

STUDENT RESPONSE TO MATHEMATICAL CONCEPTS IN CONTEXT

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## **Abstract**

In recent years motivation research has emerged as an area of interest within educational research. Increasing student achievement is not the only aspect of education being studied. Improving the quality of the learning experience and investigating how this improvement affects student achievement is an area of growing interest. Additional investigations also consider what aspects of instruction and teaching affect the quality of the learning experience. Many mathematical organizations have voiced a concern that post-secondary mathematics courses should adapt curriculum and instruction based on results of this research. The current study is an investigation into the effectiveness of suggestions made by these organizations, as well as the effect instructional adaptations have on student attitude and achievement.

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## **CHAPTER 1 - Introduction and Background**

Education is forever growing, changing and adapting. With the development of technology, information is shared and retrieved almost instantaneously, pushing changes in education to an even faster rate. Improvements, research, and new theories in education are constantly emerging, improving the educational system. Much of these improvements are a result of information being shared across research disciplines. Psychology, Sociology, and other scientific disciplines are now combining forces with education to develop learning, processing and developmental theories. Within education, various disciplines are now collaborating in an attempt to better understand and improve student learning. Most of this development in education has been focused on attempting to design instruction in a manner that would increase student achievement levels. In recent years there has been a slight shift in focus to consider what adaptations to instruction can and should be made in order to provide students with a higher quality learning experience. This study investigates the claims of researchers that students seek learning environments which appeal to their interests, prompting a more enjoyable and meaningful learning experience.

Investigators in this study sought to answer the following questions regarding student learning of mathematics.

- If presented with an option as to the context of a problem, would students select problems written in a context of interest to them?
- Would giving students an option of choosing which problem to complete change student affect, interest, or motivation to learn in mathematics?
- And finally, would providing students with the option of choosing contexts which were of interest to them, affect learning and in what way?

To test these research questions, investigators need to be able to offer each student a variety of contexts from which to choose. Furthermore, these problems must use real, current, and relevant data. Within the setting of the study this was made possible by offering the assignment online. Not only could all the students have access to the problems and data, but a database could sort and organize submitted answers by context, making grading of the assignment feasible. An unintentional benefit gained through the study was a method of

submission that made grading easier and faster. The method was new to students so it was expected by researchers that results would be affected in a small way.

The researchers hypothesized that students would in fact choose problems based on interest, resulting in a more enjoyable learning experience. The assignment was only given twice in the spring in a new format (limitations discussed in further detail later). Because of this, researchers did not think that student achievement results would accurately illustrate the benefits students gained from the assignment, thus results would make it appear that student achievement was unaffected.

## **Motivation Research**

### ***What Prompted Motivation Research***

In 1989 *A Nation at Risk* was published that brought mathematics and science education to the forefront of educational concern. From this publication NCTM listed as two of its primary goals for mathematics education to be *learning to value mathematics* and *becoming confident in one's own ability* (NCTM, 1989). Out of this reform movement emerged a renewed interest in student attitude toward learning and achievement motivation, or motivation to achieve a certain standard of excellence (Stipek, 1998). More specifically, the reform is centered on determining the association between three things: teaching practices, student motivation and mathematical learning (Stipek, 1998). How do modifications in teaching practices affect student motivation and to what extent is the effect? In a broader sense, does the quality of the experience of the learner affect motivation and in what ways? Does student motivation affect mathematical learning and to what degree? Finally, what modifications to instruction aid in increased motivation to learn and understanding?

Results from research prompted by these questions are far reaching. One of the previously overlooked results was that greater academic achievement is not the only sought-after result of educational research. High motivation and a positive learning experience are also desirable educational outcomes and there should be further investigations to seek out how to improve these in the learning experience (Stipek, 1998; Schiefele, 1995). This and other significant findings will be discussed in detail later.

### *Definition of Key Terms*

Before discussing the research in motivation and its effect on education, particularly mathematics education, it is first important to understand what researchers mean by motivation. Furthermore, it is essential to define the various types of motivations that are being studied in this research. Motivations are understood to be “reasons individuals have for behaving in a given manner in a given situation. They exist as part of one’s goal structures, one’s beliefs about what is important, and they determine whether or not one will engage in a given pursuit” (Ames, 1992, cited in Stipek, et al, 1998). Often, motivation is a result of student interest, or those ideas or objects to which a student attributes high value (Schiefele, 1991, cited in Schiefele & Csikszentmihalyi 1995). The feelings prompting or discouraging interest are often referred to as affect. Within education, affect is described as “how students feel about themselves, their work and the classroom as a whole (Tomlinson, 2003).”

Motivation research is often studied within two domains, intrinsic and extrinsic motivation. Students who are intrinsically motivated desire to learn for no reason other than the value of learning (Stipek, 1998). These students seek out learning activities, often regardless of possible extrinsic reward (Middleton and Spanias, 1999). From past studies, there is evidence that intrinsically-motivated students tend to exhibit many desirable learning behaviors. These include more time on task, persistence in overcoming failure while learning, greater risk-taking and selection of more difficult problems. Students who are intrinsically motivated also demonstrate evidence of more sophisticated metacognition and learning strategies (Lepper, 1988, cited in Middleton & Spanias, 1999; Blackwell, Trzensniewski, & Dweck, 2007). Students exhibiting such behaviors are often referred to as mastery-goal students, reflective of their learning goals to master and understand mathematical concepts (Middleton & Spanias, 1999).

Intrinsically motivated students or mastery-goal students can be further sub-categorized into two groups. The first group consists of those students who see mathematics as a fixed body of knowledge. These students focus their learning on memorization and procedures. They view mastery as gaining the correct answers to problems. The second group is much more adaptable. They see learning mathematics as a developing process which they control, thus they are motivated intrinsically. Students who fall into this group place value on constructing relational understanding (Underhill, 1988, cited in Middleton & Spanias, 1999).

When constructing intrinsic motivation to participate and complete an activity, students organize their motivation into three broad categories: the cognitive stimulation offered by the activity; personal control or autonomy in the activity; and the personal interest in the activity. Interest is loosely used in this context to include the degree the students enjoy the activity, the value associated with the activity and their perceived ability to successfully complete the activity (Middleton & Spanias, 1999). By studying each of these categories, researchers hope to gain insight into how to improve the learning experience.

Extrinsically motivated students are those who are prompted to act by the possibility of reward or who attempt to avoid negative consequences (Stipek, 1998). Often these students are focused on performance goals such as gaining positive feedback from instructors or peers and avoiding negative feedback (Middleton & Spanias, 1999). These students are more concerned with grades and another's perception of their ability than with understanding concepts. While this is a significant contributor to motivation in education, it is not as much of an interest since it has been found that the absence of reward decreases the likelihood that students will continue to participate in an activity in the future (Middleton & Spanias, 1999).

### ***Motivation Theories***

These definitions of motivation reflect the various theories of motivation. Early theories in motivation were created out of a behaviorist background and were rooted in studying extrinsic motivation. For behaviorists, motivation is developed by incentives to perform a certain behavior (Spence, 1960, cited in Middleton & Spanias, 1999). In more recent years, the theory has focused more on an individual's perception of his or her need to succeed, or the need to avoid failure (McClelland, 1965, cited in Middleton & Spanias, 1999). This shift in focus makes the research conducted relate more closely with work done in the study of intrinsic motivation.

Theories accounting for intrinsic motivation emerged out of investigations into an individual's perception of why he or she failed or succeeded. One of the early theories of intrinsic motivation was the attribution theory. The attribution theory of motivation considers what personal contributions an individual attributes to a success or failure in an activity (Atkinson, 1964, cited in Middleton & Spanias, 1999). From this, the learned helplessness theory has been developed to further explain motivation within the context of education. Making allowances for both intrinsic and extrinsic motivation, theorists claim that students will believe

that lack of success and the attribution of failure imply lack of ability. Thus the learner thinks he or she will never succeed, affecting and determining motivation to participate in future activities of the sort (Dweck, 1986, cited in Middleton & Spanias, 1999). Closely related to attribution theory of motivation is goal orientation. The value associated by the learner to the activity, including the learner's perception of the activity, is the primary focus of goal orientation theory (Middleton & Spanias, 1999).

### ***Teaching Practices and Motivation***

While there was research done to develop these theories, there continues to be investigations to validate their claims. More specifically, recent research seeks to explain what actions prompt student motivation. Within the education reform, it was asked, what modifications could be made to improve student motivation? Education reformers suggested that conceptual understanding rather than simply procedural efficiency should be the focus of instruction. Teachers should encourage students to develop self-confidence in their mathematical learning. Modeling the behavior desired in students, teachers should be willing to take risks and attempt challenging tasks in instruction. Finally teachers should relate positive feeling during instruction and promote enjoyment in mathematical activities (Stipek 1998). The hopes of reformers were that these adaptations to instruction would increase student motivation. Specifically, reformers believed that when instruction was focused on conceptual understanding and teachers demonstrated a willingness to take risks, students would become more learning-orientated rather than performance-orientated. The claim was that the resulting behavior would be more attentive students attempting more challenging tasks. It was also believed that learning-orientated students would persist longer with difficult problems, demonstrating more effective and elaborate problem solving skills (Stipek, 1998; Blackwell, Trzesniewski, & Dweck, 2007).

Stipek (1998) supported these claims with a study conducted on fourth through sixth grade students. The teachers involved (N=24) implemented the above adaptations in their instruction of a unit covering fractions. Researchers videotaped the teachers during instruction and on two occasions sat in and observed the lesson. Teachers were then given a rating between one and five on their effectiveness in each of nine categories which were hypothesized to improve student attitude toward learning. These categories were determined by researchers following the coding of field notes and video tapes. To determine student motivation, the

students were given questionnaires and their responses were rated on a 6-point scale ranging from *strongly disagree* to *strongly agree*. In addition to the teachers, students were also observed. The observations were then coded to determine the level of motivation. Results from the study indicated that the more teachers expressed positive emotions and encouraged risk-taking, the more likely students were to seek help. Students were also more likely to focus on conceptual understanding and experience overall positive emotions in their learning of fractions (Stipek, 1998). It was also found that student autonomy increased feelings of control, resulting in a more enjoyable learning experience, supporting the results of other research regarding autonomy (Deci, 1975; Deci & Ryan 1987; Deci, Shinman, Schwartz & Ryan 1981). Thus, it was concluded that by modifying teaching practices, teachers could prompt more positive student attitudes and motivation to learning mathematics.

