TESTS, GRADES AND INTROSPECTION: THE EFFECTS OF SELF-REFLECTION AND PERFORMANCE FEEDBACK ON STUDENTS' STUDY STRATEGIES

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By

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ABSTRACT

The present study sought to explore the impact of self-reflection quality (i.e., specificity and accuracy), the extent to which students value the opportunity to self-reflect, and whether self-reflecting can motivate students to change their study strategies. Each of these three situations was evaluated for whether it was connected to increased academic performance. In addition, this study intended to explore how students use performance feedback (i.e., grades).

Participants were 31 graduate students enrolled in a course on pedagogical studies. Participants were required to complete a brief self-reflection after each of four quizzes to reflect on their performance and study strategies. Immediately before completing each self-reflection participants received feedback from each quiz, which represented a way of training them to self-reflect. Participants were also trained to interpret performance feedback.

Each participant was coded as “specific” or “not specific” and “accurate” or “not accurate” based on his or her first two self-reflections on the first two quizzes. In addition, each participant was coded as “value” or “not value” based on his or her answers to a specific set of questions from the fourth self-reflection and as “change study strategy” or “not change study strategy” based on his or her answers to the final two questions on the fourth self-reflection.
A relationship was found between the specificity and accuracy variables such that the more specific a student's self-reflection, the more accurate his or her statements were about the quiz. This type of relationship was also found between the accuracy and value variables. A relationship was also found between students' scores on the third quiz and the accuracy variable. The more accurate the students' self-reflections, the better they performed on quiz three. A one-way analysis of variance found a significant main effect for specificity and accuracy on quiz three. Post Hoc analyses revealed that the difference was between those who were coded as specific and accurate and those who were coded as not specific and not accurate. Not surprisingly, the difference was in favor of those who were specific and accurate. In addition, a relationship between the value and change of study strategies variables was found. The amount a student valued self-reflection significantly predicted the likelihood that he or she changed study strategies.

In terms of data regarding how students use performance feedback, coding for emergent themes revealed nine categories in which students' self-reflections could be grouped: diagnostic, study strategies, understanding, confidence/struggle, healthy and unhealthy, rating, emotion, motivation/forward thinking and useless. Several of the nine categories correlated with each other as well as with the four independent variables of specificity, accuracy, value and change of study strategies.

The results of this study provide several significant contributions to the field. First, they indicate that, despite attempts to connect grades with feedback, students still experience some difficulty separating grades from performance related concepts like confidence. In addition, several of the findings pertaining to grades or performance feedback are of particular importance as they replicate findings from pre-existing
research. Another significant contribution of the present research is the developmental trend uncovered during the data analysis process. There was an added benefit of specificity and accuracy on quiz three, but not on quiz two or quiz four. What this trend means is that the benefit of self-reflection may be evident at different times for different students. This trend speaks to the importance of training students to self-reflect.
For Mom and Dad, the twin pillars without whom I could not stand.
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CHAPTER 1

INTRODUCTION

Within the field of education, the self-regulation of cognitions and behaviors to promote academic achievement has been a topic receiving increased attention (Zimmerman, 1989, 1990 & 1994). Zimmerman (2000) defines self-regulation as the self-generated thoughts, feelings, and actions that are planned and cyclically adapted to the attainment of personal goals. It has been shown that learners who report using self-regulated learning strategies more extensively demonstrate higher academic achievement than learners who use self-regulated learning strategies less often (Zimmerman & Martinez-Pons, 1986).

One of the key elements of self-regulated learning is the concept of self-reflection. The current project evolved from an interest in the concept of self-reflection, which involves evaluation of performance. In his article, Zimmerman (2002a) proposes a structure of self-regulated learning that involves three phases: forethought, performance and self-reflection. Therefore, the present research was influenced a great deal by Zimmerman's conception of the self-regulated learning process, specifically the self-
reflection phase. This reliance stems from a partiality for the cyclical nature of Zimmerman’s model and his assumption that the process of self-regulation is continuously occurring and refining.

Through the act of reflection, whether it is on the use of various study strategies or on performance, students may come to realize the impact of the strategies they are currently using to study. This is of particular interest considering the nature of higher education. At the college level, students are typically required to analyze and apply the information they have learned in their classes. The extent to which students can determine which study strategies help them to achieve in these courses will determine, at least in part, their level of academic success.

The disconnect between the type of questions students are faced with on in-class exams and the methods they use for studying is evident even at the doctoral level. As mentioned above, students, especially those in graduate school, are expected to answer questions that lie within the more complex levels of the taxonomy developed by Bloom, Englehart, Furst, Hill, and Krathwohl (1956). A graduate course that was recently offered at a large midwestern university required students to take weekly quizzes on material pertaining to cognition and learning (Tuckman, 2006). The vast majority of questions were written at the analysis and synthesis levels of Bloom et al.’s (1956) taxonomy. Each week, a small group of students was required to make a presentation intended to prepare the class for the impending quiz. Interestingly, students’ presentations were consistently at the knowledge level, merely testing the retention of discrete facts.
While basic knowledge is necessary for answering complex questions, it is not sufficient. To successfully answer questions that involve analysis or synthesis students need to prepare in ways that help them break information down and put it back together in new ways. To this end, students should try to figure out which study strategies will prepare them for different types of questions, including those written at the analysis and synthesis level. Self-reflection seems like an obvious way for students to find the appropriate study strategies as it provides them the opportunity to consider the relationship between their current strategies and academic outcomes. However, this benefit of self-reflection may be mitigated by the manner in which students self-reflect. As such, a question of interest within the current research is whether the quality of students’ self-reflections affect the benefits they may receive after completing the act of self-reflection.

This project also developed from an interest in the role of performance feedback within the academic environment. Performance feedback refers to the grades students are given for their academic work. This type of feedback is of interest given the possibility that students may use grades as a way of gauging the effectiveness of the study strategies they used to prepare for an assessment. Whether students use performance feedback to evaluate themselves, and more specifically their study habits, may account for why some students modify their strategies (engage in the self-regulatory process of performance, forethought and self-reflection) and others do not. This distinction might provide insight into the variation in academic achievement.

Similar to self-reflection, the role of performance feedback within classrooms is of particular interest given the structure of education. It seems as though students are
graded on a rather consistent basis. These grades are tied to how well they perform on various classroom assessments. Two of the most conventional assessments are tests and quizzes. The reliance on tests and quizzes is especially evident at the high school level. Garet and Mills (1995) found that in a survey of teaching practices of high school mathematics teachers, the frequency of the use of short-answer tests and multiple-choice tests had changed very little from 1986 to 1991. On a use scale of 1 (never) to 5 (very frequently), average-use ratings in 1991 were about 3.5 for short-answer tests and 2.5 for multiple-choice tests. Not surprisingly, teachers from this study were also using some form of alternative assessments, such as written reports, oral reports, notebooks, and projects. However, classroom tests were still a major vehicle for assigning grades. Personal experience reveals that this trend is also evident at the college level.

Results from this study highlight the extent to which students are receiving performance feedback. Since students are getting such a vast number of grades, it seems worthwhile to understand how they use them. It may be that students use performance feedback to evaluate their study strategies. A finding such as this may provide a mechanism though which teachers can promote or prevent strategy modification depending on the academic situation of each individual student.

Conceptual Framework

Given the theories and concepts that encouraged this project, the conceptual framework for the current research involves the relationship between study strategies, self-reflection and performance feedback. A model has been developed to illustrate how the relationship between study strategies, self-reflection and performance feedback will be conceptualized (see Figure 1). This conceptualization underlies both the assumptions
and procedures of the current research. While the concepts of the self-regulatory model inform the majority of this research, other theories, namely attribution theory, could be used to design similar research and interpret subsequent results. In the future, the expectation is to integrate attribution theory into the conceptual framework presented in this study.

Limitations

Due to certain methodological issues, further studies are needed before definite conclusions can be drawn regarding the findings in the present study. First, while the data were collected in a classroom setting rather than in a laboratory, the number of participants was less than ideal. Second, the study sample, with more female than male participants, was almost entirely homogenous in terms of race. Third, correlations comprised a large number of the analyses that were conducted. More studies are required to shed light on the constructs explored in this study. Within the research tradition of the present study, the hope is to conduct studies designed with manipulations that compare the academic outcomes of students who self-reflect with those of students who do not self-reflect. In this way, causal attributions can be made.

Operational Definitions

At the beginning of the current project, all of the a priori variables were defined within the context of the research. These definitions are presented below in no specific order.

"Study Strategies": For the purposes of the present research, "study strategies" are conceived as the ideas and specific tactics for accomplishing learning goals (Svinicki,
2004; Woolfolk Hoy & Hoy, 2003). These ideas or tactics refer to regular patterns of dealing with new information and problems (Svinicki, 2004).

"Self-reflection": The definition for "self-reflection" is an adaptation of the one provided by Zimmerman (2002a) in his study on self-regulatory cycles of learning. With respect to the current research, self-reflection is the act of making judgments about one's academic behavior and related academic performance. More specifically, self-reflection involves evaluating academic performance by comparing that performance with a standard, criterion or goal. It also involves considering how behavioral (i.e., study strategies) and other contributing factors may have affected one's academic outcomes. Self-reflection may also utilize feedback and make reference to actions or objectives from either the past or the future.

"Specific": Within the context of this research project, the term "specific" will be defined as follows. Participants' answers to the prompts on the self-reflections will be considered specific if they are detailed, especially with respect to content, question form and type, feelings, etc. It is presumed that students who are specific in their responses get more out of the self-reflection process as they take the time to self-regulate, and more specifically to critically evaluate, particular aspects of their academic behavior. The more specific a behavior that is being evaluated, the more a student would be able to make modifications or improvements to that behavior.

"Accurate": In terms of "accuracy", the present research defines this term in the following manner. Participants' answers to the prompts on the self-reflections are accurate if they are aligned with their actual performance on the quizzes. It would seem that students who are accurate in their responses benefit more from self-reflection, since
they are more aware of their behavior and outcomes. The more aware a student is of his or her situation (how well or poorly he or she is doing) the better able that student would be to improve his or her performance.

"Value": The present research uses a definition of "value" based on the concepts of worth and regard. Participants' answers to the prompts on the self-reflections will be considered to reflect a valuing of self-reflection if they contain the sentiment that self-reflection is a worthwhile activity or outright mention the benefits of reflecting.

"Performance Feedback": As mentioned above, the current research uses the term "performance feedback" to refer to the grades students are given for their academic work. Performance feedback can be thought of as specific information about the correctness of one's performance. That is, performance feedback emphasizes how well a student has done on a particular task and can take the form of a grade ranging from an A to an F (Bruning, Schraw, Norby, & Ronning, 2004; Woolfolk Hoy & Hoy, 2003).
CHAPTER 2

LITERATURE REVIEW

Students who attend college usually have a very specific set of study strategies (Pressley, Yoki, van Meter, Van Etten & Freebern, 1997; Svinicki, 2004). In their article on the role of learning strategies, Thomas and Rohwer (1986) argue that study strategies or study activities consist of the entire possibility of processes and behaviors that can be utilized during a study episode. In other words, study strategies refer to the ideas and specific tactics for accomplishing learning goals (Svinicki, 2004; Woolfolk Hoy & Hoy, 2003). Study strategies can be thought of as regular patterns of dealing with new information and problems (Svinicki, 2004). There are a wide variety of strategies that range from general study strategies to very specific ones and there are different strategies for learning verbal, procedural and conditional information (Woolfolk Hoy & Hoy, 2003).

