

The Influence of Teacher Practice on Calculus Students' Motivation

by

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TABLE OF CONTENTS

ACKNOWLEDGMENTS	ii
ABSTRACT	v
LIST OF TABLES	vi
LIST OF FIGURES	vii
I. INTRODUCTION	1
II. LITERATURE REVIEW	3
2.1 SELF-REGULATED LEARNING.....	3
2.2 MOTIVATION	3
2.3 PERSONAL MOTIVATION THEORIES.....	4
2.4 INSTRUCTOR IMMEDIACY BEHAVIORS.....	7
2.5 TEACHING STYLES.....	8
2.6 THE MATHEMATICS CLASSROOM	9
2.7 RESEARCH QUESTIONS	10
III. METHODS	11
3.1 PARTICIPANTS	11
3.2 INSTRUMENTS	11
3.2.1 <i>Student Motivation Survey</i>	11
3.2.2 <i>Verbal Immediacy Survey</i>	12
3.2.3 <i>Nonverbal Immediacy Survey</i>	12
3.2.4 <i>Teaching Style Survey</i>	13
3.3 PROCEDURE	15
IV. RESULTS	17
4.1 MOTIVATION	17
4.2 EFFORT ATTRIBUTIONS.....	21
4.3 INSTRUCTOR VERBAL IMMEDIACY.....	23
4.4 INSTRUCTOR NONVERBAL IMMEDIACY.....	25
4.5 INSTRUCTOR AFFECT.....	27
4.6 INSTRUCTOR’S USE OF GROUP ACTIVITIES	28
4.7 INSTRUCTOR’S USE OF APPLICATIONS	29

4.8 CORRELATION	31
4.8.1 Immediacy	31
4.8.2 Student Motivation	31
4.8.3 Student Effort Attributions	32
V. DISCUSSION	33
5.1 PURPOSE OF THE STUDY	33
5.2 STUDENT MOTIVATION	33
5.3 STUDENT'S EFFORT ATTRIBUTIONS	34
5.4 INSTRUCTOR CATEGORIES	34
5.5 INSTRUCTOR CATEGORIES COMPARISON	34
5.6 CORRELATIONS	35
5.6.1 Student Motivation	35
VI. CONCLUSIONS.....	37
REFERENCES	39
APPENDICES	
A. IRB EXEMPTION	45
B. DIRECTIONS FOUND AT THE START OF THE SURVEY.....	46
C. STUDENT MOTIVATION SURVEY.....	47
D. VERBAL IMMEDIACY SURVEY	48
E. NONVERBAL IMMEDIACY SURVEY	49
F. TEACHING STYLE SURVEY	50

ABSTRACT

This quantitative study investigated two correlations among Calculus II students' perceptions of their instructors' teaching styles. The first was between student motivation and instructor immediacy behaviors and teaching styles. The second correlation was between student effort attributions and instructor immediacy behaviors and teaching styles. Instructor immediacy behaviors include nonverbal and verbal; teaching styles include instructor affect—how positive the teacher appears to be with the class and mathematics—assigned group work and application problems. Students in a large Southwestern research university were surveyed at the start and end of a semester. A significant positive correlation was found between student motivation and instructor behaviors and teaching styles. The three strongest correlations were between student motivation and teacher affect as well as verbal and nonverbal immediacy behaviors. In addition, there was not a significant correlation between student effort attributions and instructor behaviors and teaching styles. These results have implications for instructors teaching a Calculus II type class. Instructors may be advised to exhibit a more positive immediacy behavior as well as have a positive attitude towards the class and mathematics. Further studies may involve other subject levels of mathematics and within different types of institutions.

LIST OF TABLES

4.1: Pre-Motivation	18
4.2: Post-Motivation Difference	19
4.3: Motivation Difference	20
4.4: Motivation t-test	21
4.5: Effort Attribution Difference	22
4.6: Effort Attribution t-test	23
4.7: Instructor Verbal Immediacy	25
4.8: Instructor Nonverbal Immediacy	26
4.9: Instructor Affect	28
4.10: Instructor Group Activities	29
4.11: Instructor's Use of Application	31
4.12: Student Motivation Correlation (Verbal and Nonverbal Immediacy)	31
4.13: Student Motivation Correlation (Affect, Group Activities and Applications)	32
4.14: Student Effort Attributions Correlation (Verbal and Nonverbal Immediacy)	32
4.15: Student Effort Attributions Correlation (Affect, Group Activities and Applications)	32

LIST OF FIGURES

4.1: Pre-Motivation and Frequency..... 18
4.2: Post-Motivation and Frequency..... 19
4.3: Motivation Difference and Frequency..... 20
4.4: Effort Attribution Difference and Frequency..... 22
4.5: Instructor Verbal Immediacy and Frequency 24
4.6: Instructor Nonverbal Immediacy and Frequency 26
4.7: Instructor Affect and Frequency..... 27
4.8: Instructor Group Activities and Frequency 29
4.9: Instructor’s Use of Application and Frequency 30

CHAPTER 1

INTRODUCTION

The main goal of an educator is student learning. However, this learning cannot solely take place inside the classroom, under instructor supervision; students must take on responsibility. The majority of learning in college classes takes place outside of instructors' supervision and the classroom. For this reason, learning during college is student driven.

Student driven learning is related to self-efficacy – the belief in one's capability to accomplish a task. Self-efficacy has been found to impact student motivation, which in turn is directly correlated to student learning. Past research examined a variety of ways in which student motivation is impacted. Instructor immediacy (the view of physical and psychological closeness of instructors), instructor comments, student goals and habits are some topics that have been researched. Many studies have found that motivation is domain specific, depending on variables such as age, subject and course. It is therefore, important for research to be carried out on specific categories, but with a variety of variables. This study looks at how teacher immediacy and teaching style influence Calculus II student motivation.

A pre- and post- survey was administered during the spring semester in Calculus II classrooms within a major research university in the southwest. A total of 515 surveys were collected, and 232 of these surveys were used in this study. The surveys were divided into two main categories: one concerning students and the other concerning students' observations of their instructors. This study created two important student categories (motivation and effort attribution) as well as five important instructor categories (verbal immediacy, nonverbal immediacy, affect, group activities and applications). A bivariate correlation was performed between the two important student categories with the five large teacher categories.

This paper is outlined as follows: A brief literature review of past research is presented in Chapter 2. Chapter 3 describes the methods researchers followed, including a detailed description of participants and instruments as well as the procedure. Results are displayed in Chapter 4 with all student and instructor categories

including the bivariate correlation. Chapter 5 contains the discussion of the results found in the previous chapter. The conclusions and implications are offered in Chapter 6. The Appendices include the Institutional Review Board (IRB) exemption and the surveys distributed.

CHAPTER 2

LITERATURE REVIEW

2.1 Self-Regulated Learning

Self-regulated learners are ones who have power over their actions and thoughts in order to successfully control their learning (Shell & Husman, 2008; Pintrich, 2004; Wolters, 1998). In addition, they are active learners who are motivated to understand the subject material (Zimmerman, Bandura & Martinez-Pons, 1992). Different subjects require the use of different metacognitive strategies and self regulated learners are aware of and are able to control different strategies for acquiring knowledge for different subject areas more so than other students (Garcia & Pintrich 1994; Pintrich, 2004). While instructors may inform students of different strategies, student learning usually takes place when personally working through material and becoming aware of the metacognitive strategy one is using. The ability to effectively apply these strategies may take time to mature and may require a certain level of motivation to develop. For this reason, self-regulated learners have developed these methods more so than average students. If a student is able to mature into a self-regulated learner he or she will not only learn the specific subject material given in a class setting, but will obtain a wealth of knowledge and become a lifelong learner.

2.2 Motivation

Motivation is defined by Wolters (1998) as a “student’s willingness or desire to be engaged and commit effort to completing a task”. Motivation is a complex drive that is impacted by many reasons and revealed through many channels. An instructor’s habits and teaching style have an immense impact on the development of student motivation in a specific subject and class. In this study, instructor behavior will be broken up into two categories: verbal and nonverbal immediacy. Teaching styles involve class structure and presentation of information. Teacher behavior and styles both affect students’ motivation.

2.3 Personal Motivation Theories

Personal beliefs and habits stem from internal and external motivation. Internal motivation involves understanding a concept for the sake of learning while external motivation involves understanding a concept for a score. There are four different student motivation theories that are heavily studied: self-efficacy, attribution, self-worth and achievement goal theory. These theories are deeply intertwined because many students have more than one motivational factor and all theories affect one another.

Self-Efficacy is defined by Albert Bandura (p137) as the “perceived ability to manage or cope with specific tasks and situations” (Marks, 2002). Students who believe they are able to complete or excel in a required task will be more apt to engage themselves than students who believe their skills are inadequate. A high level of studying effort has been found to have a positive impact on self-efficacy (Shell & Husman, 2008). Instructors should therefore know what skills are required to complete the assigned task and be able to influence student self-efficacy with the design of lessons and activities. In addition, these assignments should properly reflect the students’ abilities. They are also able to impact self-efficacy long after the tasks are designed. For instance, it has been found that teacher feedback on students’ performance impacts student self-efficacy (Tolli & Schmidt, 2008).

The mastery of a task has the greatest impact on the students’ belief of achievement, hence creating greater self-efficacy (Glynn, Altman & Owens, 2005). As stated before, self-efficacy is not an isolated motivation theory, for instance achievement goals are impacted by self-efficacy. It has been found that the academic goals placed on students by instructors, friends and parents are not necessarily the students’ personal desires. Instead, academic goals are determined by the personal belief in their own academic efficacy (Zimmerman et al., 1992). All students have self-efficacy beliefs, whether these beliefs are in correlation to the students’ actual skills, or not, they impact the students’ motivation with the specific task at hand.

Motivation is not only impacted by students’ personal beliefs of ability but also by the causes of the outcome of a task. According to Seifert (2004) attribution theory is “a person’s explanation of why a particular event turned out as it did” (p138). Weiner

(1985) views these rationalizations as having three features: locus (internal or external development of the attribution), stability (constancy of the cause) and controllability (power to change the attributions). Attribution theory tends to separate students into two categories: those who tend to be successful and those who tend to be unsuccessful. Students who succeed tend to attribute their success to internal reasons but blame their failure on external reasons, such as lack of time spent on a task (Middleton & Spanias, 1999).