Recent work has linked student perception of intelligence to higher motivation. There are two theories that attempt to define the relationship between a student's perception of ability and motivation—an entity theory and incremental theory. The entity theory states that intelligence is a rigid quantity that is fixed and cannot be further developed. Incremental theory of intelligence considers intelligence to be a flexible quantity that can evolve and grow (Blackwell, Trzesniewski, & Dweck, 2007). Research conducted by Blackwell, Trzesniewski, and Dweck (2007) presents evidence that students in a classroom taught under incremental instruction held more positive beliefs about motivation. Furthermore, more positive beliefs about motivation correlated with higher levels of achievement. In contrast to this, the achievement level of students who held an entity view of intelligence decreased throughout the longitudinal study. Some of these students with decreasing achievement scores were identified and selected for an intervention conducted by researchers. The intervention sought to change the students' opinion of intelligence from an entity notion to an incremental perspective. The adjustment in student perception of intelligence correlated with a shift from decreasing achievement scores to increasing scores (Blackwell, Trzesniewski, & Dweck, 2007). Conclusions from the research would be that teachers who can foster an incremental theory of intelligence within the classroom would be able to prompt more positive beliefs about motivation. Furthermore, this appears to have a positive effect on learning outcomes. Given the research it is reasonable to conclude that an environment which cultivates self-confidence, enjoyment in mathematical activities and an

overall positive environment develop in students a stronger sense of intrinsic motivation, manifesting many desirable learning behaviors (see above) (Stipek, 1998).

### ***Quality of Experience and Motivation***

Schiefele and Csikzentmihalyi (1995) investigated the quality of the learning experience in a study of 108 Chicago high school students. Using the Experience Sampling Method, students recorded the activity they were engaged in, their occasion and companionship and the quality of the experience whenever prompted by a pager. Student responses given during their math class were then analyzed using the ESF rating scales (see Csikszentmihalyi & Larson, 1987). The scales gave ratings over five dimensions, potency (alert, active, etc.), affect (emotions associated with the experience), concentration or cognitive efficiency, intrinsic motivation, self-esteem, importance and skill. Results indicated that interest was the strongest predictor of a positive quality of experience. Furthermore, high interest correlated to higher levels of potency, intrinsic motivation, self-esteem, importance, and perception of skill (Schiefele, 1995). The results also showed a correlation between the quality of experience and achievement motivation, but to a lesser degree than interest. Conclusions drawn from the study were that “intrinsic motivation could only be maintained as long as learning activities lead to a certain level of positive emotional experience (Schiefele, 2005).” It should also be noted that findings confirmed that achievement motivation and interest each correlate with the other. That is, there is not a strict causal relationship, rather a co-dependent relationship (Schiefele, 1995).

### ***Motivation and Achievement***

While the quality of the learning experience is an interest of mathematics education research, most inquiries are related to motivation and achievement. Does the student who is motivated achieve a higher level of success in mathematics than the student who is not motivated? Does the quality of the learning experience influence the level of achievement of students? General findings show that there is a correlation between achievement and interest or motivation, but it is not yet firmly established whether achievement prompts interest or interest prompts achievement. It has been established that students who succeed in mathematics tend to value the subject more (Eccles, Wigfield, & Reuman, 1987; Midgley, Feldlaufer, & Eccles, 1989). Henderson and Landesman found that goal orientation, or the value assigned to the task by the learner, was a strong predictor of achievement (1993).

In the same study referenced above involving fourth through sixth graders learning fractions, Stipek found that students who were mastery-oriented and enjoyed mathematics learned more (1998). However, the extent to which motivation actually played into higher learning could not be determined. It was also determined that while teaching practices that increased student motivation did not enhance computational understanding, the practices did enhance conceptual understanding (1998). Thus, one might conclude intrinsically-motivated students who view mathematics as a developing process would see a more significant increase in achievement with increased motivation than would intrinsically-motivated students who consider mathematics a fixed body of knowledge to be memorized.

Schiefele and Csikszentmihalyi's study (1995) of Chicago high school students also investigated the relationship between achievement and motivation. PSAT scores and grade point averages were considered when analyzing the possible correlation between achievement and motivation or interest. The PSAT was used to measure scholastic aptitude and GPAs were used to indicate the student's current level of mathematical achievement. Results indicated, as expected by the researchers, that ability was the best predictor of grades. These findings agree with results from a previous study conducted by Schiefele and Csikszentmihalyi. They found that interest did not correlate with GPA or scholastic aptitude (1994, cited in Schiefele & Csikszentmihalyi, 1995). However, results did suggest that though ability was the strongest predictor of achievement, achievement variance was affected, in a small but significant way, by student interest. Other surprising results addressed the possible dependence of interest upon ability. It was found that the level of mathematical ability was not related to perception of skill or the quality of experience. In other words, high ability did not imply an enjoyable experience or a positive perception of skill. Also, the interest-experience relation was independent of student ability and achievement, meaning that interest was not simply an outcome of a successful performance (Schiefele, 1995). The possible contributors to student course selection were analyzed as well. Results showed that, again, ability was the strongest predictor of course level. However, interest was also a significant contributor to the correlation. Furthermore, the contribution of interest to the correlation was independent of ability, reinforcing the claim that high levels of ability does not necessarily correlate with high levels of interest (Schiefele, 1995). It was also determined that interest at the beginning of high school was a significant and independent predictor of the level to which a student progresses throughout the high school



experience (Schiefele, 1995). These results are affirmed by studies done by Maple and Stage (1991) and Meece who determined that attitude was influential in selecting mathematics as a major, but was not an indicator of student grades (1990). Summarizing, ability was the primary factor in determining mathematical achievement, but interest and motivation appear to be significant contributors to the level of mathematical learning.

### *Unanswered Questions*

While there is extensive research on the motivation of students in education, and even a large amount in mathematics education, most of the investigation involved students at the elementary and secondary levels. Little work has been done to investigate the effects of teaching practices and motivation or the effects of application based learning at the post-secondary education level. Aronson, Friend, and Good (2002) found that college students taught from an incremental intelligence framework had greater motivation and reached higher levels of achievement, so there is evidence that teaching practices affect motivation and student learning at higher levels of education. There is also evidence that the mean levels of intrinsic motivation, which has been linked to higher achievement and more positive learning experiences, decrease over time (Spinath & Steinmayer, 2008; Gottfried, Fleming, & Gorrfried, 2001). Wigfield & Eccles (2000) found that student beliefs in mathematical ability decreased from Kindergarten to sixth grade. Further research indicated that this decline continued through junior high and high school (Wigfield & Eccles, 2000). In the same study, it was found that student opinions of the usefulness and importance of studying mathematics also decreased. It would be reasonable to assume that the decline in student belief in ability and the value associated with studying mathematics continues to decrease into college. Thus, more research is needed to determine the effects of motivation on student learning at the collegiate level. Taking all of this into consideration, it is reasonable to question the correlation between teaching practices and motivation at the post-secondary level.

## Motivation and Instruction

### *Differentiated Instruction*

The application of motivational research to teaching practices and instruction is at the root of differentiated instruction. Rick Wormmeli best explains the concept of differentiated instruction in his book *Differentiation: from planning to practice grades 6-12* by saying

When we differentiate, we do whatever it takes to help students learn by providing individual accommodations and making adjustments to our general lesson plans...we finesse the learning for students while finessing students for their learning. We don't just adapt our instructional techniques to meet their needs; we prepare students for the variety of learning and life situations they will encounter...with differentiation we strive to change the nature of our assignments not the quantity

Carol Ann Tomlinson supports this statement by stressing that differentiating instructions “advocates active planning for student differences (2003).”

To create an environment in which learning is effective and efficient, a teacher must also consider and address the students' readiness, learning profile and interest (Tomlinson, 2003). Student readiness refers to those skills, knowledge, and understanding a student already possesses relating to the topic or concept to be studied. Individual learning styles, intelligence preferences, culture, gender and other aspects affecting learning is what is meant by student learning profile. Within the context of differentiated instruction, interest is defined as “those topics of pursuits that evoke curiosity and passion in a learner—facets of learning that invite students to invest their time and energy in pursuit of knowledge, understanding and skill (Tomlinson, 2003).” Differentiated instruction is highly dependent upon the motivational research discussed above which claims that when student interest is prompted and extended, students are more likely to stay engaged and persistent in learning (Csikszentmihalyi, 1990; Maslow, 1962; Sousa, 2001; Wolfe, 2001 cited in Thomlinson, 2003).

Differentiated instruction's emphasis on adaptive instruction based on student differences affects five different areas. Teachers could implement differentiated instruction in content, process, product, affect, or learning environment (Tomlinson and Strickland, 2005—cited in Wormmeli, 2007). Content refers to the course curriculum or the skills and conceptual knowledge that students should learn throughout the course of the semester. Curriculum is to be

important, focused, engaging, demanding, and scaffolded (Thomlinson, 2003). Important curriculum can be described as the ‘big ideas’ of the content. Instruction should focus on those concepts which are essential foundations of the course. The curriculum must be focused to achieve the essential learning goals of the course, while maintaining high standards of achievement and engaging student interest. Scaffolding curriculum refers to assessing student understanding prior to beginning instruction, determining the goal of the instruction and then adjusting the instruction to ensure the learner achieves the intended goal. The curriculum and instruction should be just beyond student understanding but at an attainable level. The process is the many different ways in which students can learn the curriculum; for example though direct instruction, group work, self investigation, etc. Learning environment is anything related to the immediate environment such as class set-up or seating arrangement. The way in which the student is to demonstrate understanding is the product (i.e. homework, projects, exams, etc). To evoke student interest, student products should focus around significant problems and issues, use meaningful audiences and help students discover how ideas and skills are useful in the world. It is further suggested that teachers provide choices for students which still require students to develop understanding and skills, look for fresh ways to present and explore ideas and share personal experiences and inviting students to do the same (Tomlinson, 2003, p 71-73). Affect in this context differs slightly from how it is defined within motivation. It refers to the socio-emotional factors that effect student learning, which includes the definition of affect within motivation, but also may include emotional factors not associated with the course at all. Like in the motivational research, differentiated instruction makes the claim that positive “student affect is more likely to support student learning than is negative, or even neutral affect (Given, 2002; Wolfe, 2001—cited in Thomlinson, 2003).” Examples could be emotions directly related to the class, or those associated with stressful situations not related to the class. Within the context of the class, affect is influenced by a student’s desire to seek affirmation, contribution, power, purpose, and challenge (Thomlinson, 2003, p 16-19). Students want to know that they are accepted and respected. They seek to know that the work they do will contribute to the class and to their own learning. Power refers to a student’s desire to learn what is useful to him or her at the time of learning and to a sense of autonomy in the assigned work. A student desires to see purpose in the material being presented, meaning that not only does the student understand what is being taught, but also see the significance and application of the material being taught.