Despite the variety of available study strategies, it seems as though the study strategies used by college students tend to be less than optimal. That is, the study strategies college students choose to employ may not help them achieve long-term learning. Instead, they seem to rely on strategies that are quick and easy and that involve the short-term memorization of facts and details. Such strategies include reading and
rereading lecture notes and the textbook and testing recall with flashcards that have exact
definitions written on them. Although this behavior is a mismatch for the demands of
most college level classes, students seem to continue using strategies that engage short-
term memory almost exclusively (Carrier, 2003).

Since study strategies are one of many different self-regulatory strategies, the
decision to use study strategies that are designed for learning discrete pieces of
information and not for mastering subject matter reflects a problem with self-regulation.
Self-regulation can be specifically defined as “a set of behaviors that are used flexibly to
guide, monitor, and direct the success of one’s performance” (Singer & Bashir, 1999, p.
265). Therefore, to be successful students who are able to process course content in a
way that leads to long-term learning, people must engage in behaviors (i.e., study
strategies) that can help them meet the demands of various academic assessments. The
following are potential reasons for the crisis of self-regulation described above.

*Self-Reflection*

To use study strategies that allow for long-term retention, students must be fairly
well developed in their self-regulatory skills. In terms of the levels in learners’
development of self-regulatory functioning proposed by Zimmerman (2002b), students
who use substandard study strategies may be operating at a lower level of self-regulatory
development. Four levels in the development of self-regulatory skill have been
established beginning with social modeling and emulation and then transitioning to self-
control and self-regulation.

Since each successive level connotes an increase in self-initiated regulatory
thoughts and behaviors, students who use less than optimal study strategies may be
functioning at the emulation level of regulation in which students do not systematically self-sustain certain self-regulatory practices including strategy use. Presumably, a student at this level has not developed the self-regulatory abilities of goal setting and time management, which means the student will be unable to use study strategies that require such capabilities. The intervention conducted in the present study can be thought of as a bridge between the emulation and self-control or self-regulation levels of development. The intervention, which will be discussed in detail below, was designed to help students acquire the self-regulatory process of self-reflection. In his article, Zimmerman (2002b) identifies self-reflection as a key activity for making self-regulation a self-sustaining process. Students who self-reflect, therefore, have a better chance of using superior study strategies since their academic functioning will reside at the self-control or self-regulation level of development.

In a related sense, it is probable that student perception of self-regulatory capability can affect performance in an academic setting by influencing strategy use. In a study on self-regulation, the performance of students lacking belief in their ability to be self-regulated and to complete a course-related extra-credit task was compared to those possessing self-confidence and those whose confidence was in-between in both competitive (only a fixed percentage of students could receive extra-credit) and individualistic (any student could receive a grade bonus) goal situations (Tuckman, 2003b). Those who believed in their self-regulatory capabilities earned significantly more extra-credit points than self-doubters overall. Therefore, it is possible that students who are confident in their self-regulatory abilities are more inclined to use study or learning strategies that lead to successful academic outcomes. This is supported by the
results of Tuckman's (2003b) study; self-doubters were less able to earn extra-credit points than their self-believing counterparts, which points to the idea that they were either not using study strategies when completing their work or that the ones they were using were ineffective.

Given the nature of these potential problems, a possible solution may be found within Zimmerman's (2002a) three-part, cyclical model of self-regulation. This self-regulated learning model includes three phases: forethought, performance control and self-reflection. The forethought phase involves goal setting and the selection of strategies and methods. Performance control involves focusing attention on the given task and includes the self-monitoring of progress. The self-reflection phase, which is of particular interest in the current research, involves self-evaluation against a standard or goal, attributions of ability or effort and self-reactions. Following self-reflection, the cycle begins again with the forethought stage. Students who are self-reflecting are being active in their own learning processes, which may lead them to determine which study strategies need modification or need to be discarded in favor of ones that are new and more effective. These students can use this information about their study strategies to adjust the approach to studying they select during forethought phase. In fact, Zimmerman (1998) notes that students who self-reflect evaluate how effectively their strategies help them meet their academic goals and adjust strategies accordingly.

If students are not reflecting on their use of various study strategies as well as on their performance, they may never realize the impact of the strategies they are currently using to study. Once students begin to self-reflect, they may be alerted to the fact that the
study strategies they are presently using are only appropriate for the short-term learning of information. As such, the self-reflection phase of Zimmerman's model seems to be highly important for the selection of appropriate and effective study strategies.

Therefore, reflecting on one's own performance, effort, and strategies may be a valuable skill that should be included as part of the teaching and learning process. The idea would be to have reflection activities fully integrated into instruction. A fairly recent article by O'Neill (1998) argues that student self-assessment and reflection need to be central components of writing instruction. This same article presents nine specific classroom strategies that put self-assessment and reflection at the center of the writing process. While this research is focused on a particular discipline, it lends support for the argument that self-reflection should be a part of regular classroom activities and is reasonably applicable to the present research as it was written with respect to students who attend two-year colleges.

The current project utilizes three of O'Neill's (1998) suggestions for how to implement self-assessment and reflection in the classroom. The following three suggestions were used since they seemed to be the most applicable to all disciplines, not just writing. The first suggestion was to be consistent with self-assessments and reflective writing. While the focus or content may vary, O'Neill contends that it is important to require reflection with every assessment. She maintains that consistent use of self-assessment will encourage students to incorporate it into their repertoire of processes. To this end, participants in the current research were required to complete a brief self-reflection after each of four quizzes.
The second suggestion was to give students directions on writing reflectively. O’Neill (1998) gave students a handout of general instructions and questions at the beginning of the semester that provided some general guidelines for the self-evaluations. The present research provided participants with three to six open-ended questions per self-reflection. The hope was that giving participants a broad prompt, which they could answer in multiple ways, would lead to deeper assessments. The third suggestion was to allow class time for writing self-evaluations. O’Neill usually allowed 10 to 15 minutes at the start of class. According to O’Neill, this time does two things: first, and maybe most importantly, it demonstrates to the students that the instructor thinks the self-assessments are important enough to use class time for them; secondly, it provides a little time between when they engage in the academic activity and when they evaluate it. In accordance with this suggestion, all the self-reflections that participants completed for this study were done within regularly scheduled class time.

Performance Feedback

Besides issues pertaining directly to self-reflection, the reason why students seem to use substandard study strategies may be as simple as the fact that they are not receiving advice as to which study strategies are most appropriate to use when confronted with a given problem, task, or assignment. In other words, it is possible that they are not receiving feedback about different and possibly more effective strategies that are available to them. Students can learn a variety of study strategies as well as the conditional information of when and where to use them from their teachers (Pressley et al., 1997; Svinicki, 2004; Tuckman, 2003a; Tuckman, 2003c; Woolfolk Hoy, Demerath & Pape, 2001). Teachers have the power to explicitly teach study strategies to their
entire classes by making strategy learning a part of the classroom curriculum. Tuckman (2003c) developed an educational psychology-based study skills program called Strategies for Achievement to teach learning and motivation strategies to college students. Students who took the training course earned significantly higher grade point averages in comparison to a matched group presumably because of their exposure to strategies designed to make them more successful learners. However, teachers also have the option of informing students about different strategies by providing them with suggestions for which strategies to use on a more individual basis. For example, before giving back a graded assignment, a teacher could write a brief note at the top of a student’s paper listing ideas for how that student could improve his or her studying. In fact, written feedback has been found to be especially effective (Bruning, Schraw, Norby & Ronning, 2004; Woolfolk Hoy & Hoy, 2003).

Another reason why college students use study strategies that do not allow for deep understanding of information also concerns feedback, but is specifically focused on the concept of performance feedback. In this situation feedback refers to the grades students are given for their academic work. In an article on the meaning of college grades, Milton, Polilio, and Eison (1986) found that a sample of over 6,000 people (including students, parents, teachers and business representatives) agreed that the main purpose of grades should be to provide students with information about their learning. This finding suggests that a variety of people, including students, expect grades to be used as a means of gathering information about learning.

A study by Goulden and Griffin (1995) focused on this issue in a study on beliefs about grades. In particular, these researchers were interested in the purpose of grades.
The study collected cognitive and affective information about the construct of “grades” from both students and teachers using the same technique. Open-ended prompts for generating metaphors, rather than direct survey questions, were used to increase the possibility of discovering additional issues and categories of meaning beyond those preconceived by research designers. The present study adopted a similar philosophy and used prompts that allowed students to respond in any way they saw fit. The prompts used in Goulden and Griffin’s project were: “What do grades mean to you?” and “Grades are like ...”. From the student responses, eight categories emerged.

One of the lesser common categories involved metaphors that referred to grades as motivation. Of the 117 participants, 7 (6%) coded as having metaphors that fell into this category. In addition, Goulden and Griffin found that it is not uncommon for students to comment on how grades make them feel. Of the 117 participants, 27 coded as producing metaphors that highlight a connection between grades and feelings. The category relating grades to feedback represented 59% of all metaphor examples. Specifically, 61 of the 117 participants responded with metaphors that supported the view that grades provide information about achievement and about the variables that influence grades such as ability and amount of work. Since study strategies are certainly variables that influence grades, it seems reasonable to conclude that grades are seen as information about study strategies.

The question is whether students are using grades on exams and written assignments as a way of gauging the effectiveness of the study strategies they used to prepare for the assessment. Whether students use performance feedback to evaluate
themselves, and more specifically their study habits, may account for why some students modify their strategies (engage in the self-regulatory process of performance, forethought and self-reflection) and others do not.

In a relevant study, Pressley and Ghatala (1990) considered the concept of performance feedback as it relates to the monitoring and evaluation of learning strategies. These researchers concluded that learning outcomes are extremely important to continued strategy use. Learning outcomes, which include the grades students receive for their academic work, can be thought of as information pertaining to the effectiveness of a given set of strategies. Once students have attributed outcomes to strategy use, they can make decisions regarding whether to use these strategies in the future. Pressley and Ghatala's research supports the contention that students may use feedback from their academic learning in order to monitor their learning strategies and make decisions regarding strategy effectiveness. They go so far as to suggest that students should receive training that teaches them how to interpret feedback from their academic outcomes.

*Intervention*

The intervention of interest in the present research, which was a class in pedagogical studies, addressed several of the abovementioned issues of self-regulated learning in a variety of different ways. The objective of the intervention was threefold. First, the intervention was designed so that students could master content relating to pedagogy. The quizzes were case-based so students could see pedagogical principles in action and use pedagogical principles to solve problems. Since each quiz was normed to have an average of seven out of ten, it was highly unlikely that anyone would earn a
perfect score. Therefore, all students were given the opportunity to master content because they were pushed to understand the information at a different and higher level.

Second, the intervention included both frequent feedback and self-reflection. Students enrolled in this course were required to complete a brief self-reflection after each of four quizzes to reflect on their performance and study strategies. Immediately before completing each self-reflection, students were given feedback from each quiz. This feedback alerted them to specific errors and the misconceptions that might be underlying their incorrect answers on the quizzes. The norming of the quizzes meant that all students received information about their ability to respond to case study questions and to apply knowledge. In other words, all students, including the high achieving ones, got feedback. For examples of the feedback given to students see Appendix B. The idea was that the more specific and guided feedback students received, the better they would be able to master the content.

