Near the end of the year, the students and I had this great talk about lessons in life, and how we should just try and improve all the time. You know, quit aiming for perfection. The students were sharing instances of where they have improved, and where they still needed improving. They were challenging each other’s thinking. I pretty much just watched, laughed some, well and then of course redirected it when it started going in a direction I felt would be school inappropriate, if you know what I mean. I still have good memories of that discussion. Kids are so funny at times.”

[NCE, G] “That would have to be early on in my career when I would come to class with an exact plan on how I was going to teach something. The script rarely worked, and I would just stand up there thinking ‘Oh my God, what do I do now’. I had this battle in my mind between my lesson plans in front of me, and wanting to hear more from the students. As soon as I changed the lesson plan to be more
open, and allow for more student input, it got much better. I started focusing more on some key ideas I wanted to get out of the class period.”

The teachers shared scenarios from their classroom experience in which they evaluated the verbal exchange with students as positive, and negative. Though the scenarios were not coded as having a particular message design logic, they did serve three purposes. First, they provided a chance for the teachers to create their own classroom situation to talk about, and in that conversation, patterns could be identified that were consistent, or not, with the logic they used to respond to the hypothetical situations. Second, the scenarios provided further evidence for how the teacher evaluates messages to students as being successful, or not. Finally, these scenarios provide us with a glimpse of their actual teaching in the classroom.

Relating these scenarios with the Table 4.18, Mathematics Teacher Message Design Logic Themes, there are some consistencies in the scenario provided and the characteristics of the specific message design logic used to respond to the vignettes. The scenario shared by the teacher, who in both hypothetical situations gave an expressive message design, focused on problems that occurred in the scenario, being clear and explaining to students, and hoping students will get what they are supposed to from the lesson. The successful, or unsuccessful, evaluation of the communication, in both scenarios, is contingent upon the teacher being heard and students understanding.

Two teachers giving conventional message design logic responses to the hypothetical scenarios also provide scenarios where they are informed, and validated, by outside sources. In the first one, it was successful because someone of authority saw it happening on one hand. In the actual scenarios, both emphasizes appropriate language or
inappropriate behavior on behalf of the students as being unsuccessful. The teachers both give examples of them guiding the student’s thinking and keeping them on task. The teacher’s plan has a key role in determining the success, or not, of the communication.

Two teachers giving rhetorical message design logics responses to the hypothetical scenarios are shown. Both of these teachers focus on the students ideas and talk about having to be flexible in the conversation. They mention how positive it is when students are affirmed and heard, as well as negative when that does not take place.

In summary, even though actual classrooms were not used in the analysis of this study, the data that was collected indicates some correlation that the message design logic a teacher employs when giving messages to students for hypothetical, yet realistic, situations is also evident when teachers are sharing examples of actual classroom practices. A next step would be to investigate actual classroom exchanges. This would allow for more contextual factors to be considered when it relates to message design logic. Currently, we can say that message design logic does vary in secondary mathematics teachers when they are asked to create messages for students in hypothetical, yet realistic situations, and there are some consistencies in this message design logic when these teachers share scenarios from their own classroom experiences. This knowledge opens up the door to other possibilities to investigate and research. These possibilities are discussed in the next chapter, along with how this study’s findings relate to our existing literature on teacher communication.
In this study, I investigated the logics secondary mathematics teachers use to create verbal messages to students. Fifteen teachers participated in the investigation by providing a possible verbal message to students for two hypothetical, yet realistic, classroom situations. This also involved a playback, where these teachers gave reasons for different parts of their verbal message. The teachers were then later asked to give two scenarios from their own classroom instruction where they believed communication exchanges had been positive, and negative. These data were put in a member check document and validated by the teachers. Once confirmed, the member check documents were analyzed using a theoretical frame found in the interpersonal communications literature, namely message design logic theory.

Message design logics theory informs us that individuals have varying constructs for communication, called message design logics. Three message design logics have
been identified through research: expressive, conventional, and rhetorical. Depending upon the message design logic employed by an individual, a different verbal message will be provided, and heard. It was assumed that this would be an informative notion for mathematics educators. It could provide a new perspective to understanding a teacher’s communication and provide possible insight to why the encouraged communication being promoted in our current reform is not found in more classrooms.

This is because after analyzing the teacher communication being portrayed in our current reform literature, it was found to be most consistent with the highest developmental level of message design logic, the rhetorical message design logic. In previous message design logic theory studies, on average, only 22% of participants have developed this message design logic. This raised a question whether mathematics educators were assuming teachers naturally have this highly developed message design logic.

It was found that the secondary mathematics teachers in this study employed all three of the message design logics that have been identified in the communications literature: 20% expressive, 53% conventional, and 26% rhetorical. This distribution is similar to other message design logic studies. The expressive messages emphasized the need to tell the students all these ideas that came to their mind for the given situation, the conventional focused on students being cooperative and doing what is right in this situation, and the rhetorical opened up the floor and allowed for some negotiation, involving students and teacher.

As mentioned, the rhetorical message design logic is most consistent with the reform efforts currently being discussed in mathematics education literature. If this
design logic was only present in 26% of the participants in this study, and the other two logics were part of even this relatively small sample, this may seem like a valuable notion for further thought.

This study cannot claim that teachers actually use different message design logics in the classroom since the teachers in this study were responding to hypothetical, yet realistic situations. Though the teachers gave scenarios from their own classrooms, and there seem to be consistencies in the logics they used in the hypothetical situation and their own classroom example. Further studies will need to be done to state further claims on this idea. That will be discussed later in this chapter.

This study can claim that when secondary mathematics teachers formulate verbal messages intended for students, they may use one of three identifiable message design logics. Each of these logics has very distinct characteristics, and depending upon which one the teacher employs, a very different verbal message is created.

The message design logic is beyond the words used by the teacher. It entails answers to such questions as, what is the overall purpose for my verbal message to students?; what functions do I try to accomplish with my verbal messages; how do I pick my words when I talk to students?; what do I think is important to say to students?; how can I tell if the message is good, or not? Answers to these questions give a unique perspective to understanding a teacher’s verbal communication to students. This perspective may eventually provide valuable insight to the question, why is the more interactive communication being promoted in our current reform not commonly found in our classrooms?
As discussed in chapter 2 of this document, our field has given various explanations to why this communication is not making it into our classrooms, and how difficult this change can be for teachers. In this chapter, the findings of this study will be related to this current scholarly literature, along with the interpersonal communication literature on message production.

This Investigation Related to Current Scholarly Literature

The interpersonal communication will be touched upon first, by linking the findings of this study with previous message design logic studies. Then the mathematics education literature will become the focus. In particular, this study will be discussed in terms of the existing teacher’s knowledge and beliefs literature, which will include the literature on teacher change. In addition, Thompson’s (1997) framework for mathematics teaching will be related to, and in the big picture, how this study informs our reform efforts. Following this discussion, other considerations will be shared. That is, findings of this study will be used to challenge current assumptions in mathematics education, and then possibilities for future research will be shared. 

Findings Related to Message Design Logic Scholarly Literature

In the current study, the logics secondary mathematics teachers use to create their verbal messages to students was investigated. Message design logics theory, found in the interpersonal communications scholarly work, was used as the guiding framework. Barbara O’Keefe (1988) developed message design logics theory as a reaction to the constructivist literature focusing on communication competence. This literature emphasized essential components of competent communication that, according to O’Keefe, are consistent with her label of rhetorical communication. She argues that these
researchers are making an assumption that everyone has developed the necessary constructs to engage in this type of communication, and this may not necessarily be true. She hypothesized that there may be “systematic individual differences in the premises used to generate message through ends to means reasoning” (p. 80).

Her investigation of these ideas resulted in her identifying three distinct patterns of logic individuals may use to create messages. Though they are distinct, the higher developed logics subsume the lower developed logics. The most developed is the rhetorical message design logic. The other two are expressive and conventional message design logics.

When message design logics are presented, they are often displayed in tabular form, for example in Table 2.1 in this document. The tables and written text make it appear that these logics are distinct and unique relative to each other, though O’Keefe mentions that the lower logics subsume the higher. In order to visually understand this notion, I developed the following diagram to comprehend this connection.

Figure 5.1 Visual of Message Design Logics
The three logics intersect at a common point, a node, which I identify as the message design logic construct node. When an individual is verbally communicating, the message design logic construct is referenced, implicitly or explicitly, to the level it has been development by the individual. So an individual’s message design logic construct may only include the expressive, or the expressive and conventional, or all three design logics as shown in the above diagram. Each of these logics is described below for the convenience of the reader. A more extensive discussion can be found in chapters 2 and 4 of this document.