Finally, a student seeks to be challenged and stretched in his or her learning. Once considering these traits in the students, a teacher must adjust the methods of differentiated instruction to create a classroom which is the most conducive to learning by all students. In other words, differentiated instruction is heavily dependent upon what motivates individual students.

An example of how one could implement the above methods is given by Marzano (1992). He suggests planning lessons according to five dimensions. A teacher should plan the lesson to encourage positive attitudes and perceptions about learning. He or she should attempt to get students to acquire and integrate knowledge and then have students extend and refine knowledge. Students should use knowledge meaningfully and finally, develop productive habits of mind.

### ***Changes to Mathematics Curriculum and Teaching Practices***

Applying the concepts of differentiated instruction to mathematics, there has been a call for a reform in mathematics curriculum, specifically for more learning within contexts which are meaningful to students. In 1996 the National Association of Secondary School Principals published *Breaking Ranks: Changing an American Institution*. In the bulletin the NASSP recommended a renewal in curriculum that is “practical [and] will connect itself to real-life applications of knowledge and skills to help students link their education to the future.” It states

This requires that high schools do more to present the curriculum in the context of experiences that call upon students to apply knowledge in situations approximating those in which they will use knowledge in real life—‘authentic learning,’ if you will.

The desire to adapt mathematics curriculum is not isolated to the elementary and secondary levels. At the collegiate level, various organizations are calling for adaptations to be made. At the forefront of the movement is the Mathematical Association of America (MAA). Within the MAA, the Committee on the Undergraduate Program in Mathematics (CUPM) is responsible for publishing reports which offer suggestions for adaptations and reforms to undergraduate mathematics curriculum. In the *CUPM Curriculum Guide 2004* a major emphasis was placed on developing curriculum which addressed the needs of *all* college students, even those who are only taking one mathematics course. It was suggested that mathematics departments

- Understand the strengths, weaknesses, career plans, fields of study and aspirations of the student enrolled in mathematics courses and continually strengthen courses

and programs to better align with student needs, and assess the effectiveness of such efforts

- Employ a broad range of examples and applications to motivate and illustrate the material, promote awareness of connections to other subjects and strengthen each student's ability to apply the course material to these subjects; introduce contemporary topics from the mathematical sciences and their applications and enhance student perceptions of the vitality and importance of mathematics in the modern world
- Encourage and support faculty collaboration with colleagues from other departments to modify and develop mathematics courses

In an effort to further understand what students in other areas of study needed to learn their first two years of college mathematics, CUPM formed a subcommittee, Curriculum Renewal Across the First Two Years (CRAFTY). CRAFTY began the Curriculum Foundations Project, a series of eleven workshops between November 1999 and February 2001, hosted at locations across the country. The aim of the project was to gather input from partner disciplines regarding their concerns with mathematics education and open communication between the various disciplines and mathematics departments. The workshops were not designed to be a dialogue between other disciplines and mathematics departments, but rather an opportunity for other departments to voice their concerns with what students in their discipline were learning in their college mathematics courses. Following these workshops, *A Collective Vision* was published. This publication voiced the concern that what students are being taught in their mathematics courses was not relevant to their chosen field. The impression left on the participating disciplines was that mathematics departments were not concerned with the needs of their students (Ganter & Barker, 2003). *A Collective Vision* was a compilation of these concerns and suggested adjustments to mathematics education. It was suggested that mathematics curriculum should place more emphasis on mathematical modeling. Models should expect students to create, solve, and interpret mathematical models from partner disciplines showing students mathematics in context (Ganter & Barker, 2003). It was also suggested that “traditional College Algebra courses be replaced with courses stressing problem solving, mathematical modeling, descriptive statistics and applications in the appropriate technical areas while de-emphasizing intricate algebraic manipulations (Ganter & Barker, 2003).”

Finally, the report encouraged interdisciplinary cooperation, asking mathematicians to “seek out projects from partner disciplines to be used in mathematics courses (Ganter & Barker, 2003).”

The curriculum reform these organizations are calling for has been validated by education researchers, independent of discipline. It has been found that the brain learns through experience and for learning to take place, one has to make the connection between what the individual has experienced and what that experience means to the individual. This meaning is established by considering the new information in context of information the individual has already processed and stored in the brain (Caine et al, 2005). To assimilate this information, the individual must do something with the information; perform an action with it (Caine et al, 2005). While learning is not impossible without action and meaning, the brain is more efficient in learning information that has been given meaning to the individual (Caine et al, 2005). In other words, learning is best accomplished in an environment in which the students take a new concept and through an action, connect it to something with which they are already familiar.

Hitz and Scanlon (2001) attempted to validate these claims in a study comparing a project-based experimental learning method and the traditional classroom method of instruction in surface area and volume and coordinate geometry which provides evidence for the above claims. The study evaluated the scores and attitudes of 95 high school students from a small private school in central Pennsylvania over the course of three months. Participants were given a pretest two weeks before each unit of instruction. Following each unit students were given an attitude survey and a standard unit test. Two weeks following the completion of the unit, students were given a posttest to determine long-term retention. Results from the study showed that students in the traditional classroom scored higher on each of the unit tests given directly following instruction. However, students receiving the project-based instruction scored significantly higher on the posttest. The attitude survey results were split between the two units. Following the first unit (surface area and volume) students in the project-based class reported slightly more positive attitude toward learning than those taught by traditional methods. The attitude survey given at the conclusion of the second unit indicated that students in the traditional classroom held a more positive attitude toward learning than the experimental classroom. Hitz and Scanlon conclude by stating that:

The research suggests that educational experiences which are relevant and meaningful are the most effective pathways to learning. The data from this study supports the literature

to the extent that when students are able to develop a connectedness through real-life experiences, they are able to apply that learning to other situations.

Recommendations that came from the study include future investigation into the effectiveness of these two methods of instruction when comparing a variety of academic discipline such as agriculture, language arts, social studies, visual and performing arts, etc. The other recommendation was to investigate the advantages from combining the traditional and project-based instruction in one classroom.

This same recommendation was voiced at a recent CRAFTY workshop held at a mid-western university. The university was home to a significant agricultural department and funded a workshop which brought together professors in mathematics and agriculture to discuss what improvements could be made to post-secondary mathematics courses to enhance the learning and understanding of students studying agriculture. The primary concern of all participants, regardless of the branch of agricultural discipline, was the students' inability to apply concepts learned in their mathematics courses to their respective agriculture problems. The agriculture professors were concerned that students were failing to see that math has real application and students were not learning how to use mathematical tools in these applications. One participant voiced this concern by saying "they need to know what the numbers mean". Other concerns expressed were the students' inability to solve multi-step problems. One suggestion to remedy the problem was to include more practical applications, specifically agricultural examples, in mathematics course curriculum. Another suggestion from the workshop was a more personalized math course where problems were centered on their particular field of study, possibly offering problems written in different contexts but with the same underlying concept and allowing students to select which type of problem they chose to complete. The hope of the participants was that such changes would help students recognize the mathematical tools they needed to solve problems in the student's field of study. Other benefits proposed included improved motivation and a better attitude toward mathematics.

The present study attempts to implement some of the suggestions from the CRAFTY workshop and then determine the significance these suggestions have in affecting student attitude and learning. It aims to provide relevant, real-life problems to students and give them the opportunity to see how the mathematical concepts being taught apply to areas of interest to them. This is an attempt to foster interest and meaning in learning. By providing students the

opportunity to choose which type of problem to complete, the assignments were designed to improve student affect by providing the students with a sense of power and autonomy, as well as sparking personal interest by providing a context for learning which is connected to their specific areas of interest and disciplines of study.



## **CHAPTER 2 - Methodology**

The study was conducted twice at a mid-western university with large schools of agriculture and engineering. Data was collected once in the fall semester and twice in the spring semester within the same school year. Participants were taken from a reformed College Algebra class. Of the 354 students enrolled in the fall semester, 109 students participated. In the spring, all 185 students enrolled in the class were expected to participate and 166 of them completed the assignment. Students ranged in class level from freshman to seniors.

### **The Environment**

The course the students were enrolled in met three times per week. Early in the week (Monday or Tuesday) students met in classes of 25-35 people with a recitation instructor. The 50-minute class was spent reviewing concepts and fielding student questions. These questions were primarily focused on homework problems assigned for the week. Each Wednesday students attended a large lecture (250-300 students) where the course instructor lectured over concepts and skills needed for the upcoming week's homework and studio. Late in the week (Thursday or Friday) students attended a studio class, held in a computer lab. The studio classroom in the fall semester was different than the classroom in the spring. In the fall, two instructors were present in a lab of 25-35 students, located at various rooms around campus. For the spring semester, the first four weeks were conducted in the same manner as the fall. After week five, the completion of a new computer lab allowed for two sections to meet together in the same lab. In these combined sections, four instructors or graduate teaching assistants taught a classroom of 50-60 students. For both the spring and the fall, one of the studio instructors was the same instructor the students met with earlier in the week for recitation. The role of the instructors in the studio was to facilitate learning by clarifying concepts and fielding questions. Students were encouraged to combine efforts, working in groups to complete a guided self-exploration of practical application of concepts covered in lecture the previous Wednesday. The applications primarily used Excel worksheets. Students began each semester learning the basic functions of the program and then developed the skills needed to create and analyze tables and

graphs, including scatter plots and trendlines. Students wrote out answers to the studio and turned them in the following week to be graded.