Third, the intervention was designed to teach students how to interpret patterns in their feedback and, therefore, train them how to self-reflect. Using the feedback for each quiz, students were taught to look at their errors on each quiz and to reflect on patterns pertaining to, among other things, conceptual confusions and strategy use. Also, as part of these self-reflections students were encouraged to evaluate the meaning of performance feedback and to consider the role of performance feedback in their own learning.

Therefore, the students were encouraged to engage in an important component of the self-regulatory process, namely self-reflection. In addition, the course was designed with repeated assessments, which meant that the students had several opportunities to
practice self-reflecting, to try out various study strategies and to receive performance feedback from their instructor. In order to maintain a focus on mastery, a three-part plan was enacted. First, to de-emphasize performance and the importance of scores, the quizzes counted for only 25% of the students’ overall course grade. Second, students who took the optional fifth quiz were given the chance to drop their lowest quiz grade. Third, completing the self-reflections afforded students the opportunity to recapture up to two points on each quiz.

Purpose

The purpose of this study is to determine whether (1) students take advantage of the opportunity to self-reflect, (2) students value the opportunity to reflect on their performance, and (3) the act of self-reflection, which is a component of self-regulation, can cause students to change the study strategies they elect to use. Furthermore, the methodology of this study is designed to establish if any of these three situations are connected to increased academic performance. In addition, this study is intended to explore how receiving performance feedback (which in the case of the current intervention was a numeric grade ranging from a 10/10 to a 1/10) affects students’ self-regulation, specifically their evaluation and/or utilization of various study strategies. That is, this study is attempting to understand how students use performance feedback.

In essence, the present research intends to explore two specific factors, namely feedback and self-reflection, which have the potential to cause students to choose particular study strategies over others. To do this, data were collected reflecting the extent to which learners in a typical graduate level course continue using, modify or completely change their study strategies based on the grades they receive on weekly
quizzes and on the act of completing the self-reflections. In addition, these data were used to determine whether the use of self-reflection and the modification of study strategies affects academic performance.

The overall research question associated with this purpose is: What is the impact of self-reflection and performance feedback in changing study strategies?

Specifically, three aspects of self-reflection were investigated: specificity and accuracy, value and change of study strategies, and the manner in which students review and use the performance feedback they receive. The following are the specific research questions for this project:

1. What is the role of specificity and accuracy in participants' performance on quizzes?

   1.1 Are the students' self-reflections specific in nature and accurate with the quiz data?

   1.2 Does student quiz performance depend on the specificity and accuracy of their self-reflections?

2. What is the role of value and change of study strategies in participants' performance on quizzes?

   2.1 Do the students evaluate self-reflection as valuable?

   2.2 Do the students modify their study strategies as a result of completing the self-reflections?

   2.3 What percent of the time did students who value self-reflections change their study strategies?
2.4 Does performance on quizzes depend on whether students value self-reflection?

2.5 Does performance on quizzes depend on whether students changed their study strategies?

3. How do students use performance feedback?
CHAPTER 3

METHODOLOGY

Participants

The participants who completed self-reflections for this research were 31 graduate students. These students were part of a cohort and were enrolled in a summer course in pedagogical studies within the college of education at a large midwestern university. All participated as fully informed and consenting volunteers. Institutional review board approval was obtained to ensure compliance with all rules and regulations pertaining to studies involving human participants (see appendix E).

To obtain information regarding demographics, information such as gender, age and race was analyzed in terms of frequencies. Full demographic information was provided by 30 of the 31 participants.

The gender of the participants was fairly homogenous with 30 of the participants being female (96.8 percent) and 1 male (3.2 percent). The age bands of the participants were: 20 to 25 ($n = 22, 73.3$ percent), 26 to 30 ($n = 6, 20$ percent), 36 and above ($n = 2, 6.6$ percent), with most students in the 20 to 25 age band. The racial makeup of the sample was: 28 (93.3 percent) Caucasian, 1 (3.3 percent) African American and 1 (3.3 percent) other.
Materials

The data for the current study were obtained from four self-reflections, which contained from three to six open-ended questions (see Appendix A). In addition, a short questionnaire was used to gather basic demographic information from each participant (see Appendix C). A consent form was used to obtain permission for participation (see Appendix D).

Below is a description of each self-reflection the students were asked to complete:

1. Self-Reflection 1: Students were asked to think about their performance in terms of specific indicators (e.g., type of question, content, etc.) and to consider and report how they will study for the next quiz.
2. Self-Reflection 2: Students were asked to look for patterns (similarities and/or differences) in their performance across the first two quizzes.
3. Self-Reflection 3: Students were asked about the purpose of performance feedback (i.e., grades).
4. Self-Reflection 4: Students were asked about the role of self-reflection in their own thinking and what they have learned about the concept in general.

Within each self-reflection, specific pieces of information were looked for. Responses were analyzed to ascertain the variety of strategies used by the students and to determine whether or not their strategies changed or remained the same. The accuracy of their self-reflections was verified by comparing it with their actual quiz performance. To accomplish this, actual quiz data including overall scores and information concerning content and purpose of each question were obtained and utilized.

Procedure

There were two assumptions associated with the intervention, a course which focused on preparing pre-service teachers for the national PRAXIS assessment, utilized for this research project. The first was that, upon entering the course, students did not
possess the study strategies (or test taking skills) to be successful on the PRAXIS I exam. The second was that the course provided students with three distinct forms of feedback: a global measure (a grade), a specific measure (information about what each question on each quiz was trying to evaluate) and information about study strategies, which they received as a result of the fact they were asked to reflect on the strategies they used and what about them was not working.

As part of normal class routine, students enrolled in the pedagogical studies course were required to complete a brief self-reflection after each of four quizzes to reflect on their performance and study strategies. Immediately before completing each self-reflection students received feedback from each quiz. For an example of this feedback, see Appendix B. That is, following quizzes one, two and three, students were informed of what each question was asking them about and shown how to interpret incorrect answers (i.e., an incorrect answer on a particular question could be an indication of the persistence of a misconception regarding the content). Specifically, students took each quiz on a Thursday and were given feedback, while in possession of their quizzes, on the following Tuesday.

This feedback can be thought of as a way of training the students to self-reflect as they were prompted to think about their performance, especially with respect to specific questions. In other words, it could be said that the process of reviewing each quiz represented a way of training students to examine their performance as well as their associated behaviors (i.e., studying). The first two self-reflections were more feedback specific than the last two self-reflections. That is, the initial two self-reflections were classic reflections developed by the course instructor and were directly tied to quizzes
immediately preceding and following each of them. They trained students how to reflect on tests. Self-reflections three and four were qualitative in nature and were designed primarily by the graduate researcher to utilize the data from the first two self-reflections and inform the present research.

Toward the end of the course, the students were solicited to participate in the current project. The graduate researcher explained the specific purpose of the project to the students while the course instructor was out of the room. The instructor’s absence was intended to communicate to the students that she would have no idea who was participating in the project until after final grades had been submitted. It was made clear to them that they were under no obligation to participate and that the decision to participate or to abstain would in no way affect their grade in the course. In addition, they were told that no identity information would be disclosed. They were then asked to read and sign the informed consent form. After doing so, each consenting participant was given the demographic questionnaire to fill out. They were reminded that they could leave questions blank without penalty.

Data Analysis

In terms of the three main research questions, the following are the analyses that were used to examine the data. To explore the first question, both tetrachoric and point biserial correlations were calculated. In addition, several analyses of variance were run. For the second question, tetrachoric correlations were calculated as well as a number of analyses of variance. The third research question was more qualitative in nature. To capture emerging themes regarding performance feedback, a coding scheme was created
for identifying and categorizing students’ reflections. Correlations were run once the
categories were developed. Specific information about when each analysis was run is
contained in the results section of this paper.
CHAPTER 4

RESULTS

Preliminary analyses were performed to determine the equivalence of participants’ performance on the three quizzes being used as dependent variables. Using a one-way dependent within subjects ANOVA, a significant difference was found among the three quizzes \( (F_{(1, 30)} = 68.025, p < .05) \). Bonferroni T-tests revealed a significant difference between the scores on quizzes two and four \( (t_{(30)} = 8.248, p = 0.000) \) as well as between the scores on quizzes three and four \( (t_{(30)} = 3.759, p = 0.001) \). There was no significant difference between the scores on quizzes two and three \( (t_{(30)} = 2.466, p = 0.020) \). The mean score for each quiz is reported in Table 1. It can be concluded, then, that students’ performance was significantly different on quiz four as compared to the two quizzes preceding it. The difference among the three quizzes was taken into account when running subsequent analyses.

Before analyzing data concerning specificity, accuracy, value and the changing of study strategies, preliminary analyses were conducted to determine which of three final performance measures would be used to assess overall performance. For each student, his or her final points, final percentage and final letter grade for the course were determined. Means for each measure appear in Table 1. The final letter grade measure
correlated strongly with both the final points \((r_{29} = 0.987, p < 0.01)\) and final percentage measure \((r_{29} = .987, p < 0.01)\). As such, the final letter grade variable was selected to be the overall performance measure.

1. What is the role of specificity and accuracy in participants’ performance on quizzes?

1.1 Are the students’ self-reflections specific in nature and accurate with the quiz data?

In the first research question, the purpose was to determine whether students take advantage of the opportunity to self-reflect. It was predicted that the students’ performance on quizzes would depend on the specificity and accuracy of their self-reflections. To operationalize this hypothesis, each participant was coded as specific or not specific and accurate or not accurate based on his or her first two self-reflections on the first two quizzes. The first step was to code each of the first two self-reflections for specificity and accuracy. Then, the two reflections were examined to see consistency or inconsistency in how the participants were rated on specificity and accuracy. In 87% of the cases, the students were rated the same on both self-reflections in terms of specificity. In terms of accuracy, 90% of the cases were coded consistently. As such, a collapsed rating from across the two self-reflections was used to represent the participants’ “self-reflective styles” in terms of both specificity and accuracy.

To assess the degree to which different raters or observers would give consistent estimates of the number of participants coded as specific and accurate, estimates of inter-rater reliability were calculated. Two impartial raters were given eight randomly selected cases to code for each independent variable. They were asked to indicate which category (specific or not specific and accurate or not accurate) each observation fell in. The
percent of agreement between the raters and graduate researcher was calculated. While this is a fairly simple measure, it does give an idea of how much agreement exists. For the first rater, the percent of agreement in terms of the specificity variable was 88%. For the accuracy variable the agreement was 50%. This lower percentage was probably a result of the rater having to compare the accuracy of self-reflections against quizzes with which he had no previous experience. That is, his lack of familiarity with the nuances of the quiz may have hindered his ability to assess accuracy. For the second rater, the percentage of agreement was 100% for the specificity variable. The agreement between this rater and the graduate researcher with respect to the accuracy variable was also fairly high at 75%. This researcher had previous experience with the quiz, which could account for the higher percentage of agreement.