Expressive design logic. An individual employing an expressive design logic sees communication and language as a vehicle for expressing thoughts and feelings. Expressive communicators devote little attention to the social context that surrounds a situation. They say whatever is on their mind at the time. Their aim is to convey information as honestly and accurately as possible. An expressive communicator is successful in communicating if they feel they are clear and organized in their presentation.

Conventional design logic. The conventional design logic is employed by those who see communication as a cooperative game played according to rules dictated by social norms. These communicators strive to achieve social appropriateness, fulfill normative expectations, and obtain specific responses from the conversation. They say things in order to get a certain specific response, or action, from the other person. Communication is successful when the parties share the same rules, otherwise the communication is judged unsuccessful.
Rhetorical design logic. The most developed message design logic is identified as a rhetorical design logic. This message design sees communication as the negotiating of social selves and situations. Rhetorical communicators are motivated to create social consensus and interpersonal harmony within interaction. When discord is present in a conversation, persons using a rhetorical design typically reconcile the competing desires of those involved by redefining the situation. Rhetorical communicators realize that meaning is being created by the communication. According to O’Keefe (1988) 22% of her adult participants employed an expressive logic, 42% a conventional, and 32% a rhetorical.

O’Keefe’s (1988) findings were in reference to regulative situations. Regulative situations are ones where an individual is in a situation where they wish to regulate, or alter, the current situation. In this study, the first vignette could be defined as a regulative situation because the teacher is trying to alter the behavior in the classroom and get the students to be more engaged. The second vignette is less regulative and moves more into an instructional situation. The teacher is discussing with students the fact they did poorly on a test and how that situation should be handled given there are only a few weeks left of school and the need to cover more material. The purpose for the second vignette is to move the context towards a more instructional one. The teachers were then asked to provide their own scenarios where their communication was judged as positive, as well as provide a negative scenario.

The results of this study support that the three message design logics do exist, and depending upon the individual’s logic, varying messages are created. Not only was this evident in the message the teachers produced, but more so supported during the play back
part of the interview and examples of the teachers own classroom experience. The expressive messages emphasized the need to tell the students all these ideas that came to their mind for the given situation, the conventional focused on students being cooperative and doing what is *right* in this situation, and the rhetorical opened up the floor and allowed for some negotiation, involving students and teacher. Of the teachers in this study, it was found that 20% of the teachers employed an expressive logic, 53% a conventional, and 26% a rhetorical message design logic. This distribution is similar to O’Keefe’s (1988) study of college students enrolled in a university communication course.

The other characteristics that O’Keefe (1988) identifies with the message design logics are key message function, message/context relationship, method of managing face, and evaluation of communication (Miller, 2002). Key message function relates to the explicit purpose for the message. For the expressive design logic, it is self-expression. For the conventional, it is securing a desired response, and the rhetorical is negotiating social consensus. The results of in this investigation are consistent with this categorization. The expressive messages seem to focus on the ideas that came to the teacher’s mind. The situation caused numerous thoughts to come to the mind of the teacher, and the purpose of the message was to provide students with this teacher insight on the situation.

The teacher operating under the conventional message design logic said things to specifically address the student behavior. These teachers had a specific end result in mind for the situation, and their message was to inform the students what they needed to do in order to move towards that end result. Teachers employing a rhetorical message
design logic created messages to open up the conversation. They wanted the situation to change, and these teachers had ideas in mind on possibilities, but they held back on relaying this information until they heard from the students. They talked about sometimes saying their part, sometimes not, depending upon what was brought up by the students. Their purpose for creating the message was to hear from the students, and ultimately reach consensus with the students on how to change this current situation.

The next characterization, message/context relationship implies how much the current context is part of the message. For the expressive message design logic, there is little attention to context; the conventional message design logic uses the context to determine the action meaning, and the rhetorical message design logic uses the communication to create the context.

Once again, the results in this study support this categorization. In an expressive message, the context of the current situation may or may not have been part of the message. If it was, it usually was secondary, not the primary focus of the message. For example, in the second vignette where students did poorly on the test, the message dealt less with their performance and more on informing them of the studying habits they needed to adopt, or how tests count so much more when they’re in college. Little was said about the situation there and now, in that class.

The conventional message focused directly on the context of the situation, for example in the first vignette, the teachers thought they needed to get the students on task and working. In the second vignette, the teacher’s message focused on the students’ performance and what the teacher felt needed to done to fix the situation.
The rhetorical messages in some sense left the current context to create a new context to discuss the current situation. That is, for example in the first situation, the teacher took a step back and asked the students to tell the teacher what was going on in their other classes. This conversation allowed her to address the current situation in the class. Or in the second vignette when the teacher asked the students to write a note to the teacher explaining what the student thought was the problem here and how it could be resolved. This information then merged into addressing the current context of the situation.

Method of managing face is another characterization used to describe message design logics. This describes how the message producer may manage comments or perceived thoughts of the hearer within the message. An individual employing an expressive design logic will edit their words when necessary, conventional design logic will focus on being polite in the situation, and the rhetorical will aim to redefine the context to find a place where both message producer and hearer can find common ground to hold the discussion. The results of this study cannot directly support this characterization for the conventional and expressive, though inferences could be made that these methods would seem reasonable for the teachers employing these two different design logics. Definitely in the rhetorical sense, though since these teachers created messages around redefining the context in order to be sensitive to the students’ ideas and understandings. The other design logics were implicitly sensitive to the students’ ideas and understandings and even shared this understanding in the interview, but it would be incorrect for me to directly assume the expressive design logic managed the students
wants and needs by editing their words, or the conventional message focused on being polite to the students.

The last characterization is the evaluation of communication. This is how the message producer evaluates whether their message is successful or not. For the expressive communicator, the importance is that the message was clear, open, and honest; no unimpeded signaling. The conventional message producer believes the message is successful if they individually handle it appropriately, they were in control of the resources, and everyone was cooperative. For the rhetorical communicator, the importance is on being flexible, allowing for multiple interpretations and symbolic sophistication. These definitions of evaluation for the different design logics were supported in the current study. This was evident in the message and play back, as well as during the semi-structured part of the interview when the teachers shared instances in their own teaching that they evaluated as successful and unsuccessful.

Especially in the case of the conventional message design logic producers, they focused on successful communication as when students behaved and did an activity as the teacher expected them to do, usually it was with a hands-on exploration activity. Unsuccessful, on the other hand, was a similar activity but students did not behave appropriately, were out of control and/or uncooperative.

The rhetorical message producers spoke more in general in this situation discussing the importance of everyone being able to be part of the discussion, the more students involved in the communication, the more successful the communication was. One teacher, in particular, shared a successful instance of a student who had been always been so shy and quiet, but one day made a contribution to the conversation. This teacher
talked about how nice it was that this student finally felt comfortable and safe enough to contribute to the discussion. The rhetorical message producers spoke of unsuccessful communication being when they felt it didn’t matter what they did or said, students did not engage in the dialogue. Other instances provided were examples from earlier in their career, when they lost their temper or felt frustrated because of what was happening in the class. These latter examples could be explained possibly as examples where the teacher was employing one of the other forms of logic.

In summary, O’Keefe’s (1988) three message design logics are found to exist in messages created by secondary mathematics teachers. Not only were the different message design logics detected, but the characteristics O’Keefe describes for each of the message design logics were identified and consistent within the teacher messages. This study considered message production in a regulative situation, which is what message design logic theory is based on, but the message design logic theory was also resourceful and applicable when describing the message production in a less regulative situation.

The mathematics education literature could benefit from a better understanding of how to develop a rhetorical message design logic in mathematics teachers. That is, if we assume that the rhetorical message design logic is most consistent with the current reform ideas and that message design logic improves student learning. Is it true that the teacher who truly knows what is meant by the advice given are the ones that already communicate that way? Is it enough for mathematics educators to publicize the description of what this communication looks like and expect teachers to comply?

Mathematics educators have not asked this question directly, but have considered other perspectives to understand why teachers communicate like they do. In the next
section, this scholarly work is re-discussed in light of the findings of this study. In particular the teacher beliefs literature is visited, along with teacher change. Alba Thompson’s (1997) framework for mathematics teaching is also included in this discussion.

**Findings Related to Mathematics Education Scholarly Literature**

Mathematics educators have documented the difficulty teachers face when trying to implement such communicative practices. The teacher knowledge and beliefs literature informs us that there is a strong connection between a teacher’s beliefs and what happens in the classroom. In particular, “the setting in which the teacher operates influences what is taught and learned in the classroom… [Where setting is] recognized not just as the physical arrangement of classrooms but of what was inside the teachers’ head about mathematics and its teaching” (Cooney, 1999, p. 19).

There is quite an extensive literature base looking at teacher beliefs, including beliefs about mathematics and about the teaching and learning of mathematics. It has been found that teachers specifically have existing knowledge and beliefs about pedagogy (Flowerday & Shaw, 2000), subject matter (Thompson, 1997; Ball, 1986), and ways the subject matter should be taught (Thompson, 1994, 1997; Shulman, 1987).