In addition to studio homework, students were given weekly written homework assignments as well as online assignments. Problems for the written homework were taken from the course textbook. These problems were primarily application problems or ‘story problems’. Students were to write out complete solutions to the problems and hand them in the following week to be graded by a grader. Students accessed online homework problems through the course website. Upon logging on, students were given between five and seven skill development, or routine practice, problems. After finding a solution to the problems, students entered their answers on the page and submitted their solutions. They were then informed if their solution was correct and given an opportunity to either make corrections to their solution, or to accept the given score. After the due date and time, students were still allowed to log on and attempt problems, but would not receive a score.

### **Gathering Data**

Students were given online assignments in conjunction with standard course work to be completed and submitted. To test if contextual problems correlated with higher achievement levels, investigators analyzed student scores. For each problem, scores were recorded and analyzed using a standard  $\chi^2$  statistical test ( $p < .05$  accepted). Each possible submission was scored as a 0, 1, or 2. The assignments also provided investigators with the student choice of context. This provided investigators with information to determine if students preferred problems written within the context of their discipline of study.  $\chi^2$ -statistical test again was used to determine the correlation between context-choice and major. Online attitude questionnaires were completed with students on a volunteer basis to assess student motivation and attitude towards mathematics and the assignment given in a modified format. A second purpose of the survey was to gain student opinions of how to improve later assignments given in a similar format. Two-tailed heteroscedastic t-test was used to analyze a Likert-scale portion of the attitude survey. Several students were selected and asked to volunteer in an interview. The interviews were conducted in conjunction with a concurrent study investigating attributes of student learning. Results from analysis of student attributes done within the concurrent study determined which students were asked to participate in an interview (results from the study to be

published later). Interview protocol can be viewed in Appendix C. Interview and free-response questions of the attitude survey were analyzed by investigators to determine recurring themes and the frequency of each theme.

The independent variable identified in the study was student major. Dependent variables included student score on the assignment, student attitudes as recorded by questionnaires and interviews, and student choice of context. Other variables which were not controlled included the time during the semester in which the assignments were given, the type of student as classified in a parallel study, the order in which the contexts were listed, the semester the study was conducted, and the familiarity of the students with an online assignment versus the typical written assignment.

## **The Layout**

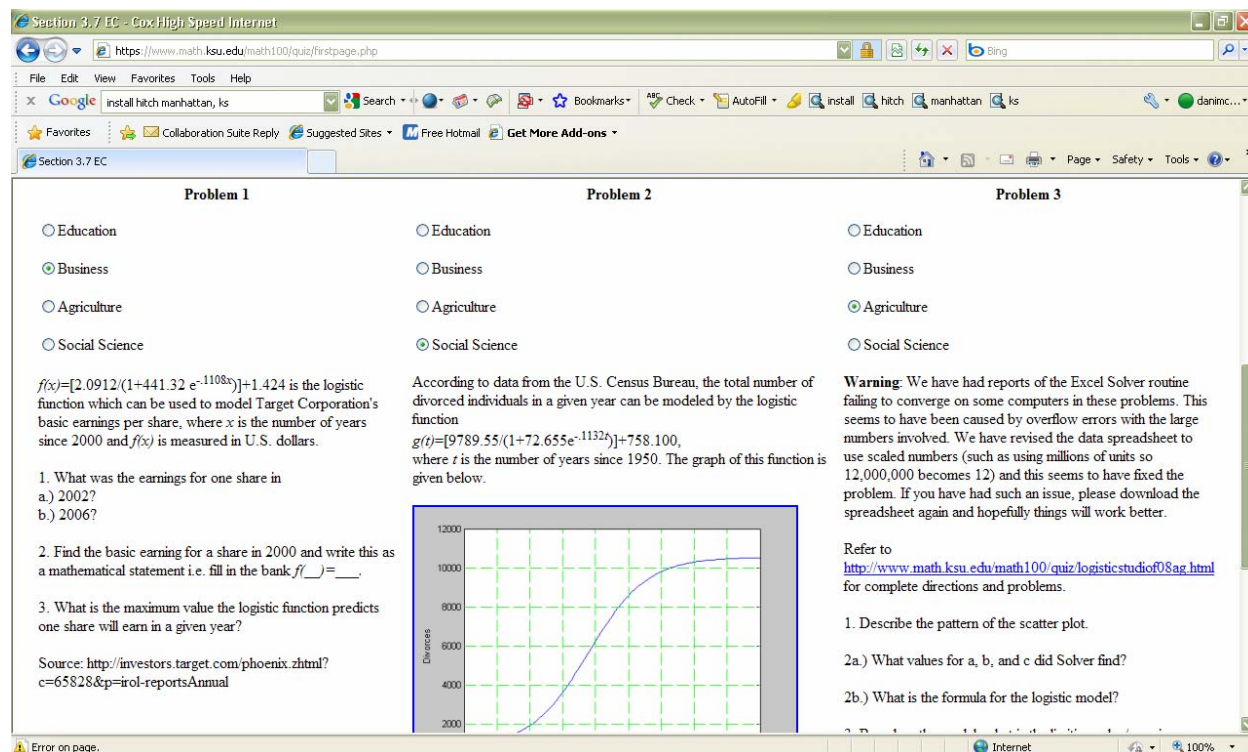
The study in the spring semester was slightly modified from the study in the fall semester. For both semesters, students were given an online assignment to complete which offered them a practical application, using current and real data, of a mathematical concept that had been introduced to in the week's lecture. Rather than having one problem for all the students to complete, students were given an option of four different contexts. The four problems tested knowledge of the same basic mathematical concept, but each was using data from a different context. Prior to the study, the investigators identified the four most prominent choices of major of students enrolled in the class. Of the majors which were declared by the students, Agriculture, Education, Business, and Social Science were identified as the most common choice of study by the students. Thus, the assignment was written so that the options of contexts given to students reflected this. That is, students were given an option if they wished to complete an agriculture problem, an education problem, a business problem or a social science problem. Students could change their selection at any point and were encouraged to read each of the four problems before deciding on a problem to complete. To select a problem type, students clicked on a radio button next to the problem type. Upon selecting the radio button identifying which context they preferred, the problem would be displayed on the screen next to, or under the context heading. For every assignment, the questions had the students access data from a Microsoft Excel worksheet linked to the page and use functions within Excel to analyze the data and make predictions based on their investigations (see Figure 1.1).

Students were encouraged to show as much work as possible and given sufficiently large textboxes on the webpage to explain and justify answers. After students had solved the problems, they saved their answers. Once the answers were saved, the students were given a summary of what answers they had submitted up to that point. Each time students logged in and saved answers, the database was updated and the most current solutions submitted were displayed for the student. At any point up until the deadline, students could return to the page and make changes to the solutions they had submitted, each time being informed of what the database had saved for their solutions.

### ***The Fall Test***

In the fall semester, the assignment assessed student understanding of logistic functions to model real, current data. The assignment was given as extra credit to the entire class and was assigned over the Thanksgiving holiday (see Figure 1.1). It consisted of three problems. For each problem the students were given the choice of Education, Business, Agriculture, or Social Science. The context options were listed in the mentioned order. The first two problems gave functions as models of context-relevant situations and asked questions regarding the properties of the data and/or function. The third problem was a mini-studio and required the students to download the appropriate Excel worksheet corresponding to their choice of context. Unlike previous studios, this problem required the students to use the Solver application in Excel to determine an appropriate model of the data. This addition to the assignment was a response to the university's business department request to expose students to Solver prior to entering one of the standard business courses required for graduation.

**Figure 1.1 Fall Extra Credit Assignment Web Page**



After saving solutions, students were directed to a page requesting their participation in an attitude survey for an additional two bonus points. Students were not allowed to participate in the survey until their understanding of the survey and agreement to participate voluntarily was obtained. The 37 question attitude survey was a modification of an attitude survey given to students in an introductory astronomy class designed by Mike Zelik, a professor of Astronomy at the University of New Mexico. Students were requested to respond to a statement with *strongly agree*, *agree*, *disagree*, *strongly disagree* or *ambivalent*, based on their attitude or feelings toward that statement. A total of 62 students chose to complete the attitude survey.