A third rater was brought in to determine whether the percentage of agreement on the accuracy variable would increase for someone who was unfamiliar with the quiz if they were given specific information pertaining to the quiz. In addition to the quizzes and self-reflections, the third rater was given the same feedback students received. This feedback was supposed to familiarize the rater with the details of each quiz question and the related answer options. With this supplemental information, the percentage of agreement between the graduate researcher and a rater who did not have much experience with the quiz increased to 75%.

Of the 31 participants, 17 (54.84 %) were coded as producing self-reflections that were specific in nature while 14 (45.16 %) were coded as producing self-reflections that were not specific. All of the participants coded as specific were female. In terms of the participants coded as not specific, 13 were female and one was male. With regard to the
accuracy of their self-reflections, 23 (74.19%) of the participants were coded as having accurate self-reflections while eight (25.81%) were coded as having self-reflections that were not accurate. All of the participants coded as accurate were female with the one male participant among the nearly entire female group of not accurate participants.

To examine the relationship between specificity and accuracy, a tetrachoric correlation was calculated. There is a relationship between the specificity and accuracy variables such that the more specific a students' self-reflection was, the more accurate his or her statements were about the quiz ($r_{(29)} = .650, p < 0.01$). In essence, 42% of the variance was shared by specificity and accuracy. This type of relationship was also found between the accuracy and value variables. As the accuracy of their self-reflections increased so did the value students placed on self-reflecting ($r_{(29)} = .508, p < 0.01$). In this instance, 26% of the variance was shared by accuracy and value. Neither specificity nor accuracy were correlated with the change of study strategies variable. Table 2 contains the pattern of correlational relationships between the four independent variables (specificity, accuracy, value, and change of study strategies) and the four performance measures (quiz two, quiz three, quiz four, and final letter grade).

1.2 Does student quiz performance depend on the specificity and accuracy of their self-reflections?

To explore the extent to which quiz performance is related to the specificity and accuracy of the students' self-reflections, a point biserial correlation was calculated. This analysis showed a relationship between students' scores on the third quiz and the accuracy variable. With a significant correlation ($r_{(29)} = .498, p < 0.01$) it appears as though the more accurate the students' self-reflections, the better they performed on quiz
three. That is, accuracy significantly predicted performance on the third quiz. When this correlation coefficient was squared, the amount of variability in quiz performance that could be explained by the accuracy of the students' self-reflections was 25%. As noted in Table 2, there was no significant correlation between the specificity of students' self-reflections and the third quiz. Also, neither specificity nor accuracy were significantly correlated with quiz two, quiz four, or final letter grade.

In addition, several analyses of variance were run to assess whether quiz performance was dependent on the specificity and accuracy of student self-reflections. A separate ANOVA was run for each dependent variable (quizzes two through four and the final letter grade). Separate analyses were run due to the preliminary finding that there was a difference among the quizzes. Students were classified into groups based on how they were coded for specificity and accuracy. The three groups were as follows: specific and accurate ($n = 17$), not specific and accurate ($n = 6$), and not specific and not accurate ($n = 8$). There were no participants who coded as specific and not accurate.

As noted in Table 3, the one-way analysis of variance with the specificity and accuracy classification groups and quiz three as the dependent variable was the only one to show significance. Specifically, there was a significant main effect for specificity and accuracy on quiz three ($F_{(2, 28)} = 4.650, p < .05$). A Tukeys Post Hoc analysis revealed that the difference was between those who were coded as specific and accurate ($M = 5.705, SD = 2.008$) and those who were coded as not specific and not accurate ($M = 3.562, SD = 1.347$).
2. What is the role of value and change of study strategies in participants' performance on quizzes?

2.1 Do the students evaluate self-reflection as valuable?

The purpose of the second research question was to determine whether students value being able to reflect on their performance. It was predicted that the students' performance on quizzes would depend on whether they value the act of self-reflection. To operationalize this hypothesis, each participant was coded as value or not value based on his or her answers to a specific set of questions from the fourth self-reflection. These questions required participants to indicate how they used the self-reflections and what they learned about self-reflection after having completed four of them. In essence, the participants were given a set of questions that openly asked them to specify their level of value. The way in which each participant answered this set of questions was rated to illustrate whether he or she values the act of self-reflection.

To assess the degree to which different observers would give consistent ratings of the codes for value, estimates of inter-rater reliability were calculated. The same two impartial raters were given eight randomly selected cases to code for this independent variable. They were asked to indicate which category (value or not value) each observation fell in. The percent of agreement between the raters and graduate researcher was calculated. For the first rater, the percent of agreement in terms of the value variable was 86%. For the second rater, the agreement was 100%.

To explore this research question, tetrachoric correlations were calculated, the results of which are presented in Table 2. A relationship between the value and change of study strategies variables was found. The more students valued self-reflection, the
more likely they were to report a change in their study strategies ($r_{(29)} = .508, p < 0.01$). Similar to the variance shared by the accuracy and value variables, the value and change of study strategies variables share 26% of the variance. Also, as mentioned above, a relationship was found between the accuracy and value variables. As the accuracy of their self-reflections increased, so did the value students placed on self-reflecting ($r_{(29)} = .508, p < 0.01$). The value variable was not correlated with specificity.

2.2 Do the students modify their study strategies as a result of completing the self-reflections?

The purpose of research question 2.2 was to determine whether the act of self-reflection can cause students to change the study strategies they elect to use. It was predicted that the students’ performance on quizzes would depend on whether students changed their study strategies. To operationalize this hypothesis, each participant was coded as “change study strategy” or “not change study strategy” based on his or her answers to the final two questions on the fourth self-reflection. The first question asked participants to indicate if their study strategies change as a result of their participation and to detail the reason for their staying the same or changing. The second question prompted participants to consider the conditions under which students change their study strategies and asked them to indicate if the conditions they listed contributed to the change in their own study strategies. Basically, the participants were posed two questions that directly asked them to state if their study strategies changed. The way in which each participant answered these questions was rated to indicate whether he or she changed study strategies.
Estimates of inter-rater reliability were calculated to determine the consistency of ratings of the codes for the change of study strategies variable. Again, the two raters were given eight randomly selected cases to code. For the first rater, the percent of agreement for the change of study strategies variable was 100%. The agreement was also 100% for the second rater.

As mentioned above, there is an association between the value and change of study strategies variables. The amount a student values self-reflection can significantly predict the likelihood that he or she changed study strategies \((r_{(29)} = .508, p < 0.01)\). The change of study strategies variable was not correlated with accuracy or specificity.

2.3 *What percent of the time did students who value self-reflections change their study strategies?*

Of the 29 participants who completed self-reflections three and four, 22 (75.86 %) were coded as producing self-reflections that indicated they value the act of self-reflection while seven (24.14 %) were coded as producing self-reflections that did not show a valuing of self-reflection. All of the participants coded on the value variable were female. With regard to changing study strategies, 17 (58.62 %) of the participants were coded as having changed their study strategies while 12 (41.39 %) were coded as not having done so. All of the participants coded on this variable were female.

Since it has been determined that there is an association between the value and change of study strategies variables, it seems reasonable that, 73 % of the time, a student who valued self-reflections also changed his or her study strategies.
2.4 Does performance on quizzes depend on whether students value self-reflection?

To explore the extent to which quiz performance depended on whether students value self-reflection, several analyses of variance were calculated with value and change of study strategies as the two independent variables. Participants were divided into four groups, each of which contained students who coded as one of four possible combinations of the value and change of study strategies variables. The groups were as follows: value and change of study strategies (n = 16), value and no change of study strategies (n = 6), no value and change of study strategies (n = 1) and no value and no change of study strategies (n = 6). A separate ANOVA was run for each dependent variable (quizzes two through four and the final letter grade). Again, separate analyses were run due to the preliminary finding that there was a difference among the three quizzes in question. None of the analyses of variance revealed significant effects with respect to the value variable (see Table 4).

2.5 Does performance on quizzes depend on whether students changed their study strategies?

To answer this question, results from the analyses of variance discussed above were utilized. However, none of the analyses of variance that were done showed significant effects of the change of study strategies variable (see Table 4).

3. How do students use performance feedback?

Coding scheme. The purpose of the third research question was to explore how receiving performance feedback (i.e., a letter grade ranging from an A to an F) affected students’ self-regulation, specifically their evaluation or utilization of various study
strategies. After reading through self-reflections three and four, the comments of several students made it clear that there were themes regarding performance feedback within the content of their self-reflections. To capture these themes, a coding scheme was created for identifying and categorizing students' reflections. In total, nine codes were developed. It was possible and very common for participants to be identified as being in more than one coded category. See Table 5 for examples of each of the nine codes pertaining to performance feedback.

To assess the degree to which different observers would give consistent ratings with regard to the nine codes developed by the graduate researcher, estimates of inter-rater reliability were calculated. The same two impartial raters were given eight randomly selected cases and were asked to code them using the nine codes described below. Again, the percent of agreement between the raters and graduate researcher was calculated. Since these codes were fairly subjective, agreement was said to have occurred if either of the following conditions were satisfied: the rater coded exactly the same as the graduate researcher with no additional codes or the rater coded exactly as the graduate researcher but added one or two more codes. Disagreement occurred when the rater did not list a code the graduate researcher had listed. For the first rater, the percent of agreement in terms of the value variable was 63%. For the second rater, the percent of agreement was 100%.

Self-reflections within the "Diagnostic (D)" category are those in which students refer to performance feedback as a means for making a diagnosis, judgment or decision. These reflections do not specifically refer to the concept of understanding. While this
category may seem very similar to the “Understanding” category, the difference is that reflections coded as diagnostic refer to the process of learning and not the learned information itself.

Self-reflections within the “Study Strategies (SS)” category directly refer to the act of studying or to study strategies themselves. Students who write reflections of this sort profess to use performance feedback in a way that helps them evaluate and modify their study strategies. Self-reflections within the “Confidence/Struggle (CS)” category refer to students’ confidence, expectations, preparation and feelings of struggle. For students who have reflections of this nature, performance feedback is used to confirm or disconfirm feelings of self-assurance. Self-reflections within the “Understanding (U)” category explicitly express the notion that performance feedback is a way to gauge understanding or thinking and to determine how much is actually known. Reflections within this category are related to content or course material.

Self-reflections within the “Healthy and Unhealthy (HUH)” category are those in which students react to performance feedback in ways that can be classified as healthy or unhealthy responses. Not everything that is listed under the other categories was coded as healthy. Only comments that are healthy and do not fit into any of the other categories were included in the “Healthy and Unhealthy” category. Students who have self-reflections within the “Rating (R)” category use performance feedback as a basis for ranking themselves as below average, average or above average. Self-reflections within the “Emotion (E)” category identify feelings related to performance feedback or grades.

Self-reflections within the “Motivation/Forward Thinking (MFT)” category specifically refer to the next quiz and how the performance feedback has served as a form
of motivation. The essence of this category is that the student is referring to the future and to his or her drive. It is important to note that answers that mention where to focus or which refer to weak areas, strengths, weaknesses, etc. do not belong in this category, as they do not explicitly refer to the next quiz. Self-reflections within the “Useless (UL)” category contain the sentiment that performance feedback is not useful.

Three of these categories resemble those that were developed in Goulden and Griffin’s (1995) study, which was discussed in the Literature Review of this paper. Specifically, Goulden and Griffin’s categories of grades as feedback, grades as emotional triggers and grades as motivators each have a similar category within this research. The resemblance between the categories developed in these two studies lends support to the contention that students use grades for the purposes of feedback and motivation and experience feelings when confronted with grades.