The majority of successful students have a belief that they have control over the outcome of their grades. This belief tends to stem from a constant internal belief which positively develops self-worth. On the other hand, students who fail tend to attribute success to external factors and failure to lack of ability (Middleton & Spanias, 1999). If failure seems to be the constant outcome, those who attribute failure to lack of ability develop a belief of learned helplessness. When failure is persistently the outcome those with learned helplessness believe that no matter how much time or effort spent on the task it is wasted (Seifert, 2004). Students with this belief do not always fail at tasks, however, even if success is the outcome, they tend to attribute this to external factors and the lowering of self worth continues. Those who tend to fail generally have a stable belief in uncontrollable factors, such as inability, which lead to failure, and have an unstable belief in the uncontrollable factors that lead to success such as luck (Seifert, 2004). The factors that students attribute to success and failure yield to emotion which in turn has a strong impact on self-worth beliefs. Additionally, students who attribute success to internal factors tend to major in subjects which require above average mathematical ability (Middleton & Spanias, 1999).

Self-worth theory explains why a student does or does not behave in a certain manner as to protect self-worth. Those motivated by self-worth believe a student with high grades is smarter than one with low grades. Therefore, students who are motivated by protecting or proving self-worth will focus on the external reward—grades—rather than the internal reward—knowledge. Those who attribute failure to an uncontrollable factor—an inability—have lower self-worth than those who attribute failure to a controllable factor—time spent on a task (Johnson, 1993). These students

believe that their inability is fixed and have three values: do not make mistakes, do not work hard, and do not try to fix mistakes (Dweck, 2007). If these students feel they are unable to complete the task efficiently they are more likely to not attempt the task. Students feel less threatened to say they failed because of lack of effort than lack of ability (Seifert, 2004). It is easier for these students to be viewed as lazy rather than “stupid”. Students motivated by protecting self-worth strive to appear intelligent, which means high grades are necessary.

Achievement goal theory states that student motivation stems from the desire to achieve a specific objective. These objectives or goals are usually categorized as mastery goals or performance (ego) goals. Mastery goals reflect students’ values of knowledge and performance goals indicate a value of grades and exhibiting intelligence to others (Middleton & Spanias, 1999). It has been found that self-regulated learners construct goals, evaluate their progress, and modify actions or goals until these are accomplished (Pintrich, 2004).

Two students may have different means to accomplish the similar end outcome. For example, two students may want to go to graduate school. The first student wants to understand the course material so he develops a strong background before continuing on, while the second student wants to receive an A in all courses so she is appealing to the graduate school. Both students had different goals to obtain their main objective of graduate school. While both students may be successful, it has been found that those who hold mastery goals—as in the first student—hold a higher positive self-efficacy belief in their ability to complete a task (Deemer & Hanich, 2005; Gregoire, Ashton & Algina, 2001). In addition, as stated above, this higher self-efficacy belief is held by more self-regulated learners. Furthermore, students with a lower grade point average hold more performance goals than those with a higher grade point average (Middleton & Midgley, 1997).

Goals are not necessarily made to accomplish a task or activity; they can also be made to avoid a task. This task avoidance mindset is held by students who hold performance goals; students who avoid work, rated success in learning as not important (Johnson, 1993). Work avoidance stems from a belief that success comes from good

behavior (Middleton & Spanias, 1999). Those who protect self-worth believe that laziness is better than failure and have a work avoidance mindset. In addition, those who attribute success to uncontrollable, stable factors, such as innate knowledge will be more apt to avoid work, because whatever effort they exert will never be enough to succeed.

2.4 Instructor Immediacy Behaviors

Instructors are able to use immediacy behaviors and teaching styles to motivate students for developing skills they need to become self-regulated learners. Students' habits and thoughts are impacted by instructors' behaviors, whether consciously or not (Andersen, Norton, Nussbaum, 1981). Instructor immediacy is defined by Richmond, Gorham and McCroskey (1987) as the perceived psychological or physical distance between instructor and student. These immediacy behaviors are not necessarily dependent upon what the instructor believes his or her behaviors are, but the students' impressions upon the instructor's verbal or nonverbal behaviors (den Brok, et. al., 2005). Verbal immediacy is a nonaggressive type of verbal communication used by instructors to help students feel closer to them (Rocca, 2001). Nonverbal immediacy refers to the nonverbal cues that instructors exhibit to change the perceived or actual distance between instructor and student (Plax, Kearney, McCroskey & Richmond, 1986). The more personable the instructor is viewed—making eye contact with students, using humor, being supportive, and praising student work—the more willing students will be to invest time and energy in the class (Andersen, Norton & Nussbaum, 1981; Seifert, 2004). This increasing investment of time and energy reflects the development of motivation.

Verbal immediacy has been found to have more of an influence than nonverbal immediacy with student motivation in community college mathematics classes (Furlich & Dwyer, 2007). Furthermore, instructors who use one form of immediacy tend to use the other form as well (Furlich & Dwyer, 2007). Some argue that this connection might be a reflection of the type of teaching styles that are used in mathematics classrooms

(Furlich & Dwyer, 2007). Students who have instructors who display increased immediacy behaviors will increase in their motivation (Richmond & McCroskey, 1992).

2.5 Teaching Styles

It is an instructor's duty to help students become self-directed learners. Much research has examined student motivation—which will help in the development of a self-directed learner. Though motivation impacts others to become self-directed learners, instructors are able to impact students within the classroom as well. Instructors impact students by the many decisions, large and small, that they make within the class time. These decisions may be conscious or unconscious and include instructor immediacy as well as teaching style.

Teaching styles vary from subject to subject and from individual to individual. Generally, it has been found that most instructors' teaching style reflects the way in which they learn or the way they were taught (Stitt-Gohdes, 2001; Brown & Borko, 1992). Traditionally, mathematical classrooms are instructor-centered classrooms and are usually lecture based. Students and teachers view the instructor as the giver of knowledge.

Much research has been performed on student centered classrooms. This is based on the idea that students who discover the material personally are more able to internalize and recall this knowledge later (Roth-McDuffie, McGinnis & Watanabe, 1996). Student centered classrooms present information with more of an investigative learning process. This teaching style is being favored because deep mathematical learning does not take place until students interact with the material themselves (King, 2001).

It has been found that in student centered classrooms above average students perform better, while in teacher-centered classrooms below average students benefit (Giles, Ryan, Belliveau, DeFretias & Casey, 2006). The authors hypothesized that this might have been the cause of above average students adapting to instructor-centered teaching for success. They also caution the overuse of one teaching style, because students learn best in a certain manner, and when this style is not used it is difficult for

the students to adjust. For example, while a student might succeed in a lecture based classroom, they fail in a student structured classroom.

2.6 The Mathematics Classroom

Whether teaching in more of a lecture based classroom or in a collaborative working style, mathematical concepts can be understood by a variety of methods. Traditionally, straight computational problems are assigned for teaching mathematical concepts. However, the use of application problems is found to aid in developing mathematical concepts, and in developing more positive attitudes about mathematics (Lauver, 1994; Portal & Sampson, 2001). Application problems give rise to a variety of approaches; these approaches tend to intertwine the straight forward computation with deeper understanding (Wu, 1999). These application problems require a qualitative approach, which deals with the use of words. Describing the concepts and methods needed to solve the problem at hand, not merely the use of strict computation, is vital to deeper understanding, (Oakes & Star, 2008).

In addition, to help students understand mathematics at a deeper level, instructors need to ask deep-level questions. Instructors also cannot be solely satisfied when a student answers a question correctly. The instructors must inquire “why” to investigate the deeper concepts (Oakes & Star, 2008). Asking “why” aids students to look into the one-dimensional answer and investigate the reasoning behind the solution. Deeper understanding might also require the use of objects or pictures. It has been found that with the use of manipulatives, students responded differently, including increased motivation and enthusiasm (DeGeorge & Santoro, 2004). Also, the use of graphs and pictures can increase students’ problem solving ability (Jitendra, 2002). The use of numbers, language, and objects or pictures in classrooms allows teachers to reach a variety of learning styles. Learning styles are traditionally broken up into four common categories: visual, auditory, reading/writing and tactile.

Mathematics classrooms are more conducive to certain learning styles and motivation than others. For example, it has been found that those successful in mathematics are able to take the material presented and internally visualize the situation

(Carlson, 1999). Hence, those who teach mathematics at the college level are more able to visualize the mathematics concept so that they do not see the need to aid students in visualizing. In addition, a classroom which emphasizes inquiry-based learning helps develop students who are less focused on performance goals (Middleton & Spanias, 1999). Inquiry based learning also helps students realize that there is more than one way to solve a problem and that the instructor's method is not the only correct method. This is because students are given more time to ask questions and pose other solutions (Middleton & Spanias, 1999).

2.7 Research Questions

This study addresses five research questions:

RQ1: Is there a correlation between the perceived verbal immediacy of instructors and student motivation?

RQ2: Is there a correlation between the perceived nonverbal immediacy of instructors and student motivation?

RQ3: Is there a correlation between perceived instructor affect and student motivation? Instructor affect involves the instructor's positivity towards mathematics and the students within the classroom.

RQ4: Is there a correlation between group activities and conversations within the classroom and student motivation?

RQ5: Is there a correlation between the perceived application of mathematics and student motivation? This application of mathematics can be within the classroom or in the mathematics outside of the Calculus II classroom, and outside of academia.

CHAPTER 3 METHODS

3.1 Participants

Participants in this study were undergraduate students enrolled during the spring semester within a Calculus II class at a large southwestern research university. The surveys were administered during the first two and the last three weeks of the semester. Participation was voluntary, and a total of 515 surveys were collected. However, data for this study was taken from only 232 students who completed both surveys and included their social security number. This was done for comparison purposes. Age varied from 17 to 38, with a mean age of 19.0. Freshmen were numbered at 102, sophomores at 45, juniors at 18, seniors at 7, while 60 did not include their classification. One hundred seventy-seven students recently had taken Calculus I, 14 previously had taken Calculus II, two students had previously taken Calculus III, while 39 did not state either their previous class, or had a previous class outside of the Calculus sequence.