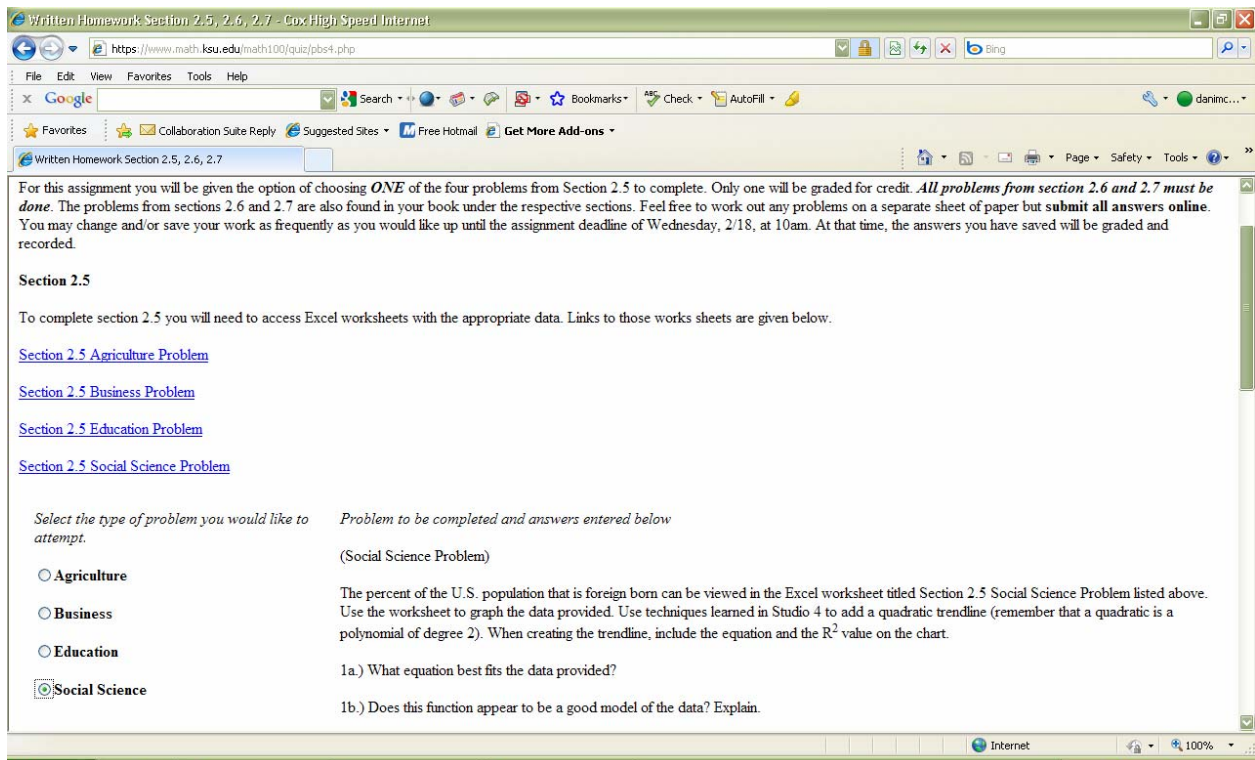
### *The Spring Test*

In the spring semester two assignments were given to all the students as a requirement for the written portion of their homework grade. Again, students were to access the assignment and submit answers online. For both assignments, students were given standard word problems in addition to the context-choice problems.

The first assignment tested student understanding of modeling data using quadratic functions. It was assigned during the fifth week of the semester, a standard week of class. It consisted of three sections, with the first being a context-choice problem. The remaining two

sections consisted of standard word problems taken from the text book. For the context-choice problem, students were instructed to download the appropriate Excel worksheet to accompany the problem. The problem contexts were listed in the following order: Agriculture, Business, Education, and Social Science with the link to the Excel download listed above the choices. The problem consisted of three parts (see Figure 1.2).

**Figure 1.2 Spring Assignment 1 Web Page**

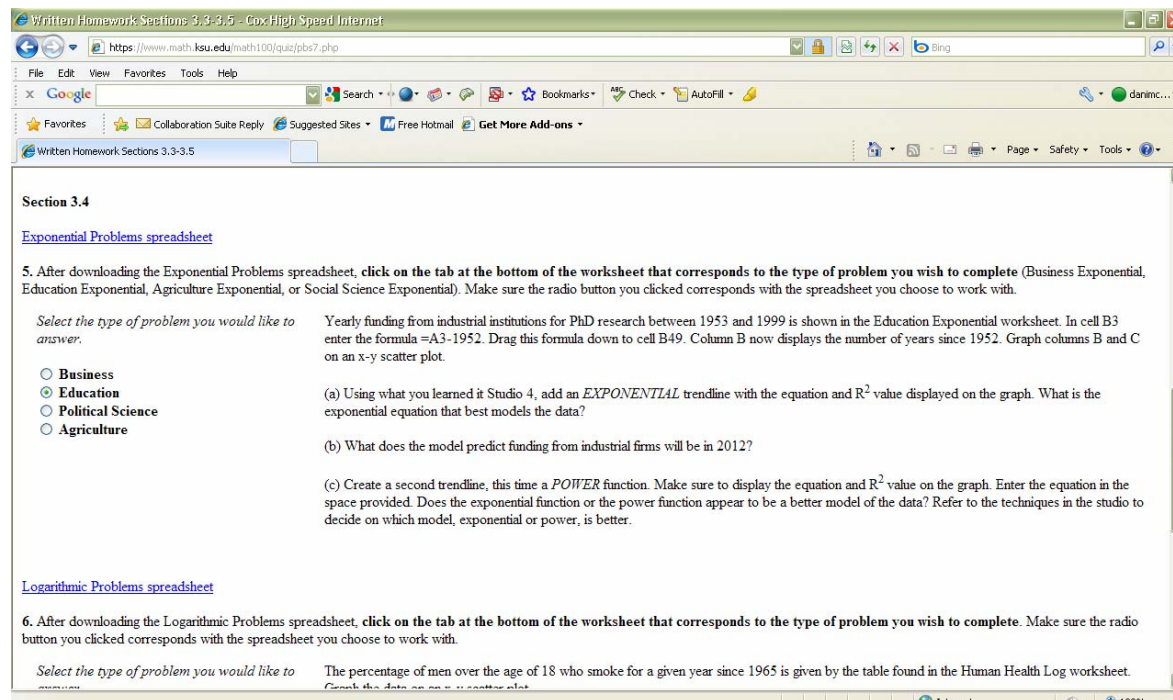


Students were instructed to perform operations typical of a studio assignment. After finding solutions, students saved their work and were directed to a page which confirmed the answers entered. A total of 142 students submitted an answer for context-choice problem. There were 24 students who chose not to complete any part of the context-choice problem but did complete at least one of the other standard problems on the assignment. The remaining 19 students enrolled in the class did not submit answers for any portion of the assignment. Using a selection process designed by investigators conducting a parallel study, nine students were selected and asked to volunteer for an interview (for responses pertaining to study see Appendix D).

The second assignment given in the spring semester assessed student understanding of exponential and logarithmic functions. It was given over the spring break holiday. The deadline for the assignment was extended an additional two days due to system malfunctions. Like the

first assignment in the semester, the assignment consisted of a combination of context-choice problems and standard textbook-type problems taken from three different sections in the textbook. Those problems which were not context-choice in format were taken from the text book or modeled after similar problems but using more relevant, recent data. The assignment contained two context-choice problems, both from the same section in the textbook. Both problems required students to download the appropriate Excel worksheet and complete a series of operations typical to a standard studio assignment. The first problem, testing understanding of exponential functions, offered the students the options of Business, Education, Political Science, and Agriculture (see Figure 1.3). The second problem tested student comprehension of logarithmic functions and listed the contexts as Health, Agriculture, Business, and Education.

**Figure 1.3 Spring Assignment 2 Web Page**



Out of the 185 enrolled in the class, 144 students submitted an answer for the first problem and 144 students submitted an answer for the second problem. It is interesting to note that the students who chose not to attempt the first problem were the same students who chose not to attempt the second problem on the assignment. Only 4 students chose not to submit answers for the context-choice problems but did attempt to answer at least one other problem on the assignments. This left 19 students who did not attempt any problems on the assignment.

Following the submission of solutions on the second assignment, students received confirmation of saved data and then were asked to voluntarily participate in a survey over their attitude toward the assignment. The survey consisted of three open-ended questions and eight Likert-scale questions with responses ranging *strongly disagree*, *disagree*, *ambivalent*, *agree*, and *strongly disagree*. The statements were worded both positively and negatively. In general the questions asked students to give their attitude toward statements addressing their belief in ability to learn mathematics, the complexity of the assignment compared to previous assignments, the option of choosing problem contexts, using the computer as a method of turning in assignments, the value in the material learned, the value of math as preparation for major area of study, the usefulness of information in the assignment to their career and the relevance to life of the topics covered. A total of 25 students chose to participate in the survey. Of the 25, 19 students responded to the question “Why did you choose the problem you selected to complete?” All 20 students answered “What did you like or dislike about this assignment?” Nine students gave responses to “Do you have any suggestions for further assignments of this type?” Using the same method of selection as the interview process following the first assignment of the semester, ten students, in addition to the nine interviewed after the first assignment, were selected and asked to voluntarily participate in an interview. Interview questions were similar to questions asked in the attitude survey (see Appendix B and C). For student responses to interview questions pertaining to this study see Appendix D.

### **Limitations in Current Study**

As can be expected, there were limitations to the current study. Though students had completed online homework prior to the modified assignment, they had not been assigned written homework online. That is, previous online homework was focused on developing computational skills. This assignment was the first time students submitted answers to word problems online. This provided the only practical way for investigators to offer multiple contexts for a large number of students. The format limited student explanation of answers to the problems, making it difficult to determine if students fully understood the concept being tested. The format also frustrated some students, prompting them to submit incomplete answers.



## CHAPTER 3 - Results

### Context-Choice vs. Interest Analysis

Data was collected using three different methods. To test the first research question, each student's major and the contexts chosen for each of the problems was compared. Student majors were classified by colleges within the university. Six colleges were identified, Arts and Science (N=90), Agriculture (N=17), Education (N=21), Business (N=18), Engineering (N=8), and Human Ecology (N=14). Tables 1.1-1.3 display the number of students who chose each context, organized by major. In the table AS refers to Arts and Science, EN to Engineering, AG to Agriculture, HE to Human Ecology, BA to Business Administration, and ED to Education. For the contexts, NC refers to No Choice, AG to Agriculture, BU to Business, ED to Education, and SS to Social Science.