Findings. As Table 5 shows, the most common use of performance feedback was for diagnostic purposes (n=20). The second most frequent use of performance feedback was to evaluate old and prompt new study strategies (n = 16). The least common response regarding performance feedback was that it was useless (n = 3).

Both the “Healthy and Unhealthy” and “Emotion” categories contained reflections that could be classified according to valence. Of the eight participants whose self-reflections fell into the “Healthy and Unhealthy” category, six of them (75%) made comments that were healthy or positive. Of the seven participants who specified an emotion, six of them (86%) listed feelings that could be classified as negative. These emotions included anger, anxiety, frustration, discouragement, and disappointment, which was mentioned by two different participants. The one positive emotion that was
expressed related to feeling good. When analyses were run using these two categories, reflections were not divided with respect to valence. For example, the “Emotion” category was considered as a whole and results should be interpreted as such.

To ascertain the relationship between the nine performance feedback codes and the four independent variables of specificity, accuracy, value and change of study strategies, correlations were computed. The results of these analyses are presented in Table 6. With regard to how the four independent variables are related to the nine performance feedback codes, there were several significant findings.

First, a relationship between the specificity variable and “Study Strategies” category was found, which indicated 14% of shared variance ($r_{(29)} = .369, p < 0.05$). The more specific a student’s self-reflection, the more likely it was that he or she would use performance feedback to refine his or her study strategies. Second, the specificity variable was also related to the “Useless” category ($r_{(29)} = -.404, p < 0.05$). This negative correlation means that students whose self-reflections were specific in nature were less likely to be the ones who thought performance feedback was useless.

Third, the value variable was negatively correlated with the “Healthy and Unhealthy” category ($r_{(29)} = -.734, p < 0.01$) but positively associated with the “Study Strategies” category ($r_{(29)} = .464, p < 0.05$). Meaning, students who valued self-reflection were less likely to be the ones who had reflections that fell into the “Healthy and Unhealthy” category but more likely to be the ones whose self-reflections exhibited characteristics of the “Study Strategies” category. The correlation between the value variable and “Study Strategies” category also means that the two share 22% of the variance.
Fourth, the correlation analyses revealed a significant relationship between the change of study strategies variable and the “Healthy and Unhealthy” category ($r_{(29)} = -0.421, p < 0.05$). Students who indicated that they changed study strategies were less likely to have reflections that coded as “Healthy and Unhealthy”. No other categories were significantly correlated with the independent variables; however, correlations were found between a number of the categories themselves (see Table 6).
CHAPTER 5

DISCUSSION

The purpose of this study was to investigate the quality of student self-reflections, the extent to which students value the opportunity to self-reflect, and whether self-reflecting can motivate students to change their study strategies. Each of these three situations was evaluated for whether it was connected to increased academic performance. In addition, this study was designed to explore how students use performance feedback. In essence, the aim of the present research was to examine how the concepts of self-reflection and feedback impact students’ self-regulation, specifically their evaluation and/or utilization of various study strategies.

1. What is the role of specificity and accuracy in participants' performance on quizzes?

1.1 Are the students' self-reflections specific in nature and accurate with the quiz data?

One of the main purposes of this investigation was to test the extent to which students' self-reflections are specific in nature and accurate with respect to their quiz scores. In terms of the specificity variable, slightly more than half of the participants coded as being specific. With regard to the accuracy of self-reflections, roughly three-fourths of the participants were coded as having self-reflections that were accurate.
While these numbers are encouraging, results presented later in this section illuminate the need to increase the number of students who produce self-reflections that are specific in nature and accurate with regard to their actual academic performance.

In terms of the relationship between these two variables, results suggest that there is a fairly strong positive correlation between the specificity and accuracy variables. This relationship confirms that students who take advantage of the opportunity to self-reflect by offering comments that are specific will also take the time to make comments that are accurate.

If the specificity and accuracy of student self-reflections tend to correlate, teachers who utilize reflections in their classrooms should promote a type of writing that is detailed. Given the results of this research, students would be more likely to make comments that are accurate with respect to their classroom performance if their self-reflections are specific in nature. However, because correlation analyses were done, the opposite is true as well; if students produce accurate self-reflections, the more likely it is that their comments will be specific. Therefore, teachers should also nurture students’ abilities to reflect on their performance in ways that are consistent with their actual outcomes.

Supporting self-reflections that are specific and accurate is especially important in light of the results pertaining to question 1.2.

1.2 Does student quiz performance depend on the specificity and accuracy of their self-reflections?

Related to the aforementioned purpose was the intention to establish if the specificity and accuracy variables were connected to increased academic performance. It
was predicted that the students' performance on quizzes would be related to the specificity and accuracy of their self-reflections. When analyzing whether quiz performance was associated with the specificity and accuracy of the students' self-reflections, a positive correlation between students' scores on the third quiz and the accuracy variable was found. This result suggests that students who are accurate in their responses benefit more from self-reflection as they also have higher quiz scores. This increase in performance may be a function of the fact that students with accurate self-reflections are more aware of their behavior and outcomes. It stands to reason that the more aware a student is of his or her situation (how well or poorly he or she is doing) the better able that student would be to improve his or her circumstances.

At the same time, however, a significant correlation was found for quiz three only. This was also the case for the results stemming from the analyses of variance done to assess whether quiz performance was dependent on the specificity and accuracy of student self-reflections. There was a significant main effect for specificity and accuracy on quiz three only. The difference was between those who were coded as specific and accurate and those who were coded as not specific and not accurate. The difference in mean scores on quiz three was in favor of specific and accurate students and was quite striking.

The question is, then, why was there an added benefit of specificity and accuracy on quiz three, but not on quiz two or quiz four? It is possible that students may be specific and accurate on the self-reflections prior to quiz two, but that they may not know what to do with the insight they gain from their comments. That is, they may not realize that they should apply their newfound insight and possibly change their approach to studying. However, by the third quiz, specific and accurate students may realize what
they should do (i.e., modify their study strategies) with the information about their behavior and outcomes they have gained from self-reflecting. Using the self-reflections to make changes may be what led these students to higher scores on quiz three. Then, by the time the fourth quiz rolled around, it is likely that the other students (those who are not specific but accurate and those who are not specific and not accurate) caught up to their specific and accurate peers so much that the significant difference in scores that was evident for quiz three is no longer present. For a visual representation of this trend, see Figure 2.

The idea that other students caught up to those who were specific and accurate is grounded in the question of why not specific and not accurate students did not receive scores on quiz four that were significantly lower than those of their peers. The answer to this question may be as simple as differing response times to classroom instruction or training. In other words, it may just be that at a later point certain students (those who are not specific but accurate and those who are not specific and not accurate) change their study strategies and do moderately well on performance measures. The not specific and not accurate students may simply respond to classroom instruction or training at a slower rate.

The results presented in this section are similar to those presented in May and Etkina’s (2002) study on college physics students’ epistemological self-reflection. In their research, students who had high conceptual learning gains tended to be those who wrote reflections in which they tried to make coherent sense of course material by making knowledge relevant to their personal experiences. While their self-reflections may not have been lengthy, they were highly detailed. May and Etkina concluded that it
may not be the quantity of reflection, but the quality that matters. Similarly, the current investigation found that specificity and accuracy, both characteristics related to the quality of a self-reflection, make a difference for performance with respect to certain quiz scenarios.

Given these findings, it may be prudent for teachers to conduct interventions with respect to the quality (specificity and accuracy) of self-reflections. If students who have nonspecific and nonaccurate self-reflection styles are not given instruction on how to be specific and accurate, it is possible that they will never develop these skills and continue to use self-reflections in a superficial fashion. If they do not learn how to increase the quality of their self-reflections, they may miss out on the early positive effects (i.e., increased quiz performance) that are related to having self-reflections that are specific in nature and accurate with respect to actual performance.

However, if self-reflection is not a component of standard classroom procedures, then no students are receiving its benefits. Results from this study suggest that teachers should use reflection exercises along with regular course material. Again, the importance of incorporating self-reflection into curricula stems from the finding that it may help students experience better performance outcomes.

2. What is the role of value and change of study strategies in participants' performance on quizzes?

2.1 Do the students evaluate self-reflection as valuable?

Another purpose of this investigation was to determine whether students value being able to reflect on their performance. Results suggest that there is a fairly strong
positive correlation between the value and change of study strategies variables. This relationship will be discussed further under question 2.2, mainly in terms of test preparation.

The accuracy variable was also positively correlated with the value variable. This correlation indicates that the more accurate students' self-reflections are, the more they tend to value self-reflection. The results are presented in this manner due to the fact that data regarding accuracy were collected before data regarding value. The truth is, students could enter their classrooms already possessing a value for self-reflection.

Given that there is a potential for value to come before accuracy, it may be important for teachers who utilize self-reflection in their classrooms to obtain a baseline measure of value for each student. In this way, teachers might be better able to gauge whether their students are going to take advantage of the opportunity to reflect on their performance, especially in terms of accuracy. Within the context of this research, two options are available for teachers who find that their students do not value the opportunity to self reflect. One option would be to counsel their students on the benefits of self-reflection with the idea that this would help them see the value behind reflection exercises. Several benefits have already been presented here. In addition, a study by Mercurio (2005) found that middle school students using a self-reflection reading program learned that they could enjoy a book and learned that they could like more than one genre. Therefore, besides the benefits offered by the current research, Mercurio's article presents a powerful benefit of self-reflection, namely insight into one's own preferences.
The other option would be to concentrate on helping students produce specific self-reflections. As seen in the previous section, there is the potential that students who take advantage of the opportunity to self-reflect by offering comments that are specific will also take the time to make comments that are accurate. Since it has been shown that accuracy is correlated with value, helping students become more specific may indirectly impact how much they value self-reflection.

2.2 Do the students modify their study strategies as a result of completing the self-reflections?

The current research also intended to establish whether the act of self-reflection can prompt students to change the study strategies they elect to use. As mentioned above, results suggest that there is a fairly strong positive correlation between the value and change of study strategies variables. This relationship confirms that the more a student values the opportunity to self-reflect, the more likely it is that he or she will indicate a change in study strategies. However, because correlation analyses were done, the opposite can also be true; students who modify their study strategies will be more likely to be the ones who value self-reflection.

This finding is especially significant given that study strategies are a main mechanism through which students prepare for various performance measures including quizzes and tests. According to the data presented in this research, a student will be more likely to modify his or her strategies if he or she values self-reflection. This finding is of particular importance for students who are using inappropriate study strategies. To help these students adequately prepare for exams, it may be wise for teachers to encourage them to self-reflect and to see the value of doing so.
2.3 What percent of the time did students who value self-reflections change their study strategies?

A question of interest within this research was the percentage of time students who value self-reflections also changed their study strategies. It has already been said that there is an association between the value and change of study strategies variables. More specifically, 73% of the time a student who valued self-reflections also changed his or her study strategies.

These findings support the recommendation made under question 2.2. The rather high percentage of students who valued self-reflection and changed their study strategies seems to indicate that teachers who utilize self-reflection and help students value the act of reflecting may very well encourage students to modify the study strategies they choose to employ.