3.2 Instruments

This study used four surveys: student motivation, nonverbal immediacy, verbal immediacy, and teaching style. Appendices 3 through 6 show each of these instruments respectively. The student motivation survey was administered at the start of the semester, while all four surveys were administered at the end of the semester. The latter was administered as one large survey, divided into two sections. The first involved student observations of instructor while the second involved student motivation.

3.2.1 Student Motivation Survey

This survey was developed by the author. Students indicated a number for each item concerning how frequently they believed or participated in the indicated action (Never = 0, Rarely = 1, Occasionally = 2, Often = 3, Very Often = 4). Each question concerned students' personal motivation within their mathematics classes.

The main motivation category included questions 14, 15, 17, 19 and 20. The reliability was confirmed by obtaining an alpha score of 0.763 (alpha greater than 0.7) through factor analysis. In addition, questions 5, 7, 16 and 18 were used in the “Effort Attribution” category. The reliability yielded an alpha score of 0.523, which may not indicate a significant correlation.

An alpha value of 0.523 corresponds with the “Effort Attribution” category, which implies there is not a significant correlation within the survey questions. The analysis was still carried out within the “Effort Attribution” category and is reported and discussed below; however, one must take care in interpreting the data.

3.2.2 Verbal Immediacy Survey

Gorham (1988) developed the verbal immediacy survey used in this study. This portion contains 17 questions (numbered 1 - 17 in the larger survey administered) all of which evaluate positive verbal immediacy exhibited by the instructor. Students were asked to evaluate the verbal immediacy they perceive on a scale of zero to four (Never = 0, Rarely = 1, Occasionally = 2, Often = 3, Very Often = 4). Christophel (1990) used this verbal immediacy survey and found a Chronbach alpha reliability coefficient of 0.80, and Gorham and Zkahi (1990) produced a Chronbach alpha reliability coefficient of 0.92. This study produced an alpha reliability coefficient of 0.889. In addition, Rubin, Palmgreen and Sypher (1994) have shown that this survey has construct validity.

3.2.3 Nonverbal Immediacy Survey

The nonverbal immediacy survey was developed by Richmond, Gorham and McCroskey (1987). This portion consists of 14 items (numbered 18-31 in the larger survey administered). These items evaluate students’ perceptions of their instructor’s nonverbal immediacy behaviors, on a scale of zero to four (Never = 0, Rarely = 1, Occasionally = 2, Often = 3, Very Often = 4). Five of the 14 items (numbered 1, 3, 6, 9, 10 and 11) were phrased to evaluate the non-immediate behaviors of the instructors. This survey has been used previously and deemed to be reliable. Rocca (2004) produced a Chronbach alpha reliability coefficient of 0.86 and Christensen and Menzel (1998)

produced a Chronbach alpha reliability coefficient of 0.73. This study produced a reliability coefficient of 0.826. In addition, this survey has also shown sufficient validity (Rubin, Palmgreen & Sypher, 1994).

3.2.4 Teaching Style Survey

The teaching style survey was developed by the author and consists of 29 questions involving student perception of teaching style. The survey roughly parallels the Canfield Instructional Styles Inventory (CISI) categories. Given that the survey was designed by the author, and does not follow the CISI completely, a few questions fall under multiple CISI categories. In addition, fifteen other questions were designed which are not measured in the CISI. The CISI breaks instructional styles into four main categories: "Conditions for Instruction", "Areas of Interest", "Modes of Instruction" and "Influence". Note that the "Influence" category was not of concern in this study. The survey questions fall into these CISI categories as described below; however, these categories were not used directly for the correlations.

"Conditions for Instruction" refers to the preferred circumstances of instruction and is broken into eight categories, two of which we surveyed: "Peer" and "Instructor". Questions 42 and 44 ask students how much they perceive the instructor placing value on positive interactions between students, while questions 36, 37, 40, 41, 59 and 57 ask students how much they perceive the instructor valuing positive interactions between students and instructors.

"Areas of Interest" deals with the preferred type of subject matter or object of study. This is broken up into four categories all of which we evaluate: "Numeric", "Qualitative", "Inanimate" and "People". While mathematics classrooms are the focus of this study and strict numeric computations comes to mind, students perceive their instructors placing value or preference on a certain aspect of mathematics which is of concern. Question 34 falls under the "Numeric" category which places preference on numbers, logic and solving mathematics problems. Questions 35, 38, 43 and 50 concern the "Qualitative" aspect of mathematics which places preference on words and language. Question 60 falls under the "Inanimate" category which places value on

working with objects. Finally, questions 41, 44 and 59 fall under the “People” category which values relating or understanding other people.

“Modes of Instruction” deals with the preferred method of presenting new information this has two main categories that we focus on. “Lecturing” is the category which involves the traditional method of presenting information. It was assumed that the predominant instruction method in all Calculus II classes was lecture, and was measured with questions 42 and 44. The “Iconic” category which deals with visual materials used to aid in the development of a concept or provide information was surveyed with questions 51 and 60.

Other categories that were not measured with the CISI but are of concern in this study are the categories that we will denote as “Application” and “Outcome”. The “Application” category deals with an emphasis on applications, rather than traditional strict computations, and is surveyed in questions 33, 35 and 47. The “Outcome” category deals with the main goal of the instructor: knowledge of the subject (questions 43, 48, 53, and 56) or grades (questions 49 and 54).

Lastly, questions 39, 45, 46, 55, and 58 do not fall under a specific category but are included for interest.

Considering the above categories, the three main categories were developed through consultation and feedback from experts in field: “Affect”, “Group Activities” and “Applications”. These categories were verified through face validity, which was determined through experts. The reliability was also verified within each of the categories, since all categories received an alpha reliability coefficient greater than 0.7 through factor analysis.

The “Affect” category determines how the students viewed their instructor’s positivity toward mathematics and the students within the class. Questions 37, 45, 46, 48, 53 and 54 are all included, and an alpha reliability coefficient of 0.906 was found using factor analysis.

The “Group Activities” category determines how the students viewed their instructor’s use of group activities within the classroom. Questions 41, 42, 44 and 59

were included. Factor analysis was performed and an alpha reliability coefficient of 0.727 was received.

The “Applications” category determines how the students viewed their instructor’s use or emphasis of applications outside of the Calculus II classroom and outside of academia. Questions 33, 35, 39 and 47 were used within this category, and an alpha reliability coefficient of 0.788 was found using factor analysis.

3.3 Procedure

All Calculus II instructors were asked to participate in this study, and all nine instructors accepted. During the first week of spring semester the first survey was administered to all Calculus II classes in the first 10 minutes of the class period. This survey was given at the start of the semester so the instructor would have minimal impact on the students’ pre-survey responses. Students were informed before they received the survey that it was for educational purposes only, participation was voluntary and would not affect their course grade. Students were asked to place the last five digits of their social security number on the top of their survey for the purpose of comparing individual responses regarding initial motivational factors with those same factors in an end-of-semester survey. If students did not wish to participate in the study they were asked to leave the survey blank.

The second survey was administered by the researchers to all Calculus II classes during the last three weeks of the semester. This survey took approximately 15 minutes at the beginning of the class period. Students were informed this was a follow up survey to the one completed at the start of the semester. Students were informed that the last five digits of their social security were important to compare the first survey to the final survey. They were also notified that no one but the researchers would see their responses in either survey and that their social security numbers would be destroyed after the data were collected. Students who did not complete the survey at the start of the year were asked if they would still participate. If students wished not to participate they were told to leave the survey blank. Once both surveys were collected all social

security numbers were deleted and students were identified by a randomly assigned number; therefore, destroying all student and instructor identification.

Statistical Package for the Social Sciences (SPSS) was used for the analysis of data. All bar charts and tables were developed by SPSS. A bivariate correlation was used to determine a significant correlation between student categories and instructor categories.

CHAPTER 4

RESULTS

All questions had responses ranging from 0 to 4, where 0 indicated no agreement and 4 indicated a high level of agreement. Some questions were phrased positively while others were phrased negatively and were recoded to reflect the reverse scale. Below are the survey question responses grouped by category. A paired t-test was performed on the pre-survey and post-survey of two student categories: "Motivation" and "Effort Attribution". The results are shown below. In addition, a bivariate correlation was carried out between the student categories and the three instructor categories.

4.1 Motivation

Survey questions 14, 15, 17, 19 and 20 were used as measures within the "Motivation" category. Factor analysis was performed on these five questions with an alpha score of 0.763. This category was used for the pre- and post-survey. Each student's response to the category questions was summed together, the higher the score, (maximum of 20) the more motivated the student indicates he or she is with mathematics.

A total of 221 completed responses were included in the pre-Motivation category. The mean is 13.8, the median is 14 and the modes are 13 and 15. The range is 15, with a minimum value of 5 and a maximum value of 20.

Figure 4.1 shows the frequency of the pre-Motivation categories.

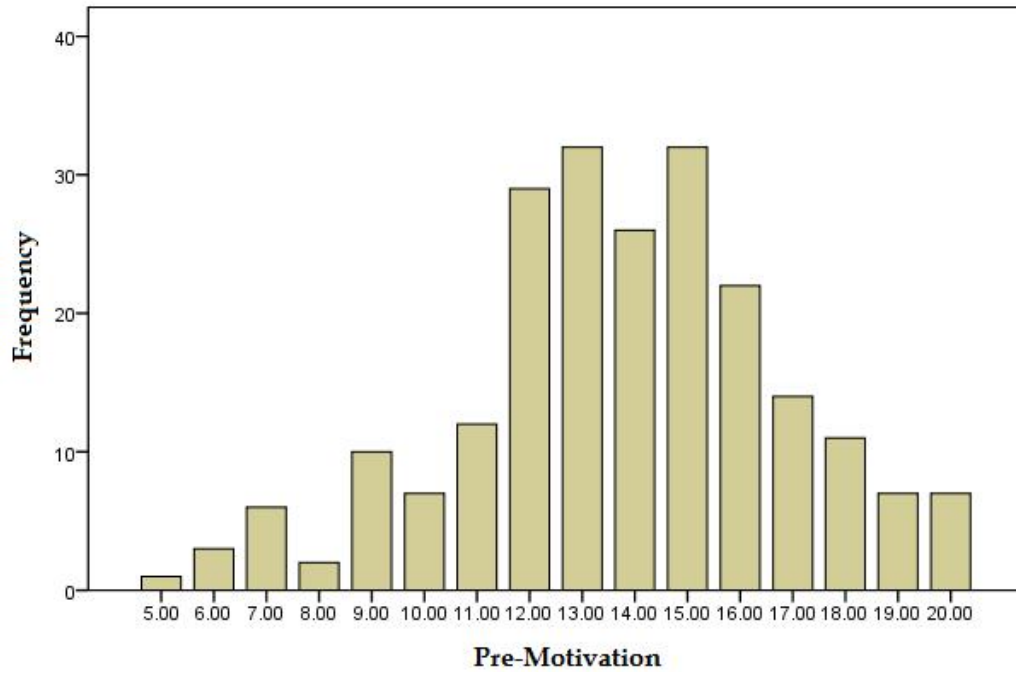


Figure 4.1: Pre-Motivation and Frequency

The table below indicates each category's value, frequency and the corresponding percent within the 221 respondents.