**Table 1.1 Question 1.1 Context-Choice by College**

	<b>NC</b>	<b>AG</b>	<b>BU</b>	<b>ED</b>	<b>SS</b>	<b>Total</b>
<b>AS</b>	14	18	19	13	26	90
<b>EN</b>	1	5	0	0	2	8
<b>AG</b>	1	14	1	1	0	17
<b>HE</b>	3	5	0	2	4	14
<b>BA</b>	3	2	8	2	3	18
<b>ED</b>	5	0	3	11	2	21
<b>Total</b>	27	44	31	29	37	168

**Table 1.2 Question 2.5 Context-Choice by College**

	<b>NC</b>	<b>AG</b>	<b>BU</b>	<b>ED</b>	<b>SS</b>	<b>Total</b>
<b>AS</b>	11	2	65	10	2	90
<b>EN</b>	3	1	3	0	1	8
<b>AG</b>	3	11	3	0	0	17
<b>HE</b>	1	0	10	3	0	14
<b>BA</b>	4	0	14	0	0	18
<b>ED</b>	3	0	16	2	0	21
<b>Total</b>	25	14	111	15	3	168

**Table 1.3 Question 2.6 Context-Choice by College**

	<b>NC</b>	<b>AG</b>	<b>BU</b>	<b>ED</b>	<b>SS</b>	<b>Total</b>
<b>AS</b>	11	1	9	5	64	90
<b>EN</b>	3	1	0	1	3	8
<b>AG</b>	3	5	0	0	9	17
<b>HE</b>	1	1	0	2	10	14
<b>BA</b>	4	0	4	1	9	18
<b>ED</b>	3	0	3	4	11	21
<b>Total</b>	25	8	16	13	106	168

For the first assignment, of the students who had the option of selecting a context similar to their major, 58.93% did so (33/55). For the second assignment, 48.21% of the students who could choose problems within the same context as their major did so on the first problem and 23.21% did on the second problem. Each of the problems were also analyzed using a standard  $\chi^2$ -statistical test to determine if student major influenced choice of context. Results from the first context choice problem given (denoted 1.1 in analysis, tables and graphs) yielded a  $p$ -level of  $3.345 \times 10^{-8}$ . The  $p$ -levels found for the problems on the second assignment (denoted 2.5 and 2.6 in analysis, tables and graphs) were  $1.55135 \times 10^{-12}$  and 0.000359 respectively.

Additional analysis was done using student choice in an attempt to determine possible factors that influenced choice other than the students' program of study. It was hypothesized that student choice was influenced by the order in which the contexts were listed (i.e. students chose whichever context was listed first). Of the 168 students who participated in the assignment, 44 chose the first option on the first assignment (26.19%), 111 chose the first option on problem 4 of assignment 2 (66.07%), and 106 chose the first option on problem 5 of assignment 2 (63.10%). A  $\chi^2$ -statistical test was again used to test the null hypothesis, "student choice was not determined by which context was listed first." The test yielded a  $p$ -level of  $2.4006 \times 10^{-6}$ .

Further analysis considered a possible correlation between student choice of context and exam scores. Researchers divided students into two groups. The first group (Group A) is compiled of those students who chose at least two of the three problems from the same context and the second group (Group B) included students who chose problems from different contexts. The idea was that students in Group A intentionally considered problems of interest while the students in Group B chose problems at random. Table 1.4 displays the grades of students in Group A and Group B for Exam 1 (given soon after assignment 1), Exam 2 (given shortly after

assignment 2) and the final exam. Table 1.5 provides the mean percentage earned by students in of the two groups.

**Table 1.4 Student Exam Grade by Group**

		Grade On Exam				
		A	B	C	D	F
Exam 1	Group A	27	26	25	6	6
	Group B	11	6	6	2	1
Exam 2	Group A	46	31	43	17	13
	Group B	10	8	5	2	3
Final Exam	Group A	51	38	31	13	12
	Group B	11	9	5	2	1

**Table 1.5 Average Exam Grade (Percent) Earned by Students in Group A and Group B**

Mean Percent for Group A and Group B			
	Exam 1	Exam 2	Final Exam
Group A	75.9%	70.4%	69.4%
Group B	74.6%	67.4%	63.4%

A standard two-tailed hemeoscendastic t-test conducted on Group A and Group B for each of the exam categories yielded  $p_I=0.6561$ ,  $p_2=0.0931$ , and  $p_F=0.2691$ .

### Affect Analysis

The spring attitude survey can be found in Appendix B. The attitude survey was analyzed in two different manners. For the Likert-scale portion of the survey, responses were assigned a value between one and five. Positively worded questions were given a rating of one for *strongly disagree* and ranged to a five for a *strongly agree* response, with ambivalent receiving a value of 3. Negatively worded statements, numbers one and seven, were rated in reverse order. That is, *strongly agree* responses were given a value of one and *strongly disagree* a value of five (i.e. positive responses were given higher ratings and negative responses were assigned lower ratings). A total of 25 students responded to the survey. Each student's average response was also calculated. Mean student response was 2.639 with standard deviation of 0.545. Since this is below 3, it is consistent with a sense that students mildly disliked this assignment. A rating of 2.16 on question one indicated that student attitudes were slightly more negative. In other words,

students somewhat agreed that the assignment was more complicated than the usual written homework. The rating of 2.42 on question seven indicated that they somewhat agreed with the statement “the lesson was irrelevant to my life.” On the other hand, the mean of 3.04 for question 2 suggests students were at least ambivalent about the option of choosing the context for their problem while the mean of 3.24 for question 4 indicated students saw at least some value in the material they covered in this assignment. Central tendency values for each of the questions are recorded below in Table 2.1.

**Table 2.1 Central Tendency by Question Spring Attitude Survey**

	<b>Questions</b>							
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>
<b>Mean</b>	2.16	3.04	2.72	3.24	2.52	2.64	2.42	2.36
<b>Median</b>	2	3	2	3	3	3	2	2
<b>Mode</b>	1	3	1	3	3	3	2	1
<b>St. Dev.</b>	1.07	1.40	1.57	1.23	1.16	1.35	1.32	1.29

Again, student responses were divided into two groups A and B defined in the same way as above. Mean student response for Group A was 2.582 with standard deviation of 5.20. The mean response for Group B was 2.725 with standard deviation of 0.597. Conducting a two-tailed heteroscedastic t-test yielded a  $p$  -level of 0.5460, so one cannot reject the null hypothesis that the two groups had similar views.

To analyze the free-response portion of the attitude survey, investigators identified recurring themes in student responses for each of the questions. These identified themes can be viewed in Table 2.2

**Table 2.2 Identified Themes in Free-Response Question Responses**

<p><b>9. How did you select the problems you chose to complete (N=19)</b></p>	<ul style="list-style-type: none"> <li>• Chose the problem that looked the easiest (5)</li> <li>• Interest/Major (4)</li> <li>• Computer problems encountered influenced choice (2)</li> <li>• Selected first problem listed (3)</li> <li>• Chose a problem that appeared to include something that looked familiar (2)</li> </ul>
<p><b>10. What did you like or dislike about this assignment? (N=20)</b></p>	<p style="text-align: center;">NEGATIVES</p> <ul style="list-style-type: none"> <li>• Turning it in online (7)</li> <li>• There were no examples to follow or assist in understanding how the problems were to be done (4)</li> <li>• Assignment was difficult to understand (2)</li> <li>• Experienced technical problems (2)</li> <li>• Difficult to show work or unclear how much work to include (3)</li> <li>• Required to use Excel (2)</li> </ul> <p style="text-align: center;">POSITIVES</p> <ul style="list-style-type: none"> <li>• Included something that could be used or applied (1)</li> <li>• General positive response(1)</li> <li>• Done online (2)</li> <li>• Had freedom to chose which problem to complete (1)</li> </ul>
<p><b>11. Do you have any suggestions for further assignments of this type? (N=12)</b></p>	<ul style="list-style-type: none"> <li>• Do not have the assignment turned in online (3)</li> <li>• Do not have the work done on a spreadsheet (1)</li> <li>• Did not want further assignments of the type (1)</li> <li>• Have all the assignments done online or all in the book (1)</li> <li>• Allow students the choice whether to do the assignment online or written and turned in (1)</li> </ul>

For each student's complete responses see Appendix B. Interview responses were analyzed in a similar manner (see Appendix D for complete interview responses pertaining to this study). From the attitude survey responses, most students first determined which context-choice problem appeared to be the easiest and then used that to decide which context to select (26.263%). Of the twenty students to respond to question ten, 20% commented that their biggest complaint was that

there were no examples on the assignment to follow. The most prominent suggestion was to adjust the assignment in a way that would minimize frustrations associated with turning the assignment in online.

### **Achievement Analysis**

To test the possible effect of the assignment on the student achievement, the scores of eight groups were collected. The groups were analyzed in pairs to determine if one group scored significantly better than the other. The union of Groups A and B make up the entire sample population. The same is true for the union of Groups E and F as well as the union of Groups G and H. Groups C and D were taken as subsets of Group A such that the union of Group C and Group D is Group A. The groups were defined as follows:

Group A .....Two or more of choices were from the same context (N=89)

*Group A is defined the same as in earlier analysis*

Group B.....None of choices were from the same context (N=96)

*Group B is defined the same as in earlier analysis*

Group C.....All three choices were from the same context (N=12)

Group D .....Only two of choices were from the same context (N=77)

Group E.....Chose first context listed on all problems (N=25)

*Problems denoted as 1.1, 2.5, and 2.6 in results*

Group F .....Chose something other than first context listed for at least one problem  
(N=160)

Group G .....Chose first context listed for both problem 2.5 and problem 2.6 (N=95)

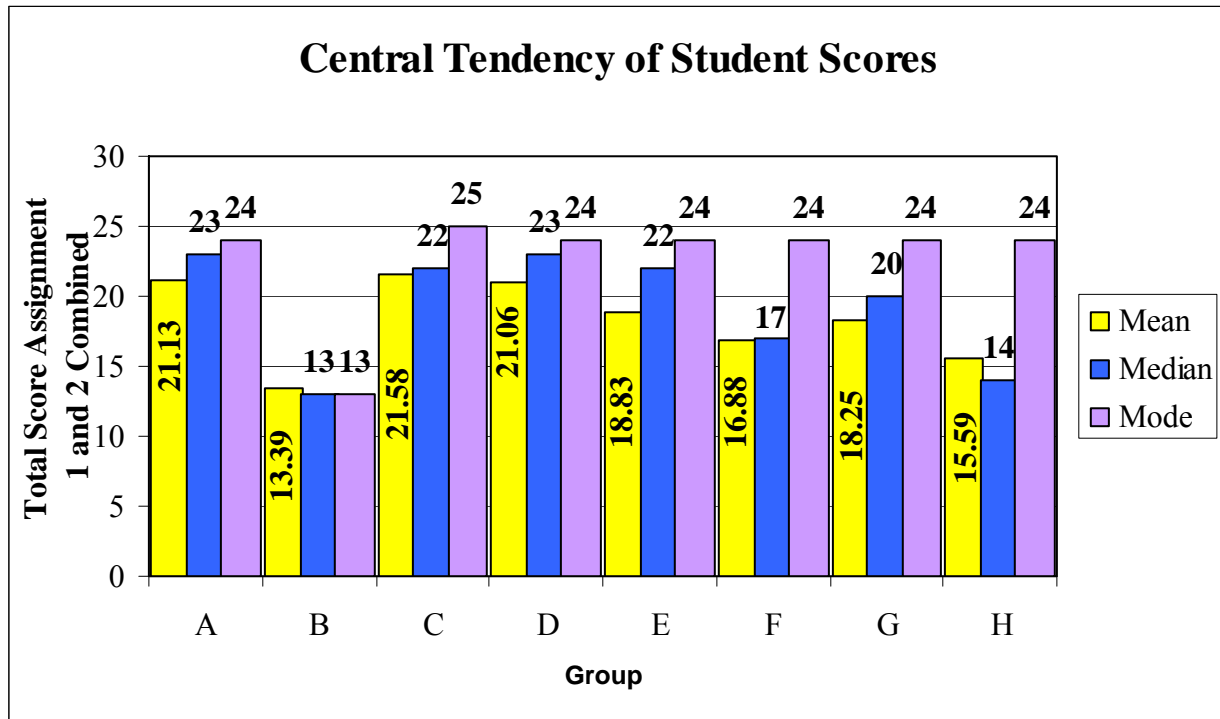
Group H .....Chose something other than first context listed for either problem 2.5 or  
problem 2.6 (N=86)