2.4 Does performance on quizzes depend on whether students value self-reflection?

The current investigation also intended to establish if the value variable was connected to increased academic performance. It was predicted that the students’ performance on quizzes would depend on whether they valued the act of self-reflection. However, none of the analyses done with respect to the value variable detected significant effects.

While the value variable may not be directly affecting quiz performance, there is a possibility that it can indirectly influence academic outcomes. Earlier in this investigation, the value variable was shown to be related to the accuracy variable. The accuracy variable, in turn, was found to have a relationship with quiz performance.
Therefore, the value variable may be associated with quiz performance in a roundabout way. Point being, teachers should still concentrate on fostering the value of self-reflection in their students, despite the lack of results suggesting a dependency between value and quiz performance.

2.5 Does performance on quizzes depend on whether students changed their study strategies?

Related to the aforementioned purpose was the intention to establish whether the change of study strategies variable was connected to increased academic performance. It was predicted that the students’ performance on quizzes would depend on whether they changed their study strategies. As for the value variable, none of the analyses computed for the change of study strategies variable revealed significant effects.

These results suggest that it makes no difference in terms of quiz performance whether students change their study strategies. What does make a difference is that a little over half of the participants were coded as having changed their study strategies. While these students may not have experienced significant changes in their quiz scores, modifying their study strategies seems to indicate the presence of metacognition. That is, it stands to reason that students who change their study strategies have thought about their study behaviors and therefore have engaged in metacognitive processes.

Metacognition is an important component of self-regulation (Zimmerman, 1986). Students who change their study strategies, therefore, are thinking in a way that may help them achieve self-regulation, if they have not already. While students who do not change their strategies may also think about their studying, it is obvious that those who actually make a change have taken a metacognitive step that enables them to be decisive in their
approach to studying. Given the potential implications for self-regulation, a change in study strategies should be viewed as a positive occurrence. As such, it may be worthwhile for students to at least consider their current methods for studying.

3. *How do students use performance feedback?*

*Evaluation of Study Strategies.* A separate purpose of this study was to explore how receiving performance feedback (i.e., a letter grade ranging from an A to an F) affects students’ self-regulation, specifically their evaluation and/or utilization of various study strategies. It was predicted that students would use performance feedback as a signal to alert them of the effectiveness of their study strategies. As mentioned in an earlier section of this article, Pressley and Ghatala (1990) concluded that student awareness of learning outcomes is critical to continued strategy use. Adults were found to be able to derive and use strategy effectiveness information when prompted to monitor their performance on a recall test following studying with differentially effective strategies. In the current research, completing the self-reflections can be thought of as the prompt that encouraged students to consider their performance on the quizzes. In light of Pressley and Ghatala’s findings, it seems reasonable to suggest that the students in this study indicate that they used performance feedback to validate the use of their study strategies or to represent a problem with them.

Results indicate that the most common use of performance feedback was for diagnostic purposes. The second most frequent use of performance feedback was to evaluate old, and prompt new, study strategies with over half the participants falling within the study strategies category. These results lend support to the idea that students are using performance feedback as information regarding the effectiveness of their study
strategies. However, prior research suggests that this conclusion depends on the age of the students in question. Ghatala, Levin, Pressley, and Goodwin (1986) found that young children need to be shown how to monitor the outcomes of their recall efforts and that they also need training in attributing recall outcomes to strategy use and in using this information to make appropriate decisions. Considering this finding, younger students should receive multidimensional instruction on how to interpret performance feedback so they can make decisions that will optimize their study strategies.

*Change of Study Strategies.* Of particular interest in the current research was how the coding categories created from the students' reflections on performance feedback related to their use and modification of study strategies and to the four independent variables of specificity, accuracy, value and change of study strategies. First, a relationship between the specificity variable and "Study Strategies" category was found such that the more specific a student's self-reflection was, the more likely it was that he or she would indicate using performance feedback to refine his or her study strategies. Second, the value variable was also positively associated with the "Study Strategies" category. Third, the correlation analyses found a significantly negative relationship between the change of study strategies variable and the "Healthy and Unhealthy" category.

These findings seem to indicate that encouraging students to evaluate their study strategies involves helping them to be specific on their self-reflections. The idea is that the more specific students are when they consider their academic performance, the more likely it is that they will uncover important information regarding their study strategies. In addition, these findings imply that students who use performance feedback to glean
information regarding their study strategies also value the act of self-reflection. These results lend additional support to the argument that teachers should promote the utility of self-reflection while training students to self-reflect in a way that is highly detailed.

The relationship between the change of study strategies variable and the “Healthy and Unhealthy” category is slightly more difficult to interpret. As mentioned in the results section of this paper, reflections within the “Healthy and Unhealthy” category were not divided according to whether they were positive or negative comments when analyses were computed. However, simple calculations revealed that 75% of the reflections within this category contained comments that were healthy or positive in nature. In light of this percentage, the correlation between the “Healthy and Unhealthy” category and the change of study strategies variable may suggest that students who report a change in their study strategies are less likely to make a healthy comment regarding performance feedback.

It may be possible, then, to interpret this finding in terms of dissonance theory. Changing study strategies can represent a dissonance producing situation. A student who is prompted to change his or her strategies but does not see a need for the change may feel a conflict after doing so. A common technique for reducing cognitive dissonance is to make an attitude change, which can serve to alleviate the psychological discomfort generated by counter-attitudinal behavior (Elliot & Devine, 1994). In other words, making comments in accordance with the situation that is causing the conflict may alleviate dissonance. Earlier in this section it was shown that some students make a connection between performance feedback and strategy modification. As such, a student experiencing conflict stemming from a change in strategies may make positive comments.
about performance feedback as a way of justifying the change. Therefore, it may just be that the students in this study did not feel conflicted about changing their strategies and consequently did not need to justify the change they made by making a positive comment about performance feedback.

What this means for teachers is that they may not want to dismiss students who make positive comments about performance feedback as being comfortable with the change in their study strategies. It is possible that students who make positive comments may be experiencing some amount of conflict regarding the change in their study strategies which could be symptomatic of a larger problem, specifically that the students have erroneously changed strategies or are using the new strategies improperly and, as a result, are struggling academically.

Additional Conclusions Regarding Performance Feedback. Of the remaining findings, there are two that deserve attention for either directly or indirectly relating to the act of studying. The “Study Strategies” category was found to be negatively correlated with the “Useless” category. This correlation means that students whose comments about performance feedback pertained to study strategies were less likely to be the ones who thought performance feedback was useless. This relationship makes perfect sense as it stands to reason that students who profess to evaluate or refine their study strategies based on performance feedback do in fact believe that performance feedback is useful. Counseling students on the uses of performance feedback may encourage them to consider how their academic outcomes relate to the strategies they use.

Another interesting correlation was between the “Diagnostic” and “Ratings” categories. The more a student used performance feedback for diagnostic purposes, the
less that student would rate him or herself. The issue now centers on why students who
use performance feedback to make a judgment about their learning do not rate
themselves. Is it that instead of distracting themselves with a rating, they prefer to be
proactive in their learning and diagnose the source of their grade? What makes this
interpretation valuable to the current research is the idea that the diagnoses students make
may impact the strategies they choose to employ. If a student decides that he or she has a
problem applying theories to case study problems, he or she may decide to change to a
study strategy that is better suited for learning at the application level. In light of the
findings presented here, decreasing students' tendencies to rate themselves means they
would be more likely to be diagnostic when confronted with performance feedback,
which in turn could mean that they would be more likely to make a necessary
modification to their study strategies.

4. Conclusions and Contributions

The results of this study provide several significant contributions to the field,
including the structure of the intervention. The course was designed so that grades were
intended as a form of feedback that could be used to check for understanding. In essence,
the classroom had a culture of mastery in which the main purpose of grades was feedback
rather than evaluation. The results of this study show that, despite attempts to connect
grades with feedback, students still experience some difficulty separating grades from
concepts like confidence and emotions, which are primarily related to performance.

In addition, several of the findings pertaining to grades or performance feedback
are of particular importance because they replicate findings from pre-existing research.
Three of the performance feedback categories developed in the present study resemble
those that were created by Goulden and Griffin (1995). Specifically, Goulden and Griffin's categories of grades as feedback, grades as emotional triggers and grades as motivators each have a similar category within this research. This replication serves to verify that students use grades for the purposes of feedback and motivation and experience feelings when confronted with grades.

Another significant contribution of the present research is the developmental trend uncovered during the data analysis process. As shown above, there was an added benefit of specificity and accuracy on quiz three, but not on quiz two or quiz four (see Figure 2). On the second quiz, the majority of the students did not achieve very high scores. However, on quiz three, students who were specific and accurate excelled. Then, by the fourth quiz, the other students (those who are not specific but accurate and those who are not specific and not accurate) caught up to their specific and accurate peers. What this trend means is that the benefit of self-reflection may be evident at different times for different students. For example, those who are not specific and not accurate may simply experience the benefits of self-reflection a bit later than their specific and accurate peers.

This trend speaks to the importance of training students to self-reflect. The training component of the present intervention is an additional contribution to the field of self-regulated learning. To train for self-reflection, the course was divided into three segments. First, the course was designed with quizzes that could be systematically broken down so students could understand the origins of their errors. These errors tended to result from conceptual confusion and disorganization of higher order principles. Second, the students were informed of the sources of their errors and were given explicit training on how to interpret the causes behind them. Third, the students were taught to
reflect on patterns in their errors across quizzes. The good news is that this approach to incorporating self-reflection into the classroom is in no way tied to the content of the intervention. While the pedagogy course was a conduit for the training, any instructor from any discipline can train their students in a similar manner.

5. Limitations and Future Research

Certain methodological issues limit the application of these findings, three of which are listed here. First, while the data were collected in a classroom setting rather than in a laboratory, the number of participants was less than ideal. Among other complications, the moderate sample size restricted the type of analyses that could be run. Second, the participants were almost entirely homogenous in terms of both race and gender. Obviously, this hinders the generalizability of the findings. Third, correlations comprised a large number of the analyses that were conducted, which made it difficult to generate causal conclusions.

Given these limitations, there is recognition of the extent to which the chosen methodology limits the scope and generalizability of the findings. However, these findings open the door to a next step of research designed to further investigate how various characteristics of self-reflection (i.e., specificity, accuracy, etc.) impact academic performance. This research also encourages other researchers to empirically examine the effects of performance feedback, especially with regard to strategy use. In addition, the findings presented here provide support for the idea that teachers should consider promoting self-reflection in their classrooms. The hope is that these findings will be both valuable and applicable to classroom teachers.
LIST OF REFERENCES


Tuckman, B. W. Personal communication. Conversation in February, 2006.


APPENDIX A

SELF-REFLECTIONS
Self-Reflection # 1:

Look over your quiz for patterns in your performance. Consider:

- Item Content (Behaviorism / Social Cognitive Theory)
- Item Type (Case Study vs. General Questions)
- Item Difficulty (Recognition, Synthesis, Evaluation, Application; Attention to Wording in Questions)

What were your strengths and weaknesses on this quiz?

Based on what you have learned about this quiz, how will you better prepare for the next quiz? What strategies will you use when taking the next quiz?