Table 4.1: Pre-Motivation

<i>Value</i>	<i>Frequency</i>	<i>Percent</i>	<i>Value</i>	<i>Frequency</i>	<i>Percent</i>	<i>Value</i>	<i>Frequency</i>	<i>Percent</i>
5	1	0.5	11	12	5.4	17	14	6.3
6	3	1.4	12	29	13.1	18	11	5.0
7	6	2.7	13	32	14.5	19	7	3.2
8	2	0.9	14	26	11.8	20	7	3.2
9	10	4.5	15	32	14.5			
10	7	3.2	16	22	10.0			

A total of 198 completed responses were included in the post-Motivation category. The mean is 12.9, the median is 13 and the mode is 12. The range is 17, with a minimum value of 3 and a maximum value of 20.

Figure 4.2 shows the frequency of the post-Motivation categories.

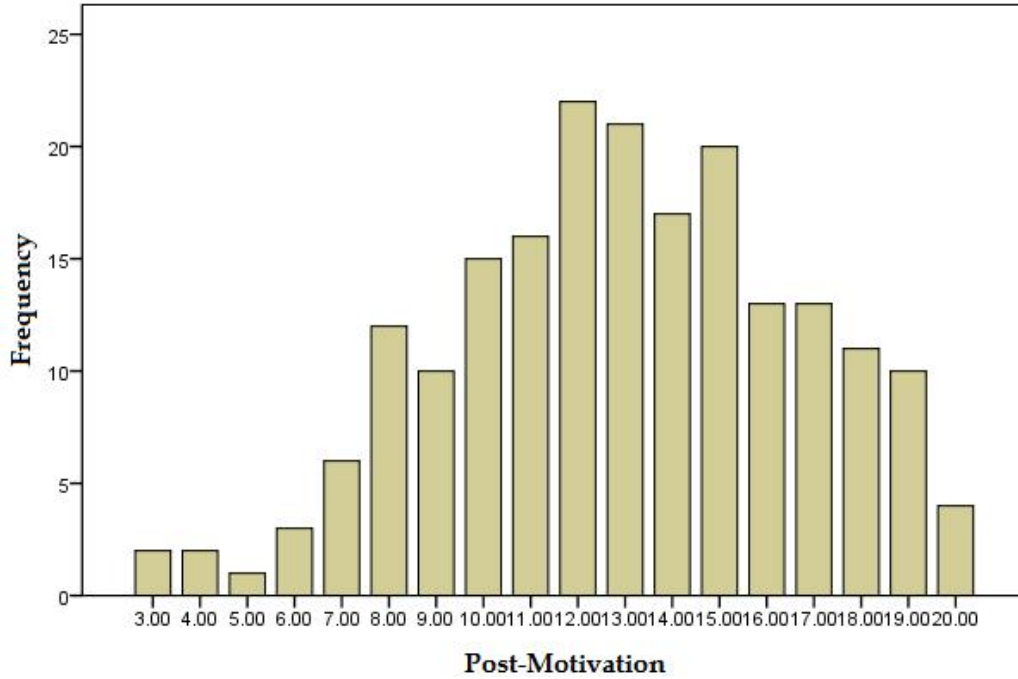


Figure 4.2: Post-Motivation and Frequency

The table below indicates each category’s value, frequency and the corresponding percent within the 198 respondents.

Table 4.2: Post-Motivation Difference

<i>Value</i>	<i>Frequency</i>	<i>Percent</i>	<i>Value</i>	<i>Frequency</i>	<i>Percent</i>	<i>Value</i>	<i>Frequency</i>	<i>Percent</i>
3	2	0.9	9	10	4.3	15	20	8.6
4	2	0.9	10	15	6.5	16	13	5.6
5	1	0.4	11	16	6.9	17	13	5.6
6	3	1.3	12	22	9.5	18	11	4.7
7	6	2.6	13	21	9.1	19	10	4.3
8	12	5.2	14	17	7.3	20	4	1.7

The “Motivation Difference” category is computed as the difference between the overall excitement value in the pre-survey and the corresponding value in the post-survey. A negative value indicates a decrease in excitement throughout the semester and a positive value indicates an increase in excitement.

A total of 192 completed responses were included in the “Motivation” category, 99 students (51.4%) decreased in motivation, and 32 students (16.7%) indicated no change in motivation, while 61 students (31.9%) indicated an increase in motivation. The mean is -0.76, the median is -1.00 and the mode is 0.00. The range is 18.00 with the minimum value of -12.00 and maximum value of 6.00.

Figure 4.3 shows the frequency of each motivation difference value.

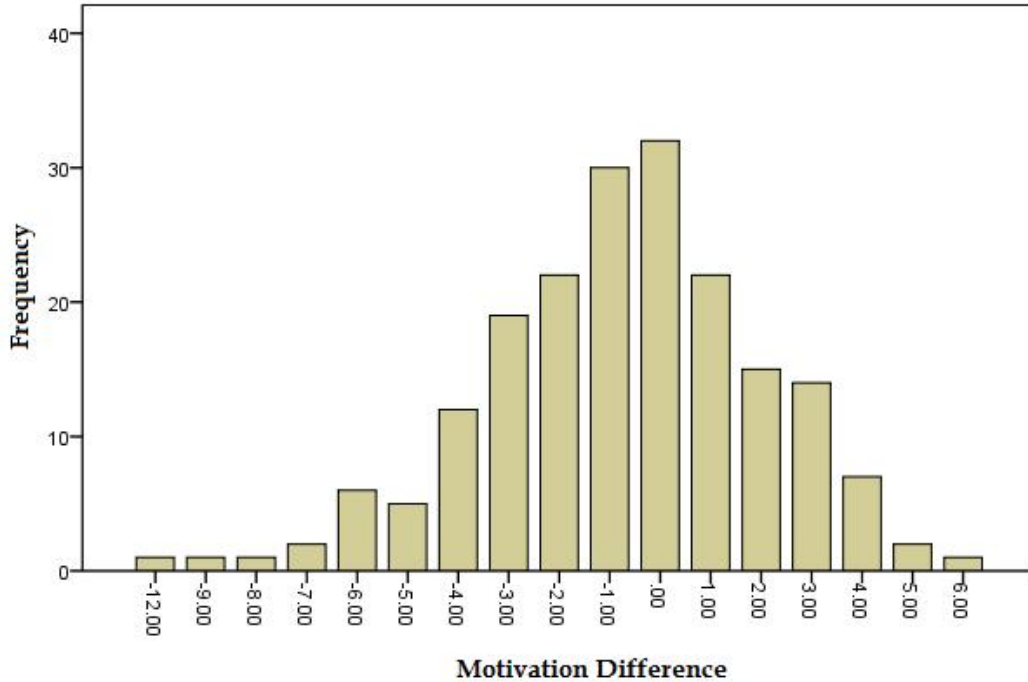


Figure 4.3: Motivation Difference and Frequency

Table 4.3 indicates each category’s value, frequency and the corresponding percent within the 192 respondents.

Table 4.3: Motivation Difference

<i>Value</i>	<i>Frequency</i>	<i>Percent</i>	<i>Value</i>	<i>Frequency</i>	<i>Percent</i>	<i>Value</i>	<i>Frequency</i>	<i>Percent</i>
-12	1	0.5	-4	12	6.2	2	15	7.8
-9	1	0.5	-3	19	9.9	3	14	7.3
-8	1	0.5	-2	22	11.5	4	7	3.6
-7	2	1.0	-1	30	15.6	5	2	1.0
-6	6	3.1	0	32	16.7	6	1	0.5
-5	5	2.6	1	22	11.5			

A paired t-test was performed on the pre- and post-test data. The t value is 3.727, which indicates a significant difference within the student motivation.

Table 4.4: Motivation t-test

Paired Differences							
Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
			Lower	Upper			
0.75521	2.80752	0.20262	0.35556	1.15486	3.727	191	0.000

Students fell into three categories in the pre-Motivation category: below average (sum of 5-10), average (sum of 11-15) and above average (sum of 16-20). The mean student motivation difference in the below average category is 0.35. The mean student motivation difference in the average category is -1.26. The mean student motivation difference in the above average category is -0.77.

4.2 Effort Attributions

Survey questions 5, 7, 16 and 18 were used as measures within the “Effort Attributions” category. Factor analysis was performed on these four questions with an alpha score of 0.523. This category was used for both the pre- and post-test. Each student’s response to the category questions was summed together, the higher the score, (maximum of 16) the stronger the student believes effort plays a role in obtaining knowledge of mathematics and/or a good grade. The “Effort Attributions Difference” category is computed as the difference between the overall effort attributions value in the pre-survey and the corresponding value in the post-survey. A negative value indicates a decrease in a student’s effort attributions and a positive value indicates an increase in effort attributions.

A total of 194 completed responses were included in the “Effort Attribution” category, 77 students (39.6%) decreased in their belief of effort within the classroom, 36 students (18.6%) indicated no change in effort attribution, while 81 students (41.8%)

indicated an increase in effort attribution. The mean is -0.08, the median is 0.00 and the modes are -1.00 and 0.00. The range is 12.00 with the minimum value of -7.00 and maximum value of 5.00.