Pedagogical beliefs encompass beliefs about teaching, students, and learning. These beliefs effect how the teacher conducts classroom management, instructional strategies, as well as influence the classroom teaching environment created. Subject matter beliefs describe how the teacher views the nature of the subject, in this case mathematics, and what does it mean to know the subject. These knowledge and beliefs influence what teachers do in the classroom. Studies looking at existing knowledge and
beliefs have been done in both experienced and pre-service teachers (Bullough and Knowles, 1990, 1991; Knowles, 1992; Cohen & Ball, 1990a, 1990b; Peterson, 1990) (as cited and discussed in Borko & Putnam, 1996; Anning, 1988).

Message design logics inform us, to some degree of, about the knowledge and beliefs teachers have about how to talk to students, what they believe is important to say and why it is important. It includes beliefs about when their talk is considered successful, or not. This theory has not been tested in the actual classroom, so we cannot claim this directly influences what teachers actually do in the classroom, but this study does suggest that there exists a variety of beliefs when it comes to creating messages intended for students. These beliefs have very distinct characteristics, and depending upon which message design logic used, a very different message is stated and heard by the teacher.

Thompson (1997) has also noted in her research the differences in teacher discourse. She relates it to the orientation teachers have for mathematics and teaching mathematics.

I think it is interesting to note the similarities in Thompson’s (1997) framework to describe teacher orientations for mathematics and teaching mathematics, and the message design logics framework used to describe an individual’s message production. Thompson’s framework uses three levels, 0, 1, and 2. Message design logic also uses three levels: expressive, conventional, and rhetorical.

Each level in Thompson’s (1997) framework varies by conceptions of five characteristics. They are 1) what is mathematics; 2) what it means to learn mathematics; 3) what one teaches when teaching mathematics? 4) what the roles of the teacher and student should be; and 5) what constitutes evidence of student knowledge and criteria for judging correctness, accuracy, or acceptability of mathematical results and conclusions.
In message design logic theory, O'Keefe (1988) characteristics can be summarized as 1) what is the fundamental purpose for communication; 2) what function does the message serve; 3) what is the relationship between the message and the context; 4) how is the other taken into account; and 5) what does it mean to have successful communication? Table 5.1 compares the 5 questions side by side.

| 1) | What is mathematics? | What is the fundamental purpose for communication? |
| 2) | What does it mean to learn mathematics? | What function does the message serve in the communication? |
| 3) | What does one teach when teaching mathematics | What is the relationship between the message and the context. |
| 4) | What are the roles of the teacher and student? | How is the other taken into account? |
| 5) | What constitutes evidence of student knowledge and criteria for judging correctness, accuracy, or acceptability of mathematical results and conclusions. | What does it mean to have successful communication? |

Table 5.1 Comparing Thompson’s framework to O’Keefe’s

The first question considered in both frameworks is a fundamental premise, Thompson in terms of defining mathematics, O’Keefe in terms of defining communication. The second question narrows the focus providing more insight into the individual’s conception of the fundamental premise in action. For Thompson, the question is what does it mean to learn mathematics? Learning is an action done with mathematics. And, for O’Keefe, the question is what is the key function of the message? Message production is an action in communication.
The third pair of questions describes the relationship within context. Thompson’s (1997) third question considers mathematics in the context of teaching, asking what does one do when teaching mathematics. O’Keefe (1988) looks at context more generally, considering the relationship between the current context and the actual message created. What does the individual do about context when creating messages?

The fourth pair of questions informs how the individual interacts in the situation with the other. Thompson gets this information by asking the teachers to clarify the teacher and student roles when teaching mathematics. And, O’Keefe uses the question to clarify how the individual interacts with the other in the given situation.

The final question in both frameworks is evaluative, clarifying what evidence is needed to successfully accomplish the task. Thompson asking what constitutes as evidence of students having mathematical knowledge, and what criteria is used for judging correctness, accuracy, or acceptability of mathematical results and conclusions. O’Keefe also asking for evidence to show that the message and communication exchange have been successful.

Two different frameworks have been discussed, one from interpersonal communications and the other from mathematics education. The interpersonal communications framework describes characteristics that distinguish a difference in the way individuals create messages in verbal communication. The mathematics education framework describes characteristics that distinguish a difference in the orientations teachers have for mathematics and teaching mathematics. This latter framework has also been linked to a difference in classroom discourse, depending upon which level 0, 1, or 2 of orientation for mathematics and teaching mathematics. Below the three different
levels of orientation are discussed and then these are related to the expressive, conventional, and rhetorical logic levels of message production.

Thompson (1994) describes the first level, level 0, with the teacher having a conception of mathematics based on common uses of arithmetic skills in daily situations. Mathematics is viewed as being hierarchical (common to most text books) where each topic and skill is a prerequisite for the next and all of them are equally important. The goal of instructional practice is to progress through a sequence of topics and skills specified by the textbook. And, emphasis is placed on developing a collection of skills (facts, rules, formulas, and procedures), mainly through memorization. There is little, or no, consideration of where the information used comes from, the validity or logical relationship.

A metaphor to describe the teacher role at this level is “demonstrator”. The teacher demonstrates well-established procedures, believed to constitute the core of the needed mathematical knowledge. Students are to imitate the procedures and practice them until they become habits. The goal is to obtain accurate answers, using the prescribed procedures, with little to no consideration of the mental process. Accuracy and correctness are important, and are judged by experts, most often the teacher, or the textbook.

For the “demonstrator”, problem solving means getting answers to assigned story problems, using the prescribed methods. For the teacher, problem solving means making sure students can identify the procedures(s) to get the correct answer. Instructing problem solving, teachers will address the problem’s quantitative relationships and appropriate mathematical operations and procedures in light of those relationships. In
addition, the teacher may remind students of “key words”, “rules of thumb” focusing on what is needed for the desired procedure(s).

Conceptions of mathematics teaching at level 1 implies a conception of mathematics being more than rote, procedural proficiency. It also includes an emerging appreciation for understanding the concepts and principles behind the procedures, or “rules” of mathematics. These rules continue to be perceived as predetermined and as governing all work in mathematics. The difference there is a distinct difference between “meaning” and “skill”.

Level 1 teachers are more aware of using instructional representations – physical & pictorial to help students develop meaning and understanding of mathematical concepts and procedures. Conceptual understanding is addressed in the instruction, but is usually done by using a collection of unique pedagogical techniques.

Hands-on activities, using manipulatives, are valued by these teachers, but their main purpose is to get students to think mathematics is more “fun”. These teachers believe that engaging students in these type of activities helps with the widespread negative view students have of mathematics. Though the teachers see that the manipulatives and pictorial representations are useful in providing empirical justification for the mathematical procedures and concepts, they spend little to no time discussing the connections or the mathematical representations. These types of things are typically left for the students to make on their own. It seems there is an assumption that if the opportunity is given to the students to engage in these activities, they will make the necessary connections on their own just by doing the activity.
For the level 1 teacher, activities, as well as instruction, are often chosen based on perceptions of others on what would be deemed desirable. For example, the teacher may use concrete or pictorial representations that others have shown him/her to explain a concept, procedure, algorithm, or formula. Though these instructional ideas are embraced, they are usually implemented with little critical consideration of their actual suitability with the mathematical content of a lesson or of important details concerning their implementation. This leads to explanations, or activities, that are often in isolation, that is, there are little to no generalizations made or adaptations of these techniques to teach other topics. This is a narrow view of the possible uses of representations for achieving cognitive objectives of instruction. The specific technique is associated with the specific concept.

The teacher role at level 1 is still viewed the same as a demonstrator, but includes some reasons behind the ideas being discussed. Complexities in mathematical content begin to get recognized by the teacher at this level. S/he can begin to see the abstract nature of familiar concepts, such as number, rate, variable, as well as the subtleties inherent in them. As a result, some instructional implications of such analyses are at times included in the lesson presentation with the demonstrations. Students still imitate the procedures and practice them until they become habituated, but this is broadened to include some understanding of the justifications for the procedures. Accuracy and correctness are still judged by experts.

Problem solving in level 1 is viewed as an important part of the mathematics curriculum, but “it is viewed as a separate curricular strand to be taught in isolation from the traditional content. Integrating problem solving into the curriculum is construed as
interspersing routine and non-routine problems amidst ordinary lessons” (p. 11).

Problem solving means teaching about problem solving. This leads to instruction that is more prescriptive in nature, focusing primarily on the selection and use of strategies and bearing little connection to what is regarded as the mainstream curriculum.