*(Note that 4 students did not attempt a context-choice problem on the second assignment.)*

Results from the scores of students in Group A were analyzed against the scores of students in Group B, Scores from students in Group C were compared with scores from students in Group D. The scores of students in Group E were compared with scores of students from Group F. Finally, student scores from Group G were analyzed in comparison with student scores from Group H.

Central tendency analysis conducted on the total scores (both assignments combined) for each of the groups is compiled in Graph 3.1.

**Graph 3.1 Total Score Central Tendencies for Spring Assignments 1 and 2**



Further analysis was conducted to compare student achievement on the context-choice problems and achievement on the other, standard text-book problems on the two assignments. Standard two-tailed heteroscedastic t-test analysis produced *p*-levels that are compiled in Table 3.1.

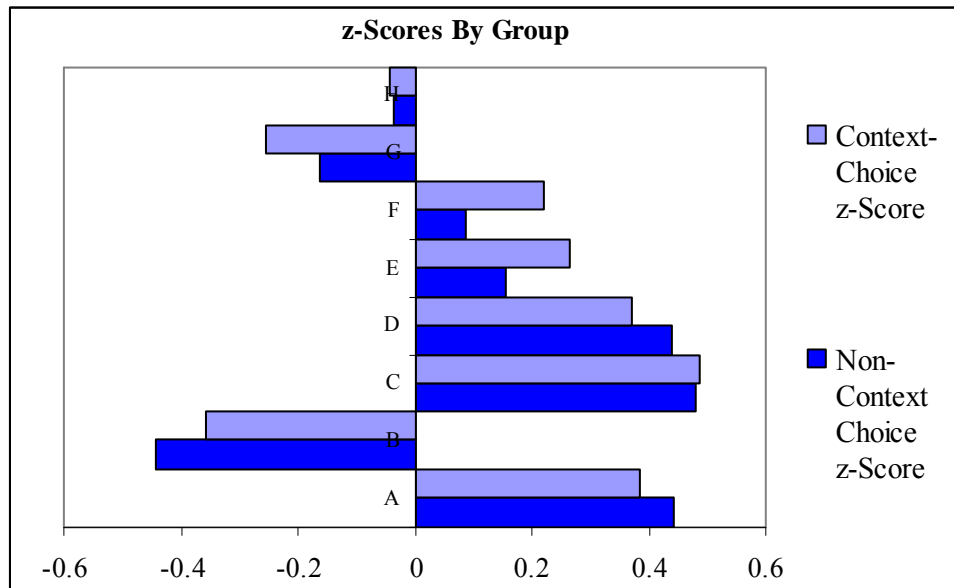
**Table 3.1 *p*-Values of t-Test Analysis Comparing Mean Scores of Groups**

		<i>p</i> -Value by Problem Type		
		Total Score	Non-CC	CC
GROUPS	A versus B	2.16712E-11	1.9692 E-10	1.91716E-07
	C versus D	0.7154	0.8203	0.6855
	E versus F	0.2311	0.3073	0.1432
	G versus H	0.0454	0.1010	0.0014

Average scores for context-choice problems and non-context choice problems are converted to z-scores and are illustrated in Graph 3.2. Z-scores indicate how many standard deviations each observation differs from the mean ( $z = \frac{x - \mu}{\sigma}$ ,  $\mu$  = population mean,  $\sigma$  = standard

deviation of population,  $x$  = raw score to be standardized). They provide a less deceptive graphical representation of the data.

**Graph 3.2 Spring Assignment 1 and 2 Mean scores on Context-Choice problems and non-Context-Choice problems by Group**

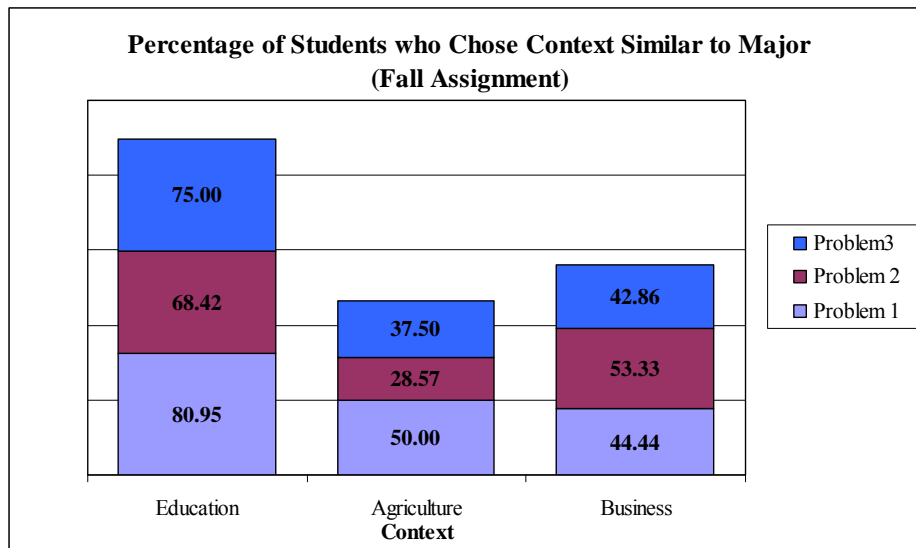


### Fall Analysis

Since the fall assignment was conducted as a trial run, little analysis was done. Its primary purpose was to test the quality of the assignment and receive student feedback as to the effectiveness and clarity of the assignment. Investigators did compare student choice with student majors. Graph 4.1 displays the percentage of students who chose contexts similar to their major for each of the three context-choice problems on the assignment. Again the  $\chi^2$ -test was conducted producing  $p$ -levels of 0.0005, 0.0680, and 0.0111 for problems one through three respectively.



**Graph 3.3 Fall Results of Context-Choice Comparison with Major**



The attitude survey given in the fall was analyzed in the same manner as the Likert-scale portion of the spring attitude survey except that values ranged from one to four (instead of zero to five) with ambivalent given a rating of 2.5. The mean student response was found to be 2.38. In addition to the total attitude, the design of the survey lent itself to analysis of four themes, the difficulty of the lesson, the usefulness of the material (or math) to life, the quality of the assignment, and the student’s perception of their own understanding of the material in the assignment. Table 4.2 displays the central tendencies for each of the themes and total student attitude.

**Table 4.2 Central Tendency of Fall Attitude Survey By Theme**

	Mean	Median	Mode	St.Dev
<b>Difficulty</b>	2.39	2.35	2.24	0.24
<b>Relevance</b>	2.34	2.22	2.22	0.73
<b>Understanding</b>	2.27	2.00	2.00	0.78
<b>Quality of Assign</b>	2.50	2.50	1.67	0.67
<b>Total</b>	2.38	2.18	2.16	0.46

## CHAPTER 4 - Discussion and Further Research

### Context Choice and Interest

For each statistical test conducted,  $p$ -levels less than 0.05 resulted in a rejection of the null hypothesis being tested. That is, if  $p < 0.05$ , it was concluded that the two samples correlated.

Addressing the first research question, investigators found that while interest and major are not the only determining factors of student choice of context, there is a correlation. The  $\chi^2$ -test conducted produced a  $p$ -value of .99 for each of the three context-choice problems given in the spring, indicating a very strong correlation between major and student choice of context. Even though students did not select contexts exclusively similar to their major, it can be expected that major did impact student choice of context. When discussing student choice of problems, it is worth looking at the number of students who chose the first context listed on the second assignment compared to the number of students who selected the first context listed on the first assignment. On the first assignment 26.19% (44/168) of the students chose the first context listed, on the first context-choice problem of the second assignment 66.07% (111/168) of the students chose the first option listed, and on the second context-choice problem of the second assignment 63.10% (106/168) of the students chose the first context listed. Some of this could be a result of interest but it is unlikely. Another factor to consider would be on the first assignment, Agriculture was the first context listed. On the second assignment, Business and Social Science were the contexts listed first respectively. For the student population, Agriculture is a much more limiting subject area than Business and Social Science. However, the significant jump in percentage from assignment one to assignment two would suggest that students gave less consideration to the context on the second assignment compared to the first. One possible explanation for the drastic change could be the timing in which the two assignments were given during the calendar year. As mentioned in the methodology, the first assignment was given during week five of the semester, a standard week of the school year. Assignment two was given during week nine, the week prior to the spring break holiday for the students (with a due date the week after spring break). It would not be unreasonable to think that this played a significant part in the phenomenon observed. Another possible explanation is that students tire of the work and

demands of the problems. Consider that the average score per problem on the first assignment was 1.11 and 1.04 on the second. When conducting a t-test on the scores of the first assignment and scores on the second assignment, a  $p$ -level of 0.0353 was found. That is students scored significantly better per problem on the first assignment than the second. While several factors could contribute to this result (more difficult assignment, different format, more context-choice problems and less standard book problems, etc) it does prompt further investigations into the optimum timing and frequency of assignments of this type.