Figure 4.4 shows the frequency of each effort attribution difference value.

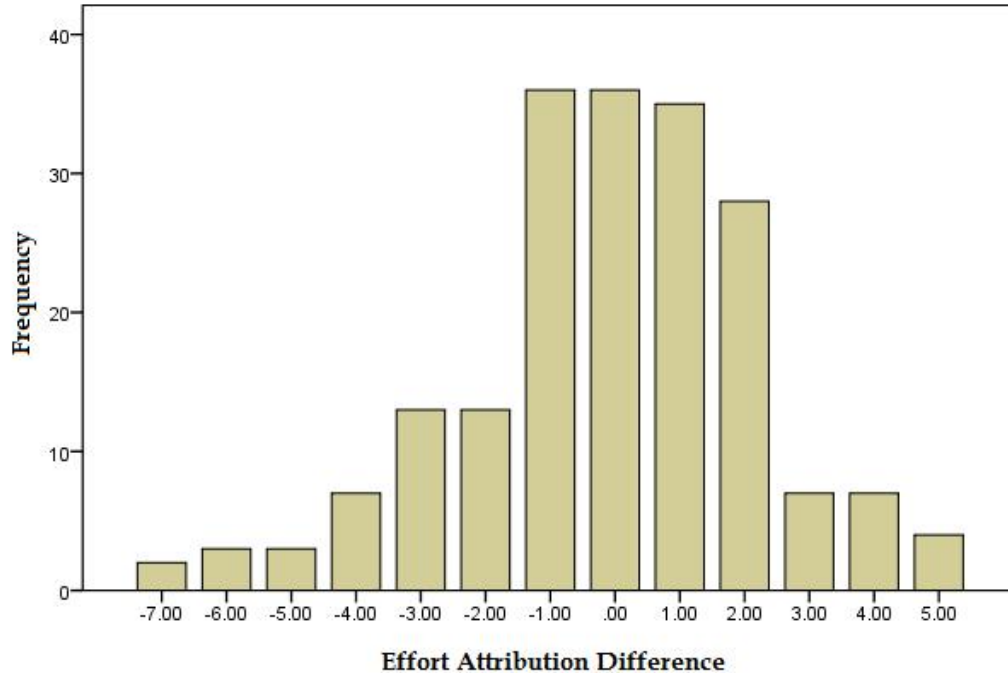


Figure 4.4: Effort Attribution Difference and Frequency

Table 4.5 indicates each category's value, frequency and the corresponding percent within the 194 respondents.

Table 4.5: Effort Attribution Difference

<i>Value</i>	<i>Frequency</i>	<i>Percent</i>	<i>Value</i>	<i>Frequency</i>	<i>Percent</i>	<i>Value</i>	<i>Frequency</i>	<i>Percent</i>
-7	2	1.0	-2	13	6.7	3	7	3.6
-6	3	1.5	-1	36	18.6	4	7	3.6
-5	3	1.5	0	36	18.6	5	4	2.1
-4	7	3.6	1	35	18.0			
-3	13	6.7	2	28	14.4			

A paired t-test was performed on the pre- and post-test data. The t value is 0.500, which does not indicate a significant difference within the students' effort attribution.

Table 4.6: Effort Attribution t-test

Paired Differences							
Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
			Lower	Upper			
0.08247	2.29742	0.16495	-0.24285	0.40780	0.500	193	0.618

4.3 Instructor Verbal Immediacy

Questions 1-17 were used in the "Instructor Verbal Immediacy" category. When factor analysis was performed the category obtained an alpha of 0.889. Each student's response to the category questions was summed together, the stronger the student viewed the instructor as being verbally immediate the higher (maximum of 68) the verbal immediacy score. A total of 224 responses were valid in this category. The range is 55, with a minimum of 7 and a maximum of 62. The mean score is 32.23, a median of 32.00 and a mode of 25.00.

Figure 4.5 is a chart which shows the students' perceived level of the Calculus II instructor's use of verbal immediacy.

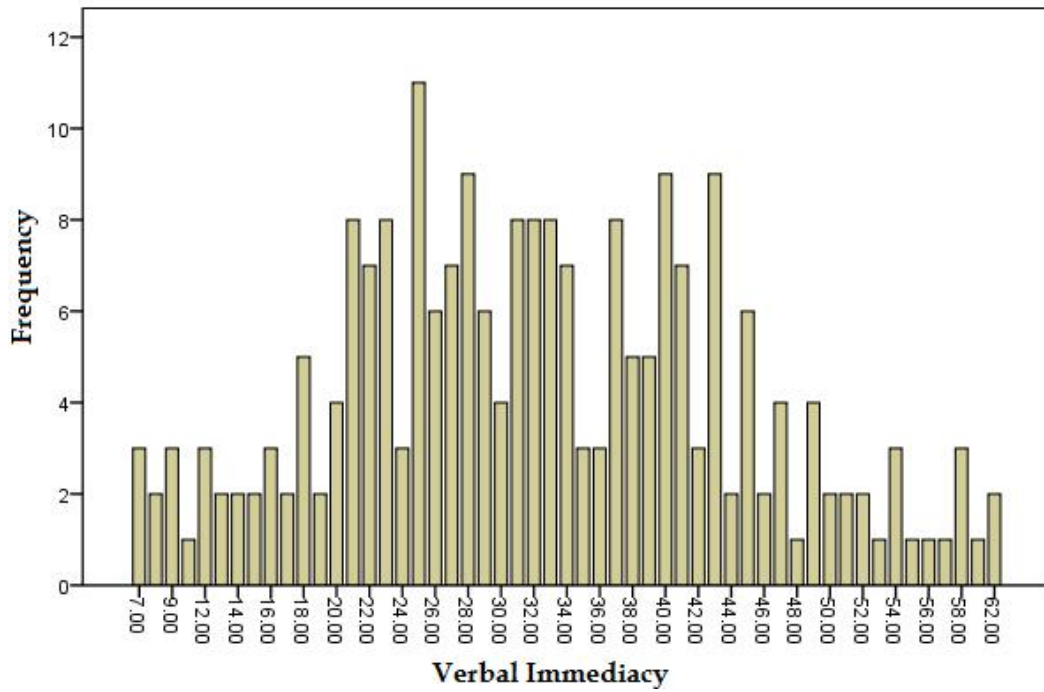


Figure 4.5: Instructor Verbal Immediacy and Frequency

Table 4.7 contains the verbal immediacy level (value), number of students who viewed their instructors in a certain level (frequency) and the percentage of the 224 surveys completed.

Table 4.7: Instructor Verbal Immediacy

<i>Value</i>	<i>Frequency</i>	<i>Percent</i>	<i>Value</i>	<i>Frequency</i>	<i>Percent</i>	<i>Value</i>	<i>Frequency</i>	<i>Percent</i>
7	3	1.3	26	6	2.7	44	2	0.9
8	2	0.9	27	7	3.1	45	6	2.7
9	3	1.3	28	9	4.0	46	2	0.9
11	1	0.4	29	6	2.7	47	4	1.8
12	3	1.3	30	4	1.8	48	1	0.4
13	2	0.9	31	8	3.6	49	4	1.8
14	2	0.9	32	8	3.6	50	2	0.9
15	2	0.9	33	8	3.6	51	2	0.9
16	3	1.3	34	7	3.1	52	2	0.9
12	2	0.9	35	3	1.3	53	1	0.4
18	5	2.2	36	3	1.3	54	3	1.3
19	2	0.9	37	8	3.6	55	1	0.4
20	4	1.8	38	5	2.2	56	1	0.4
21	8	3.6	39	5	2.2	57	1	0.4
22	7	3.1	40	9	4.0	58	3	1.3
23	8	3.6	41	7	3.1	61	1	0.4
24	3	1.3	42	3	1.3	62	2	0.9
25	11	4.9	43	9	4.0			

4.4 Instructor Nonverbal Immediacy

Questions 18-31 were used for the “Instructor Nonverbal Immediacy” category. When factor analysis was performed, the category obtained an alpha of 0.826. Each student’s response to the category questions was summed together, the stronger the student viewed the instructor as being nonverbally immediate the higher (maximum of 56) the nonverbal immediacy score. A total of 227 responses were valid in this category. The range is 37, with a minimum of 16 and a maximum of 53. The mean score is 36.19, the median 36.00, and the mode 35.00.

Figure 4.6 is a chart which shows the students’ perceived level of the Calculus II instructor’s use of nonverbal immediacy.

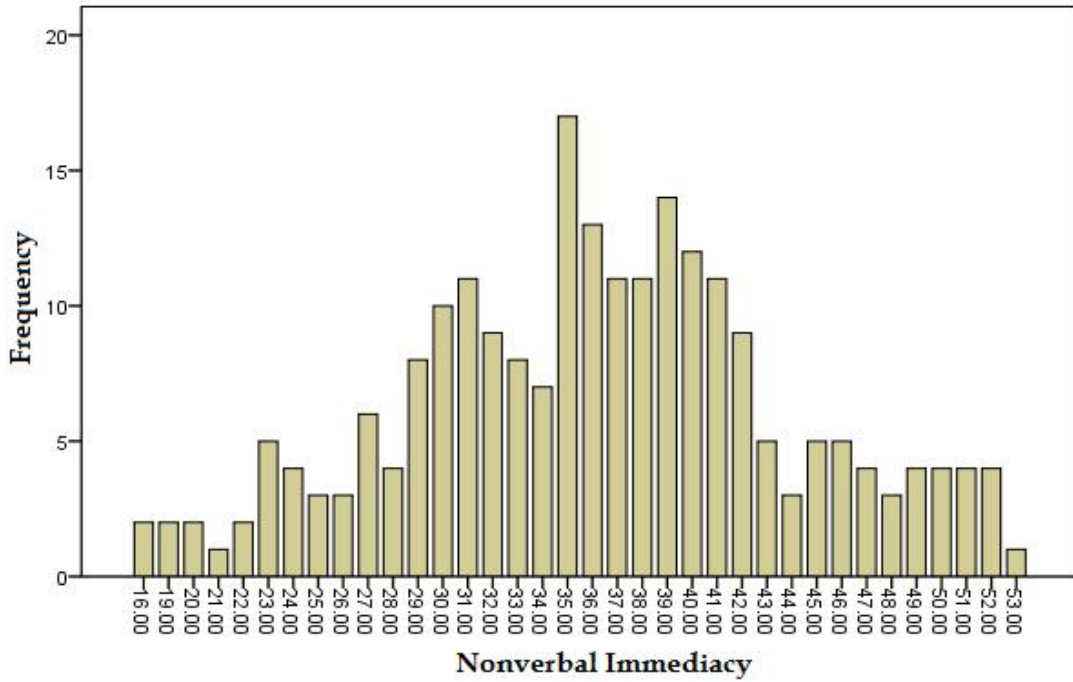


Figure 4.6: Instructor Nonverbal Immediacy and Frequency

Table 4.8 contains the nonverbal immediacy level (value), the number of students who viewed their instructors in a certain level (frequency) and the percentage of that frequency.