The most developed level of mathematics teaching, level 2, is characterized by a view that students must engage in mathematical inquiry if they are to make sense of the mathematical ideas. Mathematical reasoning in students is achieved by investigating and constructing mathematical ideas. It is an important goal of instruction that students understand the ideas themselves. “The view of teaching for understanding that begins to develop at Level 1 is replaced at Level 2 with a view that understanding grows out of engagement in the very process of doing mathematics” (p. 12). Having students involved in specializing, conjecturing, refuting, and validating conjectures, in addition to generalizing are an integral part of the learning and teaching of mathematics at this level.

Level 2 teachers carefully design tasks in order to explore ideas and generate procedures. Physical and pictorial representations are provided for contexts so students can further engage in the exploring of ideas and generating of procedures. Students are also expected to judge their procedures generated for whether they make sense, whether they meet the purpose for which they were generated. This is just as an important cognitive objective as being able to “do” and understand the mathematical problem.

Another major goal in level 2 teaching is getting students to recognize that the same or similar mathematical ideas arise from seemingly different situations, as well as recognizing the distinctions inherent in the various topics, or areas of mathematics. This
goal is incorporated in the lesson design of the teacher, through instruction and/or activities.

The role of the Level 2 teacher is to steer students’ thinking in mathematically productive ways. Questions are posed with the intent of stimulating, guiding, or focusing students’ thinking rather than for the sole purpose of eliciting answers. Instructional decisions are guided by concerns about the quality of the students’ reasoning. This is inferred from their work and the discussions. Teachers are more aware of the cognitive obstacles for students and what leads to common misconceptions. There is careful consideration to shaping instruction so that students can themselves make subtleties explicit. Opportunities for students to express their ideas and for the teacher and other students are available, expecting all to listen to and assess the reasoning are an essential part of a lesson.

“The hallmark of this level is the presence of cognitively-based principles that are explicitly used to guide instructional decisions. Cognitive objectives of instruction are also explicitly used in selecting and designing instructional activities. Criteria for judging the soundness of instruction are stated in terms of student outcomes consistent with broad goals that drive instruction.

Thompson (1997) found of the twelve teachers in her study, none were said to have developed conceptions of mathematics teaching that fully fit the Level 2 description, despite a genuine desire to teach in ways that are consistent with those conceptions. “All of the pre-service and three of the experienced teachers had initial conception at Level 0. Only two of the experienced teachers were judged to have initial conceptions at Level 1. All of the teachers starting at Level 0 showed change to Level 1
with some evidence that aspects of Level 2 conceptions were beginning to take shape. The three teachers starting at Level 1 have shown little evidence of growth to Level 2 conceptions” (p. 13).

The different levels show a progression similar to the message design logics. That is, the lowest level implies a process that is straightforward, be it in communication or learning mathematics. There is an assumption that everyone can learn, or understand, things as long as it is addressed in an openly, direct, and clear manner. The conversation is usually organized as reactions to immediately prior events or thoughts, which correlates to the hierarchical presentation of mathematics.

The next level shares the similarities that they both place more of an emphasis on conventional rules and procedures where the rules are perceived as predetermined. Teachers, and message producers, focus on what is appropriate, coherent, and meaningful, and they use conventionally defined actions that count as an appropriate way to obligate the hearer, or in this case the student.

The highest level realizes the importance of the engagement of the individuals involved in the interaction. In communication the focus is on creating and negotiating, as well as realizing the dynamic interaction. This is similar to Thompson’s emphasis on the dynamic involvement students must have in their learning, having them conjecturing, refuting, and validating mathematical conjectures. Questions are posed with the intent of stimulating, guiding, or focusing students’ thinking rather than the sole purpose of eliciting answers. This would imply messages that are flexible and the context being determined by the communication taking place.
The three levels have similarities as described above. The current investigation was not done in the classroom, and at some point it would be beneficial to see how the two frameworks relate in that context, but I found myself asking: Could a teacher be at level 1 and use an expressive or rhetorical design logic, or be at a level 0 and use a conventional or rhetorical message design logic? The answer to these questions, and others, come to mind for future investigations. But, I do think the noted similarities can be used to further our knowledge base of the orientations teachers have for teaching mathematics, since communication is such an important part of the teaching. Before sharing other future studies that come to mind, other considerations are stated. This is a summary of things that come to mind as a result of this investigation, and how I think this can inform mathematics educators in the current reform movement.

Other Considerations

The current study showed that the secondary mathematics teachers used one of three message design logics when asked to create messages for students. Even though this study was not done in the actual classroom, if we make the assumption that the three message design logics are also used by teachers in classrooms, then we need to re-think the way communication is taught in our educational programs.

For example if we consider the following passage taken from the NCTM Standards (1991), it describes the need for mathematics teachers to pose questions and tasks that elicit, engage, and challenge each student’s thinking; ask students to clarify and justify their ideas orally and in writing; decide what topics to pursue in depth from the ideas that students bring up during discussion; decide when to provide information, when to clarify an issue, when to model, when to lead, and when to let a student struggle with
difficulty; decide when and how to attach mathematical notation and language to students’ ideas; and monitor students’ participation in discussion and deciding when and how to encourage each student to participate.

Using the thoughts identified in the current investigation, the teacher employing a rhetorical message design logic understands this passage as it is intended. O’Keefe (1988) tells us that for the rhetorical message design logic, the fundamental premise for communication is creating and negotiating social selves and situations. They allow the communication process to create the context, and they allow for redefinition of context when necessary. These communicators are used to creating messages to gather input and decide what needs to be done in order to guide in any redefinition. Even though explicit mathematical instruction was not investigated in the current study, for the purpose of discussion here, I would like to hypothesize that the teacher employing a rhetorical message design logic during mathematical instruction would see their communication as a vehicle for the students, with the teacher, to create and negotiate the mathematical ideas. Their main message function would be get the students to negotiate and come to consensus with their ideas. The communication would create the mathematical context, and when necessary redefinition would be incorporated to allow for students to feel safe in making possibly incorrect conjectures. Their evaluations of the communications are determined by their flexibility in creating the communication, the depth of their interpretation of the students’ understanding, and the sophistication used to orchestrate the classroom dialogue.

From the perspective of the conventional communicator, communication is a game played cooperatively by social rules, where the key function is to secure a desired
response. Action and meaning determine the context of the communication, and they are successful when things are done appropriately, they are in control of the resources, and everyone is cooperative. In reference to the NCTM passage, I hypothesize the conventional communicator believes they are implementing these ideas in their classroom. The teachers who employ a conventional design logic come to class with questions and tasks in mind that they have decided will elicit, engage, and challenge their students’ thinking. When a student does not give the answer or action anticipated, the teacher asks for clarification, models when necessary, may delay in providing the correct response by asking more questions, gets students to practice the desired result, and makes sure the correct mathematical notation and language are emphasized. These teachers know that group work has been identified as helpful for students, so they incorporate this in their lessons. These teachers walk around and contribute to the conversation as needed, always moving students towards the desired result.

Teachers employing a conventional message design logic become very good at being sensitive to the challenges that students are faced with. Teachers are very student centered by nature. Individuals would not enter this profession if they weren’t. They learn from their experience and incorporate this into their messages. I believe these teachers truly believe they understand and are implementing the ideas present in the above NCTM passage. They interpret, reason, and implement these ideas in a manner that is consistent with the conventional design logic.

Finally for the expressive message design logic, the fundamental premise is using language for expressing thoughts and feelings. The key function is self-expression, and little attention to given to context in the message. The expressive communicator edits the
message when necessary, and believes communication is successful when they are clear, organized, open and honest. This is the design logic that reflects more what our literature has labeled the traditional teacher, though I believe teachers who believe they are implementing our current reform ideas can also use this design logic.

The teachers in the current study who were categorized as having an expressive design logic I believe would read this passage and identify themselves as meeting these ideas in the classroom. These teachers create messages for students, hoping they say and do what is best for students to learn and understand. I believe these teachers use their current thoughts and feelings to decide on the questions and tasks to engage students with the mathematics. Based on the response of the students, these teachers elicit advice, provide remarks or questions that they believe challenge the student’s thinking. When they read about these current reform ideas, my guess is that they go into the next classroom and try, for example getting their students to write. If they think about it again in the future, they’ll maybe try it again. Because these teachers create messages for students by providing whatever comes to mind, I am sure they have developed constructs which they reference, at least sometimes, that involve attaching mathematical notation and language to students’ ideas’, and encouraging students to participate in the discussion, with the mathematics. For example, the teacher who provided the following expressive message:

[Exp, V2, F] Class, I graded the test, and it’s obvious that many of you didn’t study. How do you expect to do well when you don’t take time to study for the test? This is something you need to do, especially if you plan on doing well in college, which I’m assuming most of you intend to do. Tests count so much more than they do in high school, and you need to study for them. Well, enough said, let’s go over this test. Hopefully you’ll think about studying more for the next one.
This teacher believes they are challenging the students’ thinking and providing input which causes the students to engage in thought. In terms of instruction, I assume this teacher may use similar techniques. When teaching a concept, this teacher explains and clarifies all the ideas they feel will cause the students to think, or be engaged and challenged with the mathematics. Reading this passage, they would likely go to class and explicitly tell the students I want you to struggle with this idea some before I answer that. And so, the expressive communicator believes they are indeed implementing the ideas being presented in the current reform.