Self-Reflection # 2:

My score on the first quiz was: below the class average average above the class average

My score on the second quiz is: below the class average average above the class average

When looking at my performance on the types of items (case study questions 1-3 versus general content questions 4-10), I learned...

When looking at my ability to discriminate between the two different pedagogical perspectives (Piaget/Individual Constructivism vs. Vygotsky/Social Constructivism; items 1-3), I learned...

When looking at the success of my strategies for using the textbook and sample case studies to prepare for the quizzes, I learned...

In order to prepare for the next quiz, my plan is to...
Self-Reflection # 3 (Your response to this reflection will be confidential. Please write your name on the post-it note so that Evan may award you 1-2 points credit for completing the reflection. She will then remove the post-it with your name on it so that my reading of your responses will be anonymous.)

Looking only at your Quiz 3 grade, what does this grade mean to you?
What does it tell you about yourself as a learner? And as a teacher?
What does it tell you about me (Heather)?
Given the relatively low impact of quiz grades on your final grade for the course, what purpose do you think these grades serve?

Self-Reflection # 4

How did you use the self-reflections completed in this course? What have you learned about self-reflections from this course?
How did you use performance feedback from the quizzes? Based on your experience, how should students use performance feedback?
Did your learning/study strategies change as a result of participating? Why or why not?
Under what conditions do you think students change their learning/study strategies? Was this the case for you?
APPENDIX B

FEEDBACK EXAMPLES
On the first quiz, students were tested on concepts from behaviorist and social cognitive perspectives. Students were expected to answer both case study and broader multiple-choice questions to evaluate their mastery of the material. Below is a list of the principles underlying each test item. When students made errors, they were taught to attribute their mistake to a misunderstanding or misconception concerning these principles.

*Quiz 1 Feedback*

Quiz Characteristics:

1. Identify constructs from Social Cognitive Theory and apply concepts to the case.
2. Identify constructs associated with self-management and apply concepts to the case.
3. “In keeping consistent with her current implemented pedagogical objectives”.
4. & 5. Distinguish between behaviorism and social cognitive theory; Distinguish between operant and classical conditioning.
5. Characteristics of effective praise.
6. Fine discrimination between social cognitive theory concepts.
7. “Traditional” educational psychology perspective.
8. Characteristics of mastery learning; “pedagogical advantage”.
9. Synthesize research across the token reinforcement literature.

On the second quiz, students were tested on concepts from individual and social constructivist perspectives. Again, students were expected to answer both case study and broader multiple-choice questions to evaluate their mastery of the material. Below is a
list of the principles underlying each test item and the related discriminations that were necessary in order to correctly answer the question. When students made errors, they were taught to attribute their mistake to a misunderstanding or misconception concerning these principles.

Quiz 2 Feedback

Quiz 2 Characteristics:

1. “After the Post Assessment/Talking with Teacher/Picture Books”
   a. Discriminate between Individual (a,b,c) and Social Constructivist Concepts (d,e)
   b. Discriminate between assimilation and accommodation
   c. Apply concepts to the case

2. “Purpose of using collaborative pedagogies”
   a. Discriminate between individual (a,c) and Social Constructivist Concepts (b,d)
   b. Discriminate between a purpose/rational “a” and a possible outcome “c”
   c. Misconception about Piaget’s Theory: Not all 1 theory
      i. Learning Theory and a Developmental Theory
   d. Misconception about “perspective taking” – that cooperative grouping is developmentally appropriate for children at all developmental levels

3. “After post assessment… modify to reflect cognitive apprenticeship”
   a. Discriminate between Individual (a,b,c) and Social Constructivist Concepts (c,d)
b. "Modify" – Students are already actively exploring and activities she has are designed to explore underlying principles of simple machines

c. Identify components of cognitive apprenticeship and apply: “familiar” = authentic, real-work; “convey understanding” = modeling, articulation

4. “Constructivist approach” = student-centered
   a. Misconception about modeling

5. “Understanding complex content from one method”
   a. Rule out poor answers
   b. Best answer “c”

6. “Discipline from a constructivist perspective”
   a. Distinguish between constructivist and social cognitive (rule out “a”)
   b. Misconceptions about negotiation
   c. Managing conflict; choosing between “b” and “d”; not something we got to discuss in class but was from text and deals with effective communication

7. “Teachers role” = misconceptions of constructivism
   a. Demonstration does not = modeling
   b. Student-centered does not = non-involvement, no guidance
   c. Constructivists value intellectual conflicts (disequilibrium; indicator that students are trying to find meaning)

8. Misconceptions about constructivism
   a. Not “anything goes” with regard to intellectual and behavioral boundaries; not moral relativism
9. & 10. Misconception about constructivism that its most important contribution is managerial; “instructional aspects” = predominance of language, value of cognitive conflict

Bonus. “Failure to establish intersubjectivity”

a. Intersubjectivity requires 2 people (rule out “a”)

b. As long as 2 or more people are dialoging they are engaging in intersubjectivity (rules out b,d,e).

c. Failure happens when 2 or more people “stop” talking

d. “c” is the best answer
APPENDIX C

DEMOGRAPHIC QUESTIONNAIRE
The Affect of Performance Feedback and Self Reflection on Study Strategies

Demographic Information

Directions: For each item, either circle the answer that best applies to you or fill in the requested information. At any time, you may choose to leave an item blank.

1.) Gender: Male       Female

2.) Age:

3.) Race: Caucasian       African American       Hispanic       Asian       Other

4.) Residence: On-campus       Off-campus

5.) Undergraduate GPA (e.g., 2.4):

6.) Anticipated GPA (e.g., 2.4) after this quarter:

7.) Anticipated grade for this course (EDP&L 718): 70       75       80       85       90       95       100

8.) Other employment: Full-time job       Part-time job       None

9.) Extra-curricular activities (e.g., professional associations, parenting, sports, etc.):

10.) Being specific about the strategies you use, describe your preferred method of studying for:
    a.) a graduate level seminar in education:
    b.) this course (EDP&L 718):
APPENDIX D

CONSENT FORM
STUDENT CONSENT FOR PARTICIPATION IN
AN OHIO STATE UNIVERSITY RESEARCH PROJECT

Protocol Title: The Affect of Performance Feedback and Self Reflection on Study Strategies

Protocol Number: 2005E0370

Principal Investigator: Heather A. Davis

Co-Investigator: Elizabeth A. Colarusso

Purpose of the Study: (1) The purpose of this research project is to improve the quality of the course (EDP&L 718). (2) The purpose of this research project is to examine the role of performance feedback (i.e., quiz grades) on the, maintenance and modification of student study techniques.

I consent for my participation in a research project being conducted by Elizabeth A. Colarusso, a graduate student of The Ohio State University. I understand the overall goal of the research is to better understand the affect of performance feedback on the types of study strategies students choose to utilize. I understand this project uses information from the four quiz reflections that are course requirements for a College of Education Course (EDP&L 718: Pedagogical Studies).

I understand the possible benefits, if any, of my participation. I also understand the information I give is private unless disclosure is required by law. I know that I can choose not to participate without penalty to me. If I agree to participate, I can withdraw from the study at any time and there will be no penalty.

I give my permission for Elizabeth A. Colarusso to:

- Review and analyze my self-reflections for the 4 quizzes I took as part of EDP&L 718.
- Review and analyze all of my performance information.
- Use my background information from the demographic questionnaire.
- Disseminate the findings from this research in aggregate form to a scholarly journal for publication or to a conference for presentation.
- Use the findings from this research as part of her graduate thesis.

I understand that:

- Participation will have no effect on my course grade.
- Although Dr. Heather A. Davis will be involved in the data analysis, she will not know who has agreed to participate until after final course grades have been submitted.
- Data will not be examined until after the course has been completed (7/26/05).
- Elizabeth A. Colarusso will collect all of the consent forms.

I have had a chance to ask questions and to obtain answers to my questions. I can contact the principal investigator, Dr. Heather A. Davis, at (614)-282-0449.

I understand the purpose of this project and the types of questions I will be asked. I understand it is my choice to participate in this project. I have read this form or I have had it read to me and I sign it freely and voluntarily. A copy has been given to me.

Print the name of the participant: _____________________________ Date: ________________

Signed: __________________________________________
(Student Consent for Participation)

Signed: __________________________________________
(Principal Investigator)

Signed: __________________________________________
(Co-Investigator)
APPENDIX E

IRB APPROVAL LETTER
TITLE PAGE - APPLICATION FOR EXEMPTION
FROM REVIEW BY THE INSTITUTIONAL REVIEW BOARD
The Ohio State University, Columbus, OH 43210

Principal Investigator

Name: Heather A. Davis
Phone: 614-292-0448

University Title:
- Professor
- Associate Professor
- Assistant Professor
- Instructor
- Other. Please specify (May require prior approval)

Department or College:
School of Educational Policy and Leadership.
College of Education

Campus Address (room, building, street address):
165 A Runnymede Hall
29 W. Woodruff Ave

Signature: [Signature]
Date: 7/15/05

Co-Investigator

Name: Elizabeth A. Colarusso
Phone: 614-688-4011

University Status:
- Faculty
- Staff
- Graduate Student
- Undergraduate Student
- Other. Please specify

Campus Address (room, building, street address) or Mailing Address:
250C Younkin Success Center
1060 Neil Ave

Signature: [Signature]
Date: 7/15/05

Co-Investigator

Name: 
Phone: 

University Status:
- Faculty
- Staff
- Graduate Student
- Undergraduate Student
- Other. Please specify

Campus Address (room, building, street address) or Mailing Address:

Signature: [Signature]
Date: 
Fax: 

Protocol Title: The Effect of Performance Feedback and Self Reflection on Study Strategies

Source of Funding: Personal Funds

For Office Use Only

Approved. Research has been determined to be exempt under these categories: 
- 1...
Research may begin as of the date of determination listed below.

Disapproved. The proposed research does not fall within the categories of exemption. Submit an application to the appropriate Institutional Review Board for review.

Date of determination: 7/15/05
Signature: [Signature] Office of Research & Sponsored Programs

317.1.0
Page 2
Approved by the Policy Coordinator 3/21/2000, revised 1/29/2009

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APPENDIX F

FIGURES AND TABLES
Figure 1

Conceptualization of the relationship between study strategies, self-reflection and performance feedback
Figure 2

Developmental trend concerning the added benefit of specificity and accuracy
<table>
<thead>
<tr>
<th>Performance Measure</th>
<th>n</th>
<th>M</th>
<th>SD</th>
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</thead>
<tbody>
<tr>
<td>Quiz Two</td>
<td>31</td>
<td>4.258</td>
<td>1.031</td>
</tr>
<tr>
<td>Quiz Three</td>
<td>31</td>
<td>5.193</td>
<td>1.965</td>
</tr>
<tr>
<td>Quiz Four</td>
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<td>6.838</td>
<td>1.619</td>
</tr>
<tr>
<td>Final Points</td>
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<td>128.23</td>
<td>9.767</td>
</tr>
<tr>
<td>Final Percentage</td>
<td>31</td>
<td>0.801</td>
<td>0.0610</td>
</tr>
<tr>
<td>Final Letter Grade</td>
<td>31</td>
<td>6.71*</td>
<td>1.901</td>
</tr>
</tbody>
</table>

* Equivalent to a B-.