Table 4.8: Instructor Nonverbal Immediacy

<i>Value</i>	<i>Frequency</i>	<i>Percent</i>	<i>Value</i>	<i>Frequency</i>	<i>Percent</i>	<i>Value</i>	<i>Frequency</i>	<i>Percent</i>
16	2	0.9	30	10	4.4	42	9	4.0
19	2	0.9	31	11	4.8	43	5	2.2
20	2	0.9	32	9	4.0	44	3	1.3
21	1	0.4	33	8	3.5	45	5	2.2
22	2	0.9	34	7	3.1	46	5	2.2
23	5	2.2	35	17	7.5	47	4	1.8
24	4	1.8	36	13	5.7	48	3	1.3
25	3	1.3	37	11	4.8	49	4	1.8
26	3	1.3	38	11	4.8	50	4	1.8
27	6	2.6	39	14	6.2	51	4	1.8
28	4	1.8	40	12	5.3	52	4	1.8
29	8	3.5	41	11	4.8	53	1	0.4

4.5 Instructor Affect

Questions 37, 45, 46, 48, 53 and 54 make up the “Instructor Affect” category. When factor analysis was performed, the category obtained an alpha of 0.906. Each student’s response to the category questions was summed together; the stronger the student viewed the instructor’s positivity towards mathematics and the students the higher the value (maximum of 24) the instructor affect score. A total of 228 responses were valid in this category. The range is 24 with a minimum of 0.00 and a maximum of 24.00. The mean score is 13.53, the median 14.00, and the mode 16.00.

Figure 4.7 shows the students’ perceived level of the Calculus II instructors’ affect, along with the frequency.

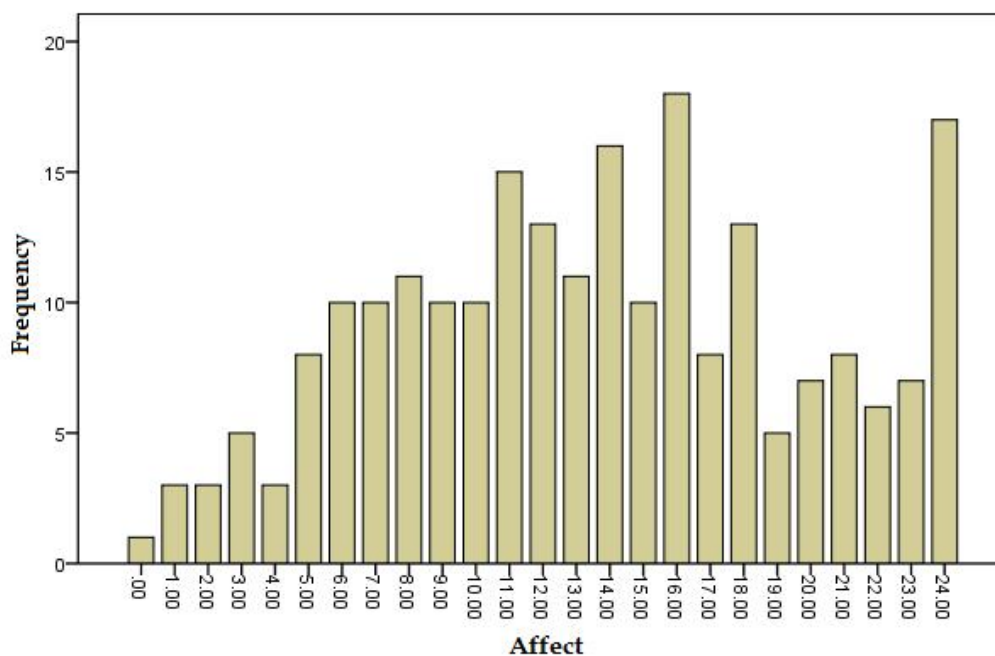


Figure 4.7: Instructor Affect and Frequency

Table 4.9 contains the affect level (value), number of students who viewed their instructors in a certain level (frequency) and the percentage of that frequency.

Table 4.9: Instructor Affect

<i>Value</i>	<i>Frequency</i>	<i>Percent</i>	<i>Value</i>	<i>Frequency</i>	<i>Percent</i>	<i>Value</i>	<i>Frequency</i>	<i>Percent</i>
0	1	0.4	9	10	4.4	18	13	5.7
1	3	1.3	10	10	4.4	19	5	2.2
2	3	1.3	11	15	6.6	20	7	3.1
3	5	2.2	12	13	5.7	21	8	3.5
4	3	1.3	13	11	4.8	22	6	2.6
5	8	3.5	14	16	7.0	23	7	3.1
6	10	4.4	15	10	4.4	24	17	7.5
7	10	4.4	16	18	7.9			
8	11	4.8	17	8	3.5			

4.6 Instructor's use of Group Activities

Questions 41, 42, 44 and 59 make up the "Group Activities" category. Factor analysis was performed and the category obtained a significant alpha of 0.770. Each student's response to the category questions was summed together; the more frequent the students viewed their instructor's use of group activities in Calculus II the higher the value (maximum of 16) within the group activities category. A total of 229 responses were valid in the "Group Activities" category. The range is 16 with a minimum of 0.00 and a maximum of 16.00. The mean score is 6.13, the median is 6.00, and the mode is 6.00.

Figure 4.8 contains the values the students' perceived use of group activities in their Calculus II class, along with the frequency.

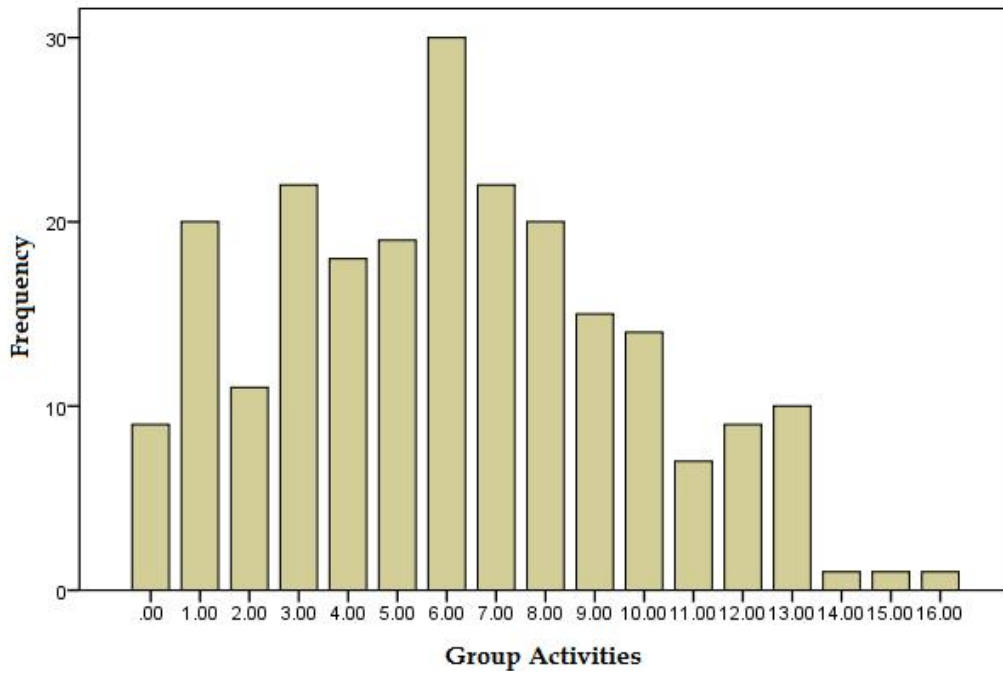


Figure 4.8: Instructor Group Activities and Frequency

Table 4.10 contains the group activity level (value), number of students who view their instructors within the level (frequency) and the percentage of that frequency.

Table 4.10: Instructor Group Activities

<i>Value</i>	<i>Frequency</i>	<i>Percent</i>	<i>Value</i>	<i>Frequency</i>	<i>Percent</i>	<i>Value</i>	<i>Frequency</i>	<i>Percent</i>
0	9	3.9	6	30	13.1	12	9	3.9
1	20	8.7	7	22	9.6	13	10	4.4
2	11	4.8	8	20	8.7	14	1	0.4
3	22	9.6	9	15	6.6	15	1	0.4
4	18	7.9	10	14	6.1	16	1	0.4
5	19	8.3	11	7	3.1			

4.7 Instructor's use of Applications

Questions 33, 35, 39 and 47 make up the "Application" category. Factor analysis was performed the category obtained a significant alpha of 0.788. Each student's

response to the category questions was summed together; the more frequent the students viewed the instructor's use of application problems in their Calculus II class the higher the score is (maximum of 16) within the application category. A total of 227 responses were valid in this category. The range is 16 with a minimum of 0.00 and a maximum of 16.00. The mean score is 8.06, the median 8.00, and the mode is 7.00.

Figure 4.9 shows the level of students' perceived use of applications within their Calculus II class, along with the frequency.