How do we address this disparity? I agree with Goos (1998) that there needs to be more examples in the literature of teachers teaching in a manner that is consistent with this reform, but I question if that too be interpreted, reasoned, and later implemented by other teachers in a manner that is consistent with their message design logic. Message design logic characteristics define how thoughts are created into message form. These readings create thoughts in the teachers, we may all agree on this, but how these thoughts are interpreted, reasoned, and then later implemented varies.

Message design logic theory informs us that individuals hear and say different messages depending upon which of the three message design logics they use. This is valuable information for our field during a time when we are trying to explain and educate teachers to incorporate the interactive communication. The implementation of this form of communication has not made it into as many classrooms as desired. Message design logic may prove to be one of the main reasons for this.
Questions that currently come to mind following this study are, how can we influence teacher thoughts to develop more rhetorical message forms? Or, in the bigger picture, what is the correlation between rhetorical messages by teachers and student learning? Can we assume this is a natural relationship just because the literature indicates the rhetorical as being the most consistent message design logic with what is being written?

Communication specifics have not been applied to mathematics educators, we are still talking about communication in the general sense, making the false assumption that if we talk about what it should look like long enough, teachers will begin to develop this form of communication. This has proven to be a false assumption. It is time for mathematics educators to begin looking at specific ideas for communication.

This study informed us that message design logics provide us with an explanation to why teachers may communicate as they do. Further research needs to be done looking at teacher messages within the message design logic framework so that we can identify more explicit advice to mathematics teachers in regards to their messages. More vignettes could be created and the different types of message designs can be discussed, making the teachers reflect on what they think is the best for students. We must remember teachers, deep down, really want to do and say what is best for students. All teachers, no matter what message design logic they predominately employ, want students to learn, be challenged in thought, and grow as people. This is a student-centered profession, in theory. We know that it is not student-centered in practice, not by the definition relayed in current reform documents.
Future Research

Based on the previous discussion, there is strong evidence to support further investigating this notion of message design logic amongst mathematics teachers. This investigation laid the foundation for future studies, showing evidence that secondary mathematics teachers may employ different logics when they create messages for students. Possible situations that are currently being considered for study are discussed below and then a closing argument is made.

The first study that comes to mind brings message design logic into the secondary mathematics classroom. If teachers from the current study would permit us to videotape their classroom instruction, and then do a play back recall, similar to the audio interview done in this study. These teachers have already been identified as having a predominant message design logic. It would be valuable to see if this is consistent during actual classroom practice. Preliminary work for this study is already under way. A number of the teachers have been asked to participate, and have agreed. Human subject forms need to be completed, along with a research agenda created.

Relating message design logic to orientation to mathematics and teaching mathematics is another perspective to consider with these secondary mathematics teachers. This brings specifics about communication more into our field of study, and creates a stronger bridge between communication and mathematics teaching. Having done this study, it becomes more apparent the need for researchers to continue the depth and breadth of our knowledge base. This responsibility is further discussed in the final chapter.
A second study involves students and correlations involving them with the teachers’ message design logic. Correlations with message design logic and students could be relative to achievement and learning, motivation, satisfaction, to name a few. For example, it would be beneficial to have students evaluate the teacher messages, informing us of their interpretation, which message design is most appealing to them as a student. We could break down the messages and have students evaluate them in phases as being beneficial for their learning of mathematics and/or in life? Documenting what the students believe the intent of the messages would be beneficial as well, so that teachers who use the different design logics can see how students are interpreting these messages, and may cause some reflection.

It would also benefit our knowledge base to have students create messages. We could have them react to a peer situation, similar to the Ron situation used by O’Keefe (1988), as well as responding to a teacher to certain situations and see what message design logic students tend to employ. Whether the message design logic was consistent or not between the two audiences could be determined. The doctor-patient study, or O’Keefe’s study, could be used as initial guides for some of these things.

Student achievement and learning relative to message design logic would also be beneficial for our field to understand. Theoretical considerations to evaluate student achievement and learning would need to be clarified. These ideas could also be correlated with the student vs. teacher’s message design logics.

If we assume that it is desirable to advance teachers message design logics to be more rhetorical, it would be beneficial to examine this process by developing various
strategies to do this and then documenting the effects of the various strategies. This information could be used in professional development and teacher education.

Social context provides another dimension to consider with a teacher’s message design logic. Research needs to be specifically done addressing any differences or similarities in message design logic and urban, rural, or suburban community teachers. Since communication is contextual, this is an important part of the context. In this study, the context was merely creating messages intended for students in a secondary mathematics classroom. The teacher often provided the context based on the scenario. That is, since the first vignette’s problem is more an Algebra 1 problem, so teachers talked to reference this predominantly younger group of students. The second vignette was related more as an Algebra II context. So subject matter being taught was insinuated by the vignette, and the community type it was assumed to be consistent with the type of school the teacher taught in. There were no rural schools in this study and only two urban schools, so this is something that should be further challenged and considered.

Finally, as mentioned in chapter 4, it would be interesting to see if there is a relationship between gender and message design logic. In this study, there was not a correlation evident in the biological factor of male versus female, but if one considers social gender issues, something else may result. This would be informative to both our field, as well as the communications literature.

Each of these research studies further the knowledge base of message design logic (subset of teacher knowledge and beliefs), teacher communication, and more general, classroom communication. Furthering these knowledge bases will ultimately influence
classroom practice, which in the long run will benefit our schools, which is a goal for our research.

Teacher talk serves a critical function for a secondary mathematics teacher. It is through a teacher’s verbal communication that she guides the students’ learning, establishes and maintains an environment, informs expectations, and creates and builds a relationship with her students. There are other identifiable influences of teacher talk, and the above influences can be achieved through nonverbal means as well. Nonetheless, a teacher’s verbal communication is a critical part of teaching.

This study was done to better understand a mathematics teacher’s verbal communication. It did provide an informative perspective for us to consider when thinking about a teacher’s communication, a perspective that can now be expanded upon further. I invite other educators into this discussion, or should I say in this negotiation and creative thought involving teacher communication, and classroom communication. The final section of the chapter is a researcher’s acknowledgement of limitations and assumptions recognized at the time of this publication.

A Researcher’s Acknowledgment of Limitations and Assumptions

This study was conducted over a longer period of time than initially planned. Though I don’t feel that has “hurt” the findings of this study in a direct way, I do have to accept that many of the thoughts that occurred during the interviewing and analysis may have been lost. A researcher’s log was used for key ideas and reflections, and upon each interview a tape recorded reflection was done on the drive home. This provided a record of many of the analytic ideas, but I will not claim all ideas were captured as well, given the extended time frame.
I am a secondary mathematics teacher who strongly believes in the importance of communication in the classroom. I have centered my pedagogical philosophy and style of teaching on communication. Understanding the communications literature has caused me to accent this even further, and has made me continually work towards being more rhetorical when I speak to my students. I realize my knowledge and reflection is not the norm, and I accept that I may be more judgmental to messages I see myself making, versus not. In order to limit, at least to some degree, this judgment, I had a second researcher code the teacher messages.

Every teacher in the study I knew to some degree, half of them were colleagues of mine at the same school I previously taught. I do not believe this directly affected their message, nor the reasoning they provided for their messages, but I have to assume there was an element of uncertainty on their part. They may have been more sensitive to what they said because of our relationship, not wanting to be negatively judged. They could have given messages they believe I wanted to hear and not necessarily what they would REALLY say in such a situation. I don’t believe that happened in this study, but still it is something that should be acknowledged. To accommodate these possibilities, first all teachers were guaranteed anonymity, and in my display of the data, I did my best to eliminate the possibilities that a teacher could be identified. Second, I had teachers provide messages to two different situations and then followed each up with clarifying questions. This allowed for consistencies to be noted, or not. In addition, the general part of the interview asked the teachers to expand upon their thoughts and give instances of actual communication in their classroom. There seem to be consistencies throughout the interview.
I am a novice researcher, and therefore I acknowledge I may have done things like a novice. Prior to this study, and throughout the study, I read research practice and theory books, I’ve taken research classes, conducted a couple of pilot studies, though these things don’t actually prepare you fully for this experience. That is impossible; one must just do it. I took the time to communicate with other researchers, ask questions from mentors, and continue reading and reflecting throughout. These things were done to improve my skills as a researcher, and make this study as valid and reliable as I was able.
CHAPTER 6

RESEARCHER, EDUCATOR, AND PERSON:
SHARING PERSONAL IMPLICATIONS

Closure to a period of time.
Exciting, fearing, maturing
Thoughts are everywhere.
What’s next in my journey?