Note. Each quiz was calculated out of 10 points and the final percentage out of 160 (10 points for each of four quizzes and 120 points for the final project).

Table 1

Mean scores on the various performance measures
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<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
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<tr>
<td>1 Specificity</td>
<td>650**</td>
<td>.344</td>
<td>.508**</td>
<td>.048</td>
<td>.498**</td>
<td>.287</td>
<td>.102</td>
<td>.102</td>
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<tr>
<td>2 Accuracy</td>
<td>.308**</td>
<td>.077</td>
<td>.097</td>
<td>.086</td>
<td>.073</td>
<td>.287</td>
<td>.102</td>
<td>.102</td>
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<tr>
<td>3 Value</td>
<td>.089</td>
<td>.292</td>
<td>.511</td>
<td>.106</td>
<td>.287</td>
<td>.102</td>
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<td>4 Change Study Strategies</td>
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<td>.097</td>
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</tr>
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<td>.097</td>
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<td>.073</td>
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<td>.102</td>
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<tr>
<td>8 Final Letter Grade</td>
<td>.005</td>
<td>.077</td>
<td>.097</td>
<td>.086</td>
<td>.073</td>
<td>.287</td>
<td>.102</td>
<td>.102</td>
</tr>
</tbody>
</table>

* p < 0.05  ** p < 0.01  * * * p < 0.001  Whole set n = 31 except for Value and Change Study Strategies for which n = 29.

Table 2: Pearson correlations between the four independent and four dependent variables.
| Source        | Dependent Variable     | Type 111 Sum of Squares | df | MS    | F      | Sig  | \( \eta^2 \) | \( \Phi \) Power |
|---------------|------------------------|-------------------------|----|-------|--------|------|-------------|----------------|----------------|
|               |                        |                         |    |       |        |      |             |                |                |
| Between subjects |                        |                         |    |       |        |      |             |                |                |
| S and A       | Score on Quiz 2        | 1.257                   | 2  | 0.628 | 0.573  | .570 | .039\(^c\) | .136           |
|               | Score on Quiz 3        | 28.882                  | 2  | 14.441| 4.650  | .018 | .249\(^d\) | .737           |
|               | Score on Quiz 4        | 9.024                   | 2  | 4.512 | 1.813  | .182 | .115\(^e\) | .346           |
|               | Final Letter Grade     | 3.296                   | 2  | 1.648 | 0.439  | .649 | .030\(^f\) | .114           |
| Error         | Score on Quiz 2        | 30.679                  | 28 |       | 1.096  |      |             |                |                |
|               | Score on Quiz 3        | 86.956                  | 28 |       | 3.106  |      |             |                |                |
|               | Score on Quiz 4        | 69.670                  | 28 |       | 2.488  |      |             |                |                |
|               | Final Letter Grade     | 105.091                 | 28 |       | 3.753  |      |             |                |                |

\( \eta^2 = \text{partial eta squared} \)

\( \Phi = \text{observed power} \)

\(^c\) Power was computed using \( \alpha = 0.05 \)

\(^d\) R Squared = .039 (Adjusted R Squared = .029)

\(^e\) R Squared = .249 (Adjusted R Squared = .196)

\(^f\) R Squared = .115 (Adjusted R Squared = .051)

\(^e\) R Squared = .030 (Adjusted R Squared = .039)

---

Table 3

Analysis of variance for specificity (S) and accuracy (A)
<table>
<thead>
<tr>
<th>Source</th>
<th>Dependent Variable</th>
<th>Type I11 Sum of Squares</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>Sig</th>
<th>*η²</th>
<th>bPower</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Between subjects</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Value (V)</td>
<td>Score on Quiz 2</td>
<td>0.150</td>
<td>1</td>
<td>0.150</td>
<td>0.144</td>
<td>.707</td>
<td>.006</td>
<td>.065</td>
</tr>
<tr>
<td></td>
<td>Score on Quiz 3</td>
<td>3.461</td>
<td>1</td>
<td>3.461</td>
<td>0.868</td>
<td>.360</td>
<td>.034</td>
<td>.146</td>
</tr>
<tr>
<td></td>
<td>Score on Quiz 4</td>
<td>1.590</td>
<td>1</td>
<td>1.590</td>
<td>0.564</td>
<td>.400</td>
<td>.022</td>
<td>.112</td>
</tr>
<tr>
<td></td>
<td>Final Letter Grade</td>
<td>0.687</td>
<td>1</td>
<td>0.687</td>
<td>0.184</td>
<td>.672</td>
<td>.007</td>
<td>.070</td>
</tr>
<tr>
<td>Change Study Strategies (CSS)</td>
<td>Score on Quiz 2</td>
<td>1.046</td>
<td>1</td>
<td>1.046</td>
<td>1.003</td>
<td>.326</td>
<td>.039</td>
<td>.161</td>
</tr>
<tr>
<td></td>
<td>Score on Quiz 3</td>
<td>0.065</td>
<td>1</td>
<td>0.065</td>
<td>0.016</td>
<td>0.899</td>
<td>.001</td>
<td>.052</td>
</tr>
<tr>
<td></td>
<td>Score on Quiz 4</td>
<td>5.134</td>
<td>1</td>
<td>5.134</td>
<td>1.822</td>
<td>.189</td>
<td>.068</td>
<td>.255</td>
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<tr>
<td></td>
<td>Final Letter Grade</td>
<td>0.299</td>
<td>1</td>
<td>0.299</td>
<td>0.080</td>
<td>0.779</td>
<td>.003</td>
<td>.059</td>
</tr>
<tr>
<td>V X CSS</td>
<td>Score on Quiz 2</td>
<td>0.031</td>
<td>1</td>
<td>0.031</td>
<td>0.030</td>
<td>0.864</td>
<td>.001</td>
<td>.053</td>
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<td>Score on Quiz 3</td>
<td>1.916</td>
<td>1</td>
<td>1.916</td>
<td>0.481</td>
<td>0.495</td>
<td>.019</td>
<td>.102</td>
</tr>
<tr>
<td></td>
<td>Score on Quiz 4</td>
<td>5.709</td>
<td>1</td>
<td>5.709</td>
<td>2.026</td>
<td>.167</td>
<td>.075</td>
<td>.278</td>
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<tr>
<td></td>
<td>Final Letter Grade</td>
<td>5.015</td>
<td>1</td>
<td>5.015</td>
<td>1.344</td>
<td>.257</td>
<td>.051</td>
<td>.200</td>
</tr>
<tr>
<td>Error</td>
<td>Score on Quiz 2</td>
<td>26.083</td>
<td>25</td>
<td>1.043</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Score on Quiz 3</td>
<td>99.693</td>
<td>25</td>
<td>3.988</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Score on Quiz 4</td>
<td>70.443</td>
<td>25</td>
<td>2.818</td>
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<tr>
<td></td>
<td>Final Letter Grade</td>
<td>93.271</td>
<td>25</td>
<td>3.731</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* η² = partial eta squared
* bPower = observed power
b Power was computed using α = 0.05

Table 4

Analysis of variance for value and change of study strategies
<table>
<thead>
<tr>
<th>Code</th>
<th>n</th>
<th>Explanatory Quote</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagnostic (D)</td>
<td>20</td>
<td>&quot;The performance feedback from quizzes helped me to focus in on what I need to review.&quot;</td>
</tr>
<tr>
<td>Study Strategies (SS)</td>
<td>16</td>
<td>&quot;The quiz grades help me to realize which study skills work for me and which don't.&quot;</td>
</tr>
<tr>
<td>Confidence/Struggle (CS)</td>
<td>9</td>
<td>&quot;This grade means I struggled with this material. I was not as prepared as I thought I was and although I felt positive when I left class, I had not done as I expected.&quot;</td>
</tr>
<tr>
<td>Understanding (U)</td>
<td>8</td>
<td>&quot;These quiz grades allowed me to have a better understanding of what I know quite well.&quot;</td>
</tr>
<tr>
<td>Healthy and Unhealthy (HUH)</td>
<td>8</td>
<td>&quot;If I don't do well then I stop trying.&quot;</td>
</tr>
<tr>
<td>Rating (R)</td>
<td>8</td>
<td>&quot;This grade shows that I did slightly below average.&quot;</td>
</tr>
<tr>
<td>Emotion (E)</td>
<td>7</td>
<td>&quot;I felt extremely discouraged when I saw my grade for this quiz.&quot;</td>
</tr>
<tr>
<td>Motivation/Forward Thinking (MFT)</td>
<td>4</td>
<td>&quot;Challenge me to study... like a game.&quot;</td>
</tr>
<tr>
<td>Useless (UL)</td>
<td>3</td>
<td>&quot;This grade doesn't mean too much for me.&quot;</td>
</tr>
</tbody>
</table>

Note. Male participant did not complete self-relections pertaining to performance feedback.

Table 5

Examples of each of the nine codes pertaining to performance feedback
<table>
<thead>
<tr>
<th>Variable</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Specificity</td>
<td>.042</td>
<td>.049</td>
<td>.369*</td>
<td>-.193</td>
<td>-.265</td>
<td>-.205</td>
<td>-.147</td>
<td>-.273</td>
<td>-.404*</td>
</tr>
<tr>
<td>2 Accuracy</td>
<td>.025</td>
<td>.125</td>
<td>.224</td>
<td>-.209</td>
<td>-.256</td>
<td>-.125</td>
<td>-.110</td>
<td>-.043</td>
<td>-.106</td>
</tr>
<tr>
<td>3 Value</td>
<td>-.030</td>
<td>.348</td>
<td>.464*</td>
<td>-.204</td>
<td>-.734**</td>
<td>-.012</td>
<td>-.130</td>
<td>-.008</td>
<td>-.338</td>
</tr>
<tr>
<td>4 Change Study Strategies</td>
<td>.042</td>
<td>.205</td>
<td>.228</td>
<td>-.110</td>
<td>-.421*</td>
<td>-.108</td>
<td>-.181</td>
<td>-.273</td>
<td>-.055</td>
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<tr>
<td>5 Diagnostic</td>
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<td>-.155</td>
<td>.289</td>
<td>-.086</td>
<td>-.420*</td>
<td>-.030</td>
<td>-.052</td>
<td>-.262</td>
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<td>6 Understanding</td>
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<td>-.253</td>
<td>-.381*</td>
<td>-.036</td>
<td>-.193</td>
<td>-.247</td>
<td>-.210</td>
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</tr>
<tr>
<td>7 Study Strategies</td>
<td>--</td>
<td>.155</td>
<td>-.374*</td>
<td>-.064</td>
<td>-.140</td>
<td>-.243</td>
<td>-.377*</td>
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<td></td>
</tr>
<tr>
<td>8 Confidence/Struggle</td>
<td>--</td>
<td>.247</td>
<td>-.247</td>
<td>.318</td>
<td>-.164</td>
<td>-.228</td>
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<tr>
<td>9 Healthy and Unhealthy</td>
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<td>.137</td>
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<td></td>
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<tr>
<td>10 Rating</td>
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<td>-.023</td>
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<td>11 Emotion</td>
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<tr>
<td>13 Useless</td>
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<td></td>
</tr>
</tbody>
</table>

* $p = < 0.05$, ** $p = < 0.01$.

Table 6

Pearson correlations between the nine performance feedback codes and the four independent variables of specificity, accuracy, value and change of study strategies.