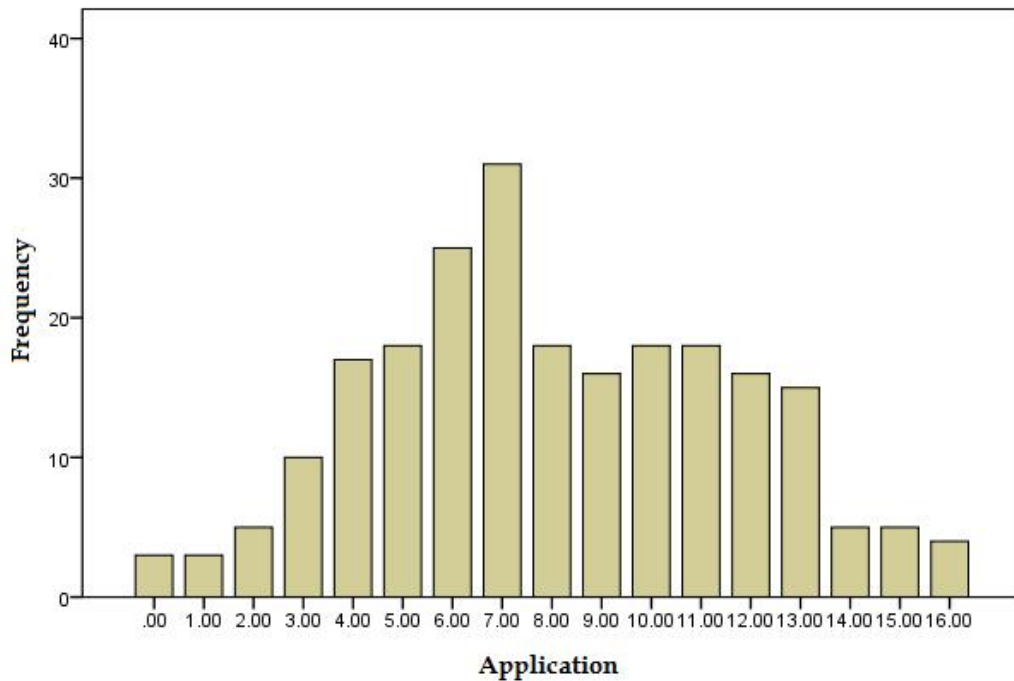


Figure 4.9: Instructor's Use of Application and Frequency

Table 4.11 contains the group activity level (value), number of students who view their instructors fitting in the level (frequency) and the percentage of that frequency.

Table 4.11: Instructor's Use of Application

<i>Value</i>	<i>Frequency</i>	<i>Percent</i>	<i>Value</i>	<i>Frequency</i>	<i>Percent</i>	<i>Value</i>	<i>Frequency</i>	<i>Percent</i>
0	3	1.3	6	25	11.0	12	16	7.0
1	3	1.3	7	31	13.7	13	15	6.6
2	5	2.2	8	18	7.9	14	5	2.2
3	10	4.4	9	16	7.0	15	5	2.2
4	17	7.5	10	18	7.9	16	4	1.8
5	18	7.9	11	18	7.9			

4.8 Correlation

A bivariate correlation was used between the student categories and the instructor categories. A significance value less than 0.05 indicates a significant correlation. The Pearson Correlation value indicates the strength of the correlation (and ranges from the lowest of 0.0 to the highest of 1.0).

4.8.1 Immediacy

Verbal and nonverbal immediacy were correlated. A Pearson Correlation of 0.726 along with a significance value of 0.000 indicates a strong correlation between the verbal and nonverbal.

4.8.2 Student Motivation

Student motivation was correlated with all five teacher categories: "Verbal Immediacy", "Nonverbal Immediacy", "Affect", "Group Activities" and "Applications". Tables 4.12 and 4.13 show the correlation values between student motivation and the five instructor categories. All of these have a positive correlation to student motivation. In addition, only the instructor applications category was not significant. The Pearson Correlation and the significance level are both indicated, a significant correlation is asterisked beside the significance value.

Table 4.12: Student Motivation Correlation (Verbal and Nonverbal Immediacy)

<i>Student Motivation</i>	<i>Verbal Immediacy</i>	<i>Nonverbal Immediacy</i>
<i>Pearson Correlation</i>	0.244	0.188
<i>Significance (2-tailed)</i>	0.001*	0.010*

Table 4.13: Student Motivation Correlation (Affect, Group Activities and Applications)

<i>Student Motivation</i>	<i>Affect</i>	<i>Group Activities</i>	<i>Applications</i>
<i>Pearson Correlation</i>	0.298	0.169	0.119
<i>Significance (2-tailed)</i>	0.000*	0.020*	0.130

4.8.3 Student Effort Attributions

In addition to studying the research questions, the student effort attributions category was also correlated with all five teacher categories: Verbal Immediacy, Nonverbal Immediacy, Affect, Group Activities and Applications. Tables 4.14 and 4.15 show the correlation values between student effort attributions and the five instructor categories. All correlations were positive; however, no correlations were significant. The Pearson Correlation and the significance level are both indicated.

Table 4.14: Student Effort Attributions Correlation (Verbal and Nonverbal Immediacy)

<i>Student Effort Attributions</i>	<i>Verbal Immediacy</i>	<i>Nonverbal Immediacy</i>
<i>Pearson Correlation</i>	0.109	0.104
<i>Significance (2-tailed)</i>	0.138	0.151

Table 4.15: Student Effort Attributions Correlation (Affect, Group Activities and Applications)

<i>Student Effort Attributions</i>	<i>Affect</i>	<i>Group Activities</i>	<i>Applications</i>
<i>Pearson Correlation</i>	0.110	0.094	0.052
<i>Significance (2-tailed)</i>	0.132	0.196	0.480

CHAPTER 5 DISCUSSION

5.1 Purpose of the Study

The primary purpose of this study was to observe if there is a correlation between student motivation on one hand and instructor characteristics on the other. The latter includes the use of group activities, outside applications and instructor affect. The overarching results show a positive correlation between student motivation and the instructor's use of outside applications and instructor affect.

5.2 Student Motivation

Overall, student motivation in the Calculus II classes decreased. 51.4% of students showed a decrease in motivation, while only 31.9% of the students showed an increase. This change in motivation was tested and found to be significantly different ($t > 1.980$), as indicated by the t-test performed on the pre- and post- Motivation scale.

The students who were included in this study completed Calculus II, were in class during both survey days, and followed directions correctly. It could be assumed that a student satisfying these three criteria would generally indicate an above average student. In the particular university the study was completed students taking Calculus II were generally students who were majoring in engineering, physics or premedical students make up the majority of those enrolled in Calculus II. The vast majority of students in this study would have a high starting level of motivation in mathematics and their decrease is somewhat surprising in light of previous studies, which have shown that their motivation would only increase as their mathematical knowledge grew (Deemer & Hanich, 2005; Glynn, Altman & Owens, 2005; Gregoire, Ashton & Algina, 2001; Middleton & Spanias, 1999). While students in the above average pre-Motivation category did not have much room to increase in motivation during Calculus II these students' motivation did decrease. In addition, the average students decreased with a mean value of decrease calculated at -1.26. Below average students showed a slight increase with a mean value of 0.35.

5.3 Student's Effort Attributions

Overall, a student's belief in effort and the impact on grades and knowledge in their Calculus II class decreased with 39.6% of students in this category, while 41.8% of the students increased in their belief in effort with Calculus II. This change in effort attribution was tested and not found to be significantly different ($t < 1.980$), as indicated by the t-test performed on the pre- and post- Effort Attribution scale.

5.4 Instructor Categories

The range of perceived instructor *verbal immediacy* is 55, with a minimum of 7 and a maximum of 62. The mean score is 32.23, a median of 32.00.

The range of perceived instructor *nonverbal immediacy* is 37, with a minimum of 16 and a maximum of 53. The mean score is 36.19, a median of 36.00.

The range of perceived *instructor affect* is 24 with a minimum of 0 and a maximum of 24. The median value is a 14, with a mean of 13.526.

The minimum value concerning students' perceived *instructor use of group activities* was a 0 with a maximum value of 16. The median group activity value was 6, with a mean of 6.13. Therefore, the majority of students did not observe group activities in their classrooms.

The range of perceived instructor's *stress of application* within Calculus II is 16 with a minimum of 0 and a maximum of 16. The median value within this category is 8, with a mean of 8.062.

5.5 Instructor Categories Comparison

Instructors' perceived immediacy and teaching styles were compared. The ratio between the mean value and the maximum score within the instructor category was calculated. Instructor's nonverbal immediacy had the highest ratio of 0.6828. This indicates out of the five instructor categories surveyed the Calculus II instructors were perceived to be more nonverbally immediate. In addition, instructor's affect had the second highest with 0.5636. Instructor's verbal and instructor's use of applications had

similar ratios of 0.5198 and 0.5039, respectively, while instructor's use of group activities was the lowest with a ratio of 0.3831.

Instructor's affect and both immediacy behavior categories were in the top three most frequently observed. Affect might be considered as an immediacy behavior because the actions instructors exhibit toward mathematics and the classroom may be similarly perceived as that of immediacy behaviors.

5.6 Correlations

5.6.1 Student Motivation

The decrease in student motivation suggested that a bivariate correlation between student motivation and teacher immediacy behaviors would be useful. A positive correlation was indicated between student motivation and perceived teacher immediacy behaviors. For teacher verbal immediacy a Pearson Correlation of 0.244 and a significance value of 0.001 was found. In addition, for teacher nonverbal immediacy a Pearson Correlation of 0.188 and a significance value of 0.010 was found.

Concerning verbal and nonverbal immediacy instructors' verbal immediacy had the strongest Pearson correlation with student motivation. Previous research by Furlich and Dwyer (2007) confirmed there is a stronger correlation between verbal immediacy and motivation. Their study was carried out within a community college's mathematics classroom and this study supports their evidence.

In addition, a positive correlation was indicated between student motivation and perceived instructor affect, with a Pearson Correlation of 0.298 and a significance value of 0.000. Therefore, as instructor's excitement toward students within the classroom and mathematics increased student motivation also increased.

There was also a significant correlation between student motivation and instructor use of group activities. The Pearson Correlation value is 0.169 and the significance value is 0.020. Therefore, as the use of group activities increase student motivation increases as well.

A non-significant, positive correlation (Pearson Correlation of 0.119, and significance value of 0.130) was discovered with student motivation and instructors stress of applications.