This project has caused me to grow as an educator, researcher, and person. It has opened my mind to an enormous amount of knowledge, and it leaves me with just as many, if not more, questions. This final chapter I’d like to use as a means to make these thoughts explicit. This is for my own benefit, as well as for those who are just starting this process.

You see, as I think back, I have learned the importance of writing personal thoughts and experiences for others to read. This is due to three main thoughts. First, I am forever grateful and respectful for those who take the time and energy to publish their ideas so others can benefit. We stand on the shoulders of each other. The research and practical literatures I have read have helped shape my thoughts; given me direction and focus for my thoughts; and have opened the doors for me to think and pursue my own
knowledge and belief base. For those who do the work and have the information, but don’t take the time and energy to share it with others, leads less of us to benefit.

Though with that said, I recognize how difficult it is to create the text to share thoughts. This can be extremely difficult, but with practice, hopefully it gets easier. I am committed to keeping the discussions alive on teacher communication by presenting and writing my knowledge and belief base.

The second thought is more how important it is to write and reflect throughout a research project. It’s human to think you’re going to remember everything, and maybe some people do. I don’t. Maybe it’s my age, maybe it’s the vast, vast, vast amount of information and thoughts being thrown at you throughout the research process. Recording thoughts and events is critical. I learned this especially when my project got extended. My records during the data collection process proved invaluable in the data analysis and write up of this document. Now that I have done this once from beginning to end, I am clearer about the importance of writing all thoughts, no matter if it seemed irrelevant, or not, at the time. In the writing, thoughts create clearer pictures.

Finally, the writing of this thesis document has been one of the most challenging tasks I’ve ever done. The drafts have been numerous, the pages many. To the reader, it looks so easy, clear, and organized in its final presentation, but let me share with you what it would look like if the work involved were artistically included.

Pages would be torn; edges burnt; there would be pages upon pages that were empty reflecting the times of confusion, writer’s block, or not knowing what to do with all this information before you; letters would be smeared from sweat and/or tears; pages would be upside down throughout; the font would be larger at times
reflecting the confidence in the words and thoughts, and then the smaller font to reflect the uncertainty, questioning, unknowing.

To the reader, the researcher presents this document that has all these pages full of text, aimed at being neat, organized, and clear in presentation. To use the communication literature, a very expressive piece of communication. It provides answers, or insight, into some knowledge that previously had not been considered.

I told my advisor at one point during data analysis and writing I felt like I was in a dingy out in the ocean with only a cooler containing bottled water, nothing to see in the horizon, only waves of thought all around me. As I sailed along, day after day in thought, eventually an outline emerged. In time, I knew I was headed in the right direction because I got closer and closer to where I wanted to be. I am now on land, and ready to explore some more, though next time I wonder out in research, I’ll be at least on a speedboat, preferably with some others on board, with a larger cooler containing better drinks.

Now, in the end, I am thankful for this whole experience because I’ve learned becoming a researcher means finding out for yourself a direction and a method; it means questioning and reflecting. It means constantly aiming to improve both your knowledge base and methods. That takes time, that takes growth, that takes hours on a dingy out in the middle of the ocean.

The most important lessons I’ve learned in this process are first, we stand on the shoulders of each other. I have gained an upmost respect for researchers who have done and finished this process, and especially those who have continued to explore and
wonder, with the aim of benefiting our larger community. I’ve decided I want to be one of those researchers. I now enjoy writing more than when I started. I enjoy contributing to the educational knowledge base, I want to be a researcher and mathematics educator. I want to be a part of making our schools a better place for teachers and students.

But, before starting the next study, I want to invest time and energy into reading, reflecting, and conversing with other researchers on method and analysis. I have plenty of questions in mind and some ideas about how to investigate, but as researchers I believe we need to continue the growth curve and not get stuck in our own thoughts and actions.

I will use much of what I’ve learned from this study, but I realize there are still many things to learn. Our role as researchers is to inform and expand the knowledge base of our field, but we cannot do it alone. We need each other. We need to work in numbers, together. We need to question one another so that each of us can improve and grow, so in the end our knowledge base expands, and our schools improve. I, personally, will need to take the time to establish a network with other researchers in terms of research and practice.

In terms of practice, I want to build a network aimed at exploring classroom communication specifics. I believe in our reform efforts and communication is such a critical component of it. We cannot give up on our efforts to improve mathematics instruction.

I’ve learned the importance of consistent involvement. It is very difficult to be involved in a research project, a reflection project, and not give it the consistent time. It takes so much more energy to pick it up and get back on board each time a study remains idle. It doesn’t mean that the research should take over ones life, but general thoughts
here and there would have made the ride a little easier. In the future, I know myself well enough that I will have a number of projects going at once. I need to create general headings for each of the projects and consistently write and talk about each of them.

Take the time for being a professional researcher, which means a lot of thinking, doing, reflecting, and writing,

I’ve learned it’s about finding balance in work, play, home, travel, thinking, writing, taking care of self, care for others, and to love. I’ve learned more about that in the last year than ever in my 45 years of life. Time passes, quickly. It is very easy to get wrapped up in things that don’t matter, as much anyways. It’s all about finding the balance. This will always be a priority for me, as a researcher, as a person.

For now, I’m tired. I am ready to close this chapter and this document and move on. Give me a few good nights rest, and let me start again. There are opportunities ahead for which I am excited about, as I continue my journey as an educator, researcher, and individual. I look forward to meeting new friends, and old, as I continue this journey.


APPENDIX A
THE RON SITUATION

Undergraduate students enrolled in a communication course were asked to imagine they were in a class where a group project counted heavily toward the final grade. The participant was assigned to be the group leader of this project and was asked to deal with one of the group members, Ron, who was causing some problems for the group. Each participant was asked to respond to this hypothetical situation by writing exactly what they would say to Ron.
Imagine that you have been assigned to a group project in one of your classes. The class is in your field of concentration (major) and it is important to you to get a good grade in this class. Your final grade will depend to a great extent on how well the group project turns out. You were assigned to your group by the instructor, who also designated you to be the leader of your group. Each person will receive two grades for the project: an overall grade to the group based on the overall quality of the project report and an individual grade based on each person’s contribution to the group effort. Your duties as group leader will include telling the instructor what grade you think each individual in the group deserves based on their individual contributions.

One group member (whose name is Ron) has been causing some problems. Ron seldom makes it to group meetings on time and entirely skipped one meeting without even calling anyone in advance to let the group know. When Ron missed that meeting, two of the group members wanted you to have the instructor remove Ron from your group, although another member persuaded the group to give him another chance. At the next meeting Ron arrived late but apologized for missing the previous meeting and mentioned something about family problems. Ron did volunteer to do all the background research on one important aspect of the group’s topic, saying he had a special interest in that part of the project.

The group project is due next week. The group planned to put together the final draft of its report at a meeting scheduled for tomorrow afternoon. Ron calls you up today and says he doesn’t have his library research done and can’t get it finished before the meeting. He says he just needs more time.
APPENDIX B
DETAILS OF TWO MESSAGE DESIGN LOGIC STUDIES

The following pages contain the details to two of the message design logic studies, Peterson & Albrecht’s (1996) study of management-subordinate relations and Bingham’s (1991) use of message design logics to inform management in sexual harassment situations.
DETAILS OF TWO MESSAGE DESIGN LOGIC STUDIES

*Message design logic theory and superior-subordinate relationships*

A study conducted and written about by Lori West Peterson and Terrance L. Albrecht (1996), used message design logic theory as a theoretical framework for looking at the social relationship between management and employees, specifically in a hospital with superiors’ and their subordinate nurses. Their aim was to explore whether relational patterns in design logics would allow them to identify and predict variables such as relational social support, trust, discussion of innovation, personal control, expected performance ratings, and burnout.

Staff nurses and Nurse managers were asked to complete questionnaires about her or his relationship with the other, and provide ratings of their perceived job performance using a 7-point Likert scale. As in other message design logic theory studies, a hypothetical situation was devised for the participants to consider. All participants were asked to respond to a situation that was similar to the Ron test used by O’Keefe, though it was a situation relevant to the nursing context.

A nurse manager was trying to regulate a problematic situation with a staff nurse (named Rhonda). The scenarios were created with the assistance of six staff nurses and one nurse manager. Response messages were coded as expressive, conventional, or rhetorical, and statistical data were run looking at the management-subordinate relationship. The difference here is that the responses to the messages were only used to convey a category: relational social support, trust, discussion of innovation, personal control, expected performance ratings, and burnout. The message was not the primary
unit of study, the job factors were coupled with the message. Comparisons were made on the type of communicator each participant had and how this was related to the other factors, job satisfaction, personality, etc.

Expressive messages were the responses that were “predominantly past oriented, incoherent, and/or failed to engage the immediate problem-at-hand” (p. 5 – 6). For example, if the nurse manager threatened sanctions without providing any explanations to the undesirable behavior. In this study, there were no expressive messages amongst the nurse managers, and only 5 of the staff nurses used this type of logic. The following is a sample message coded as an expressively-designed message.

Rhonda, you are taking advantage of this situation, and of your co-workers and this stinks. (p. 10)

Responses coded as conventional consisted primarily of messages that were task-relevant and focused on a specific action that the receiver should accomplish to alleviate the situation. These responses also consisted of references to the existing structure of rules and regulations. The nurse used these responses to get a particular response from the receiver. Twenty one of the 50 participants were coded as having a conventionally-designed message. Two samples are provided below. The first is from a staff nurse, the second from the nurse manager.

Firstly, you need to come in on time and stop taking so many breaks as we are busy and the unit cannot function properly.

I have noticed from time-sheets and reports that you are frequently late to work and take several breaks. We have policies and expectations here; and, not complying with them puts stress on everyone.

Finally, messages identified as rhetorical focused on a seeking consensus or cooperation, obtaining a desired goal by both parties. Twenty-four of the messages were
coded as rhetorical. Two samples are provided below from a staff nurse and nurse manager respectively.

You’re kind of keeping to yourself lately, taking a lot of breaks. Are you having a problem of some sort? Are you feeling well? How can I help you? If you are well, let’s talk about this and decide how we can work together to get you back to your productive self.

Rhonda, have you had previous experience with team nursing? I think the team really benefits when you participate and are an active contributor. Perhaps we can try implementing a “buddy system” on our unit where “buddies” will cover for each other during breaks. What do you think of this?

Each individual, as well as each dyad was assigned a code dependent upon their message design logic combination. For example, if both the manager and staff nurses were rhetorical, the relationship was labeled as a 1. If the staff nurse employed a rhetorical design logic but the manager did not, it received another code. The last consideration was if the manager was rhetorical, but the staff nurse was not.

The findings from the Peterson & Albrecht (1996) study indicate the highest levels of perceived support given and received are when the nurse manager is a rhetorical communicator and the staff nurse is not (p. 7). The same can be said for the highest levels of trust and the lowest levels of burnout (p. 8). Similar findings were reported when the staff nurse had a rhetorical design logic and the manager did not. The researchers say this is due to “persons employing rhetorical design logics are not only effective at producing messages that create interpersonal harmony, but are also able to reframe and look for deeper interpretations of incoming messages” (p. 8). On the other hand, when both individuals in the dyad employed the same message design logic, it showed lower levels of perceived social support given and received lower levels of relational certainty, trust, and expected performance ratings, and higher burnout scores.
The researchers comment that this “is perhaps partly the result of mixed-status nature of the nurse relationships” (p. 8).

Peterson & Albrecht (1996) particularly comment though on the finding which two rhetorical communicators in this situation seems to be less desirable in terms of perceptions of social support. They comment that “clearly, the message design logic literature emphasizes the effectiveness of rhetorical design logics. Yet, the potential interaction effect resulting from two rhetoricals in mixed-status relation (or, for that matter, in any interaction) has not previously been considered. They go on to express the need to study this relationship further, taking into account other factors such as potential saturation levels.

Message design logic theory and managing sexual harassment in organizations

This discussion shows how message design logics have been used as an approach for managing sexual harassment in organizations. Suggestions are made referencing message design logics, as well as research on influence and assertiveness. For the purposes of this discussion, the focus will be on the role of message design logics. There will also be a brief discussion on the guidelines Shereen Bingham (1991) believes should be developed into education programs within organizations in order to address the managing of sexual harassment. I include Bingham’s information here for two reasons. First, because she provides sample messages that fit each of the design logics. It guides the analysis of the current study. Second, as a result of this study, I have intentions of identifying, or at least starting the conversation on, how to implement these ideas into professional development. This is a major topic in my final chapters. I include Bingham’s suggestions here to start that conversation.
Message design logics theory, along with other theories of communication, were the focus of this discussion because “a communication focus in the study of sexual harassment should contribute significantly to understanding how the problem can be managed” (Fairhurst, 1986). In the past there have sample messages provided in how to deal with this situation, but it is argued that this is not a well-defined manner in which to address this problem, “organizations and employees wishing to deal with sexual harassment informally through interpersonal communication have not been advised of the numerous message options that may help them deal successfully with a harasser, or the circumstances under which various strategies may be effective ….. a communication focus in the study of sexual harassment should contribute significantly to understanding how the problem can be managed” (p. 89). She uses message design logics theory to describe how individuals differ in their approaches. She has found in previous studies that those having a more advanced design logic may be more effective at managing some aspects of sexual harassment situations (Bingham & Burleson, 1989). Below I share her example messages reflecting each of the message design logics.

Individuals addressing a sexual harasser that employ an expressive design logic might take the approach of an aggressive attack on the harasser, or include some noncontingent threat. They express “a string of thoughts and feelings in reaction to the harassment without including explicit negative or offensive content” (p. 97). Relational and identity concerns are addressed through vague language or omitted negative and offensive content. Examples provided are

“This is the third time today that you have made sexual comments to me and you have been making similar comments every day since I started working here. I’ve never had to put up with this from an employer before” (p. 97).
“You’re going to live to regret that last remark. I’m going to tell your supervisor about this and get you fired (p. 107).”

“You jerk. You’re really sick in the head” (p. 107).

“Working here is becoming more and more stressful for me. I don’t know how much more I can take” (p. 107).

The conventional message in this situation asserts a request or directive to the harasser to cease his objectionable behavior. The aim is getting the behavior to change, often supplying reasons or justification for their command or request. Typically, it may also contain polite or assertive-empathetic elements that attempt to minimize the possible relational damage. Examples provided are,

“You’re usually a great guy to work with, but I would appreciate it if you would stop making sexual comments about me. Please don’t take this as an insult. I just want to let you know that I don’t think comments like the ones you have been making are appropriate in the workplace. (p. 97).

“Don’t touch me like that. That kind of behavior is inappropriate between coworkers” (p. 107).

“I don’t mean to hurt your feelings, but I want you to stop touching me. I enjoy working with you but that kind of behavior is not appropriate for an employee-employer relationship” (p. 107).

The rhetorical messages use language to achieve desired effects within the situation. They strategically use language to evoke and structure a context in which they desire to achieve. The emphasis is on redefining the situation in a way that deflects relational damage and negative identities, at the same time pursuing instrumental goals. In this particular situation, the message redefines the situation to preclude the sexual harassment from continuing. At the same time deflecting the implication that the
harasser has a negative identity or that the harassing behavior has harmed the working relationship. Examples provided for this message design logic are,

“I appreciate the fair treatment you’ve always given me on this job because I have something on my mind that relates to how well we work together. When you make sexual comments to me I know you’re just teasing, but deep down I end up feeling insulted anyway and if we don’t get this straightened out I’m afraid it might start to affect our work. I know you would never want to put me down or interfere with my job performance and I would never want to do that to you. So I think the best solution here is for us to stop the sexual jokes and comments all together. Sound fair to you?” (p. 97).

“We both know you’re joking around when you make sexual comments to me, but my customers don’t seem to realize you’re just kidding. For the good of our professional images, I think the jokes had better stop. Other people don’t understand the kind of rapport we have” (p. 108 – 109).

“If I were you I’d think for a moment about my actions. We both know your behavior could be considered sexual harassment, and I could file charges against you if I had to. But, I don’t think either of us would like to see that happen. Let’s just forget about this whole incident and get back to work.” (p. 108).