The highest Pearson Correlation value is between student motivation and instructor affect. The second highest Pearson Correlation is with instructor verbal immediacy. Nonverbal immediacy along with instructor's use of group activities follows, respectively. Finally instructor's use of application has the lowest Pearson Correlation value. The ranking between strongest correlation values and most frequently perceived instructors immediacy behaviors and teaching styles is similar. The instructor's use of group activities and use of applications were both ranked the lowest. Students view of instructor's positivity toward the students and the subject may also be seen as instructor immediacy behaviors. Therefore, while instructor affect, and instructor verbal and nonverbal immediacy were all ranked in different orders they were all in the top three in both categories.

All correlations between instructors' immediacy behaviors and teaching styles as related to student effort attributions were positive. However, it does not appear that perceived instructors immediacy behaviors or teaching styles have an affect on student's effort attribution.

Notice that a correlation does not determine the cause and effect relationship between student motivation and instructor affect or applications. This study cannot confirm if instructor excitement influences student motivation or if the higher the student is motivated the more the student views the instructor's excitement toward mathematics and the class.

CHAPTER 6

CONCLUSIONS

This study discovered that the majority of students' motivation concerning mathematics decreased or stayed the same. In addition, there is a positive correlation between student motivation and perceived instructor immediacy behaviors, instructor's excitement to the classroom and mathematics, as well as instructor's use of group activities. It is interesting to note that those students in the above average category within the pre-Motivation scale (score between 16 and 20) had a motivation decrease with a mean value of -0.77. This is contrary to some previous research that suggests that these students would either slightly increase, because they do not have much opportunity to increase, or at least maintain their motivation. Furthermore, those students in the average category (score between 11 and 15) would have an opportunity to increase but nevertheless decreased with a mean value of -1.26. Finally, students in the below average category (score between five and 10) did have a mean motivation increase of 0.35.

The strongest two correlations were between student motivation and instructor affect, as well as student motivation and instructor's verbal immediacy. Instructor's nonverbal immediacy and use of group activities follows, respectively. In addition while instructor's stress of application problems was positively correlated with student motivation, this correlation was not significant.

While the vast majority of Calculus II students are majoring in mathematics, science, and engineering and generally see a purpose of mathematics, these students still need to notice their instructor's excitement toward mathematics and the classroom for their motivation of mathematics to develop. These findings imply that Calculus II instructors must be perceived as being more positive toward mathematics and the classroom. Students must perceive this positivity whether instructors believe or feel this or not. In addition, instructors must also be perceived as more verbally and nonverbally immediate. For example, instructors may be encouraged to arrive in the classroom before class has begun and initiate nonmathematical conversations with the students; or get to know students' first names and call on the students by name. Additionally if

instructors move around the room and smile at students or engage the entire class in a discussion about the topics at hand it has been found that student motivation is positively correlated to these behaviors.

While previous research found a positive correlation between instructor immediacy and student motivation this research was done in a community college (Furlich & Dwyer, 2007) and in a communications classroom at a university (Furlich, 2007). This study strengthens these past findings by extending the subjects to stronger mathematics students at a large university. Therefore, instructor immediacy behaviors are important for students' motivation and success within the classroom not only in general education classrooms, but in mathematics classrooms.

The study had some limitations. A convenience sampling of all undergraduate students enrolled in Calculus II during the spring semester in a major southwestern research university was used. The student motivation survey, along with the teaching styles survey, were both created by the researcher. These may have built in biases, because they were written with students majoring in a mathematical field in mind. The language connotation may be viewed differently by non-mathematics majors than intended. The scope of this study was limited to the Calculus II classroom; therefore the implications may be limited to specific mathematics classes.

Further studies may involve other subject levels of mathematics and within different types of institutions. A correlation between instructors' views of their own immediacy behaviors as well as students' perceived views of instructors' behaviors may also yield new insights. In addition, studies involving other scientific disciplines would also be of interest.

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APPENDIX A IRB EXEMPTION



January 2, 2008

Dr. Jerry Dwyer
Mathematics & Statistics
Mail Stop: 1042

Regarding: 501170 The Influence of Teacher Practice on Calculus Student Motivation

Dr. Jerry Dwyer:

The Texas Tech University Protection of Human Subjects Committee approved your claim for an exemption for the proposal referenced above on December 22, 2007.

Exempt research is not subject to continuing review. However, any modifications that (a) change the research in a substantial way, (b) might change the basis for exemption, or (c) might introduce any additional risk to subjects must be reported to the IRB before they are implemented.

To report such changes, you must send a new claim for exemption or a proposal for expedited or full board review to the IRB. Extension of exempt status for exempt projects that have not changed is automatic.

The IRB will send annual reminders that ask you to update the status of your research project. Once you have completed your research, you must inform the Coordinator of the Committee either by responding to the annual reminder or by notifying the Coordinator by memo or e-mail (donna.peters@ttu.edu) so that the file for your project can be closed.

Sincerely,

Rosemary Cogan, Ph.D., ABPP
Protection of Human Subjects Committee

203 Holden Hall | Box 41035 | Lubbock, Texas 79409-1035 | T 806.742.3884 | F 806.742.3892

APPENDIX B
DIRECTIONS FOUND AT THE START OF THE SURVEY

Last 5 of Social Security Number _____

Below are two surveys. The first is a series of descriptions of instructor behavior that has been observed in some classes. And the second is a series of descriptions of personal feelings. Please respond to the items *in terms of the class you are taking now*. For each item, please indicate on a scale of 0-4 how often your instructor or you engage in those behaviors in your Calculus II class. Please pay special attention to reading each item carefully because some of the items are phrased in the positive, while other items are phrased in the negative.

APPENDIX C

STUDENT MOTIVATION SURVEY

1. Math does not interest me. _____
2. It is important for me that my instructor thinks I did a good job on my assignment.

3. Math majors have to work hard at math. _____
4. Taking part in classroom discussions is important to my understanding of the material. _____
5. Math is a foreign language and hopefully I will get lucky and pass. _____
6. Concerning math I would rather do something new versus something to make me look smart. _____
7. When you get a math assignment or test back how frequently do you go back and see what you did wrong? _____
8. Math is challenging for me. _____
9. Math majors are inherently good at math. _____
10. If I fail a test my first reaction is I need to study harder. _____
11. It is important for others in the class to think I did a good job on my assignment/test.

12. After you have finally understood a challenging concept or completed a difficult problem do you think, "That took me so long, I'm done." ? _____
13. I would rather answer a question correctly versus asking my instructor a clarifying question inside or outside of class. _____
14. My math abilities can develop through effort and learning. _____
15. I have been generally enthusiastic about coming to math class. _____
16. If I work hard on an assignment that means I am not smart. _____
17. Math, as a subject, motivates me to learn. _____
18. If I fail a test my first reaction is I'm not smart enough. _____
19. After you have finally understood a challenging concept or completed a difficult problem do you think, "I finally understood/completed it and want to do another"?

20. I can learn any type of math. _____

APPENDIX D
VERBAL IMMEDIACY SURVEY

1. Used personal examples or talked about experiences he/she has had outside of class. _____
2. Asked questions or encouraged students to talk. _____
3. Got into discussions based upon something a student brought up even when this didn't seem to be part of his/her lecture plan. _____
4. Used humor in the class. _____
5. Addressed students by name. _____
6. Addressed me by name. _____
7. Got into conversations with individual students before or after class. _____
8. Had initiated conversations with me before, after or outside of class. _____
9. Referred to class as "our" class or what "we" are doing. _____
10. Provided feedback on my individual work through comments on papers, oral discussions, etc. _____
11. Called on students to answer questions even if they did not indicate that they wanted to talk. _____
12. Asked how students felt about an assignment, due date or discussion topic. _____
13. Invited students to telephone or meet with him/her outside of class if they had questions or wanted to discuss something. _____
14. Asked questions that solicit viewpoints or opinions. _____
15. Praised students' work, actions or comments. _____
16. Would have discussions about things unrelated to class with individual students or with the class as a whole. _____
17. Was addressed by his/her first name by the students. _____

APPENDIX E
NONVERBAL IMMEDIACY SURVEY

18. Sat behind desk while teaching. _____
19. Gestured while talking to the class. _____
20. Used monotone/dull voice when talking to the class. _____
21. Looked at the class while talking. _____
22. Smiled at the class while talking. _____
23. Had a very tense body position while talking to the class. _____
24. Touched students in the class. _____
25. Moved around the room while teaching. _____
26. Sat on a desk or in a chair while teaching. _____
27. Looked at board or notes while talking to the class. _____
28. Stood behind podium or desk while teaching. _____
29. Had a very relaxed body position while talking to the class. _____
30. Smiled at individual students in the class. _____
31. Used a variety of vocal expressions when talking to the class. _____

APPENDIX F
TEACHING STYLE SURVEY

32. Gave credit for effort, not just the correct answer. _____
33. Connected the topics we learned to real life. _____
34. Assigned straight forward-computational work. _____
35. Took time to explain how the class is useful in life. _____
36. Attempted to make the class interesting. _____
37. Complimented me when I did a good job. _____
38. Used word descriptions to explain a math topic. _____
39. Took time to explain how the class is useful in other math courses. _____
40. Was available outside of class. _____
41. Enjoyed conversations with the class. _____
42. Assigned group work. _____
43. When working on examples he/she talked about the general idea, not just the specific problem at hand. _____
44. Encouraged group discussions. _____
45. Was excited about math. _____
46. His/Her excitement about math was contagious. _____
47. Assigned application problems. _____
48. Expressed that all students could learn. _____
49. Expressed that most of the class would fail. _____
50. If a student answered a question my instructor asks him/her to explain his/her answer. _____
51. Used pictures to explain a math topic. _____
52. Responded differently when passing back tests to those who did poorly. _____
53. Got excited when students understood a concept. _____
54. Got excited when students answered the question quickly and correctly. _____
55. Taught the math that was covered on the homework and tests. _____
56. Taught more material than was graded on homework and tests. _____
57. Personalized instruction. _____
58. Assigned large projects worth more than homework grade. _____
59. Engaged the entire class in a discussion. _____
60. Used hands-on activities in class. _____

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Agree (Permission is granted.)

Student Signature

Date

Disagree (Permission is not granted.)

Erin Skjelstad
Student Signature

April 2, 2009
Date