Bingham indicates that messages that reflect a rhetorical design logic are perceived as more successful than the other forms. They are more likely to preserve a harmonious relationship with the harasser and maintain a positive identity for the harassed woman. Bingham notes that perceptions that the harasser would stop his offensive behavior did not vary as a function of message design logic; “in fact, none of the messages examined was perceived as particularly likely to stop the harassment (Bingham & Burleson, 1989). Further research is needed to see whether other messages may effectively deter various forms of sexual harassment under different circumstances.
APPENDIX C

INTERVIEW DOCUMENTATION

The following pages contain the set of documents that were taken to each interview. They include the information sheet, both vignettes, the classroom transcript, and semi-structured interview questions.
Introduction and Demographics: (5 min)

- Thank you for agreeing to participate in this interview.
- Purpose of interview: This is part of my doctorate work at The Ohio State University. My interest is in knowing more about the communication beliefs we as secondary mathematics teachers use during classroom discussion.
- When I’m done with all this, I hope not only to complete my thesis but write an article for mathematics teachers telling what we can learn from our communication beliefs. Would you be interested in having a copy of that article, since you are a member of this study?
- I will ask you to look at your communication to students from different angles, two vignettes, which we may play back and talk about in more detail, next you will look at one transcript of classroom dialogue and talk to me about that. Finally, with the remaining time, I’ll ask you some more general questions.
- In a few days, I will send you a narrative synopsis that I write from this interview. I’m asking you to read it over and make sure I interpreted this interview accurately. You can call, e-mail, or send me back any comments you have, or if you’d like, we can get back together to discuss it.
- Will you first take a few minutes to fill out this paperwork? (demographics)
- Do I have your permission to tape record this conversation?
Date ___________________________   Interview _________

Name ___________________________   DOB _____________

Pname ___________________________

Phone# ___________________________   e-mail ________________________

Yrs of teaching experience _____________

What subjects taught _____________________________________________

________________________________________________________________

Grade levels taught _____________________________________________

School(s)/type of community _______________________________________

________________________________________________________________

Degree(s)/yr: ______________________________________________________

Are you familiar with the NCTM Standards?

<table>
<thead>
<tr>
<th>Not at all</th>
<th>Very familiar</th>
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<tr>
<td>1</td>
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Vignette #1: The bell has rung, you asked students to get out last night’s homework and while you go around and check to see if they have it done, students are to work on a problem you’ve written on the board to start the day’s lesson.

If the value of $-7abc^2$ is negative, what do you know about the signs (positive or negative) of $a$, $b$, and $c$?

As you walk around, you notice there are many of them who had not completed the homework assignment, and even more are taking this time to socialize instead of work on the problem. You remind them to work on the board problem.

Some students begin working on the problem, others just sit there, and Max, a student on the other side of the room says “Why do we have to do this?” Another student, sitting right next to you adds, “This problem is stupid.”

Describe exactly what you would say to the student(s).
**Vignette 1:**
Here is a hypothetical classroom situation. Please take a minute to read this and think about how you would respond. When you are ready, tell me exactly what you would say in this situation to the student and/or students.

- How realistic is this situation likely to happen in a mathematics classroom?

>Cued-Recall Task
Now we are going to play back pieces of your response OR Now I am going to review some of the things you said.

Try to remember what you were thinking at that time. You are going to be asked to answer three questions the best you can about your thoughts during this period of the response. If you cannot remember or are not sure, just indicate so, do not try to guess.

- What were your reasons for saying that?
- Were you thinking about other things that you might do or say in the near future or later in the conversation?
- Was there something you thought about saying but didn’t? Why?

>After Cued-Recall
- What would you like your students to think about/do/say after hearing your message?
- What do you believe students thought were your reasons for saying that?
- In summary, what do you believe are the most important ideas needing responded to in this situation?
- What do you think will happen next?
Vignette #2: Your students have just taken a test on factoring quadratic equations, and 70% of the class failed. Your review before the test had gone really well. You and the students felt they understood this concept. But it is clear, based on the scores, that many of them still do not understand this concept.

There are only three more weeks of school left, and you still have another chapter to cover. Quadratic functions and this last chapter are both topics that will be included in the department final exam. In addition, quadratic functions have been identified by your department as one of those key concepts students must know for the next course.

Describe exactly what you would say to your students the next class period.
Vignette 1:
Here is a second situation. Please read it and again respond when you are ready.

❖ How realistic is this situation likely to happen in a mathematics classroom?

>Cued-Recall Task
Now we are going to play back pieces of your response OR Now I am going to review some of the things you said.

Try to remember what you were thinking at that time. You are going to be asked to answer three questions the best you can about your thoughts during this period of the response. If you cannot remember or are not sure, just indicate so, do not try to guess.

❖ What were your reasons for saying that?
❖ Were you thinking about other things that you might do or say in the near future or later in the conversation?
❖ Was there something you thought about saying but didn’t? Why?

>After Cued-Recall
❖ What would you like your students to think about/do/say after hearing your message?
❖ What do you believe students thought were your reasons for saying that?
In summary,
❖ What do you believe are the most important ideas needing responded to in this situation?
❖ What do you think will happen next?
Critique:
Now I am going to give you a transcript from an actual lesson. Please read through it and when you are done explain your overall impression of this classroom conversation.

- What do you believe is the teacher’s purpose in this instruction?
- What do you think it would be like to be a student in this classroom dialogue?
- Would you have done differently, if anything, in this situation? Explain and give specific examples from the text and your own experiences.
The situation:

A seventh grade teacher presented the following problem to his class:

*At some time in the future John will be 38 years old. At that time he will be three times as old as Sally. Sally is now 7 years old. How old is John now?*

After allowing students time to think about the problem and to discuss their thinking with a classmate, the teacher calls for volunteers to explain how they thought about the problem in order to solve it. What follows are the responses offered by the students and the ensuring exchange between teacher and students.

T: Let’s talk about this problem a bit. How is it that you thought about it?

S1: I divided 38 by 3 and I got 12 2/3. Then I subtracted 7 from 12 2/3 and got 5 2/3. (Pause) Then I subtracted that from 38 and got 32 1/3 (pause) John is 32 1/3.

T: That’s good! (Pause) Can you explain what you did in more detail? Why did you divide 38 by 3?

S1: (Appearing puzzled by the question, looks back at her work. She looks again at the original problem) Because I knew that John is older ….. three times older.

T: O.K. And then what did you do?

S1: Then I subtracted 7 and got 5 2/3 (Pause) I took that away from 38 and that gave me 32 1/3.

T: Why did you take 5 2/3 away from 38?

S1: (Pause) To find out how old John is.

T: OK. And you got 32 1/3 for John’s age. That’s good! (Pause) Yes, S2?

S2: Isn’t the answer 21? (Pause) I multiplied 7 times 3 and got 21.

T: Hum? Not quite (Pause) How come you multiplied 7 times 3?

S2: It says that he is 3 times as old as Sally ….. (Pause) and Sally is 7.

T: Oh I see! (Pause) You’re right, the problem says that John is 3 times as old as Sally, but that is when John is 38. That’s at the time he is 38 which is at some time in the future. (Pause) Do you understand?

S2: Sort of.

T: OK. How about you, S3? How did you think about it?

S3: I divided 38 by 3 and I subtracted that from 38. That’s 25 and something. Then I added that to 7. I got the same thing as S1, 32 something.

T: But you did it differently. Super? See? There are different ways to solve the same problem (Pause) How about you S4?
S4: I subtracted 7 from 38, and divided that by 3. (*Pause*) I got 10 something. Then I added that to 7. (*Pause*) I got that he is 17 something.

T: Hum? That doesn’t quite agree with the other answers, does it? I’m not sure I understand what you’re doing. (*Pause*) Why did you subtract 7 from 38?

S4 (*Shrugging his shoulders*) I don’t know.

T: S5?

S5: Dividing 38 by 3 can’t be right? It doesn’t dome out even.

T: That doesn’t matter, does it? We still get a number, don’t we? (*Pause*) We get that Sally is 12 2/3 (*Pause*) Let’s take a look at how to divide 38 by 3. Divide 3 into 38 (*Motioning with his hands in the air as if he were doing the long division on an imaginary chalkboard*) Three goes into 38 ten times, put up the 1, and 10 times 3 is 30. Thirty-eight minus 30 is 8. Three goes into 8 two times. Put up the 2, and 2 times 3 is 6. So 8 minus 6 is 2. The answer is 12 remainder 2, or 12 and 2/3. OK? (*Pause*) Let’s take a look at the two ways the problem was solved.

The teacher proceeds to demonstrate S1’s and S3’s solutions on the board and refers to both solutions as appropriate ways to think about the problem. The segment of the lesson ends and the class moves onto another problem.
Interview

We have been talking about particular messages you would create in the classroom, based on specific situations. Now I’d like to step back and ask some general questions about this.

- On a scale of 1 – 5, one being lowest and five highest, how would you rank your classroom communication and tell me why.
- Can you remember a time when it was higher than this number and describe that situation to me?
- What made that situation “better”?
- Can you remember a time when it was lower than this number and describe that situation to me?
- What made that situation “worse”?
- What is your role in classroom communication?
- What is the students’ role?
- What factors do you think effect your verbal communication in the classroom?
- What messages to you use the first day of school, can you give me an example?

Now we are going to play back pieces of your response OR Now I am going to review some of the things you said.

Try to remember what you were thinking at that time. You are going to be asked to answer three questions the best you can about your thoughts during this period of the response. If you cannot remember or are not sure, just indicate so, do not try to guess.

- What were your reasons for saying that?
- What would you like your students to think about/do/say after hearing your message?
- What do you believe students thought were your reasons for saying that?