The fall assignment substantiates the claim that major impacts context choice. Even though the environment in which the fall assignment was given was very different than the assignments given in the spring, similar trends can be observed. Like the spring, statistical test indicated a strong correlation between major and student choice of context ( $r_1=0.9995$ ,  $r_2=0.9320$ ,  $r_3=0.9889$ ).

Student interviews and the attitude survey provide further confirmation of the research hypothesis. In interview responses, the primary reason for choosing a particular context was major or interest. Question nine from the attitude survey further confirmed this with interest or major listed as the second most common reason for problem selection.

The value of the findings is found within the context of motivation research. Motivation research indicates that increasing student interest correlates with a better quality of experience, which in itself is a desired outcome. The research also claims that increased interest correlates with increased achievement, though the causal relationship between interest and achievement is not yet determined.

### **Context-Choice and Affect**

The second research question hoped to further investigate the effect of context-choice on the quality of experience. However, data investigating this relationship did not allow for any decisive conclusions to be drawn. Analysis indicated the opposite affect than desired, though results were not conclusive. Students who chose problems from the same context (Group A) reported a lower attitude score than students who appeared to give little attention to selecting problems of similar contexts (Group B). Though not statistically significant, the mean attitude response of students participating in the attitude survey which were in Group A was 2.58 and the mean response of students taking the attitude survey which were in Group B was 2.73 ( $p$

=0.4680). However, since these are not statistically significant, no conclusion can be drawn about the effect of context choice on student attitude. In the fall attitude survey students did not indicate any strong feelings in favor or against the assignment.

Based on results from the spring attitude survey and student interviews, it appeared as if technical issues impacted student attitude more than having a choice of context. While little was said in the free-response portion of the attitude survey about the choice of context, 85% (17/20) of the students commented that they did not like the format of the assignment (i.e. the assignment done on the computer) or that they experienced some form of technical problems during the assignment. The format, it appears, presented too many variables to accurately determine the effect of student choice on attitude or affect.

### **Context-Choice and Achievement**

Achievement was not a central focus of the study but there were interesting results that emerged from the analysis of achievement within the study. The result that students who chose problems from the same context scored significantly higher on the assignments was not surprising (see Graph 3.1). It is worth noting that students from Group C did not score significantly higher than students in group D ( $\mu_C=21.58$ ,  $\mu_D=21.06$ ). From this it would be reasonable to expect that there was a correlation between students choosing a context of interest to them and higher achievement but that it is not the only contributing factor to the increase in achievement. This supports findings from the motivation research.

In an attempt to get a better grasp on what the possible effects were on achievement, further analysis was done to uncover what other factors influenced achievement within the context of the study. From the Group A-H analysis, investigators found that students who did not select the first context listed scored better than those who did, that is Group E scored better than Group F, and Group G scored better than Group H (see Graph 3.1). T-tests indicated that the difference between Groups E and F were not significantly different. Thus, even though the students who chose at least one option that was not listed first scored better, it was not significantly better than those who chose the first option on all three assignments. This same result was found in the analysis of the total score of those who did not choose the first option on both problems on the second assignment (Group H) compared with those who did choose the first option on both problems of the second assignment (Group G). Interesting to note, however,

is that when the total score was broken down into problem type (context-choice and non-context-choice) it was found that Group H did score significantly higher than Group G on the context-choice problems. That is to say that on the problems where students were allowed to select the context of the problem, students who did not just pick the first option listed on the second assignment scored better than those who did not look beyond the first option.

All of this prompted researchers to consider that the initial results of the Group A-H analysis could be misleading. They hypothesized that context-choice did not affect achievement but rather Groups A-H were pre-determined by student characteristics. Rather than context determining achievement, student characteristics determined achievement. These characteristics self-selected students to fall into the various groups A-H. For example, highly motivated, high achieving students are students who select problems of interest to them. To test this hypothesis exam grades were considered in the analysis. Results from t-test analysis proved to be inconclusive. That is, even though on average, students who chose problems from the same context scored higher on exams than those students who chose problems from different contexts, the difference is not statistically significant. This is an area that needs further research in order to draw solid conclusions.

### **Further Research**

The possible variables affecting the results of this study prompt further investigations into the impact of each variable on the results. The location of the assignments within the school calendar appeared to play a role in student attention to context. While most instructors would claim they already know this, it would be of interest to investigate further the impact of timing of assignments on student interest. Does the time in which the assignments are given during the semester affect student participation and attention to learning? Also, does the frequency of context-choice assignments affect student participation and to what degree (does increased frequency decrease attention to context)?

It was also found that students often chose the first context listed, more on the second assignment than the first. Could the order of context play a role in student selection? For example, on the first assignment, Agriculture was listed first, while Business and Social Science were listed first on the second. Did more students choose a different context on the first

assignment because Agriculture is a difficult subject for students to relate to while Business and Social Science are less specific and appeal to a larger student population?

There were other more general questions raised by researchers. What is the effect of student experience on context selection? Are seniors more likely to choose a context of interest to them than freshman? What are the differences between traditional and non-traditional students in context selection? Are there particular majors that would benefit more from assignments in this format than others? What would the long-term effect of context-choice be on student attitude (throughout the course of the entire semester)? These are all possible areas of further research in the area of context-choice within mathematics.

## References

- Blackwell, L., Trzesniewski, K., & Dweck, C (2007). Implicit Theories of Intelligence Predict Achievement Across an Adolescent Transition: A Longitudinal Study and Intervention. *Child Development, 78*, 246-263.
- Boggs, D. and Bennett, A (2008). Proceedings of the CRAFTY Curriculum Foundations Project, March 27-28. Manhattan, KS.
- Caine, R., Caine, G., McClintic, G & Klimek, K. (2005). 12 Brain/Mind Learning Principles in Action: The Fieldbook for Making Connections, Teaching and the Human Brain. Corwin Press, Thousand Oaks, California.
- CUPM Curriculum guide 2004
- Ganter, S.L. and W. Barker (Eds., 2003). A Collective Vision: Voices of the partner disciplines, MAA Reports, Mathematical Association of America, Washington, DC.
- Gottfried, A.E., Fleming, J., & Gottfried, A. (2001). Continuity of Academic Intrinsic Motivation From Childhood Through Late Adolescence: A Longitudinal Study. *Journal of Educational Psychology, 93*, 3-13.
- Hitz, W. and Scanlon, D. (2001). Effects of Instructional methodologies on Student Achievement, Attitude and Retention. Proceedings of the 28<sup>th</sup> Annual National Agricultural Education Research Conference. New Orleans, LA.
- Köller, O., & Baumert, J. (2001). Does Interest Matter? The Relationship Between Academic Interest and Achievement in Mathematics. *Journal for research in Mathematics Education, 32*, 448-470.
- Meece, J., Anderman, E., & Anderman, L. (2006). Classroom Goal Structure, Student Motivation, and Academic Achievement. *Review in Advance, 57*, 487-503.
- Middleton, J. & Spanias, P. (1999). Motivation for Achievement in Mathematics: Findings, Generalizations, and Criticisms of the Research. *Journal for Research in Mathematics Education, 30*, 65-88.
- National Association of Secondary School Principals. (1996). *Breaking ranks: Changing an American Institution*. Reston, VA: National Association of Secondary School Principals.

- Schiefele, U. & Csikszentmihalyi, M. (1995). Motivation and Ability as Factors in Mathematics Experience and Achievement. *Journal for Research in Mathematics Education*, 26, 163-181.
- Spinath, B & Steinmayr, R. (2008). Longitudinal Analysis of Intrinsic Motivation and Competence Beliefs: Is There Relation Over Time? *Child Development*, 79, 1555-1569.
- Stipek, D., Salmon, J., Givvin, K. & Kazemi, E. (1998). The Value (and Convergence) of Practices Suggested by Motivation Research and Promoted by Mathematics Education Reformers. *Journal for Research in Mathematics Education*, 29, 465-488.
- Tomlinson, C. (2003). Fulfilling the Promise of the Differentiated Classroom: Strategies and Tools for Responsive Teaching. Association for Supervision and Curriculum Development, Alexandria, Virginia,
- Wormeli, R. (2007). Differentiation From Planning to Practice Grades 6-12. Stenhouse Publishers, Portland, Maine.



## Appendix A - Fall Attitude Survey

Would you

- a. Strongly agree
- b. Somewhat agree
- c. Disagree
- d. Strongly disagree
- e. Ambivalent

1. This lesson is something learned quickly by most people.
2. I had trouble understanding this lesson because of how I think.
3. The problems given were easy to understand.
4. I was under stress during this lesson.
5. This lesson is irrelevant to my life.
6. I understood how to apply analytical reasoning to this lesson.
7. Learning the material in this lesson required a great deal of discipline.
8. I have no idea of what's going on in this class.
9. I liked this lesson.
10. What I learned in this lesson will not be useful in my career.
11. Most people have to learn a new way of thinking to do this lesson.
12. This lesson was highly technical.
13. I felt insecure when I had to do this homework.
14. I found it difficult to understand the concepts in this lesson.
15. I enjoyed this lesson.
16. I made a lot of errors when applying the mathematical concepts in this lesson.
17. This lesson involved memorizing a massive collection of facts.
18. This was a complicated lesson.
19. I can learn the concepts presented in this lesson.
20. The lesson is worthless.

21. I am scared of math.
22. Mathematical conclusions are rarely presented in everyday life.
23. Mathematical concepts are easy to understand.
24. Math is not useful to the typical professional.
25. The thought of taking a math courses scares me.
26. I like math
27. I find it difficult to understand mathematical concepts.
28. I can learn math.
29. Mathematical skills will make me more employable.
30. Math is a complicated subject
31. I use math in my everyday life.
32. Mathematical thinking is not applicable to my life outside my job.
33. Math should be a required part of my professional training.
34. The material learned will better prepare me for my area of study.
35. I see value in the material I learned.
36. The material I learned was new information.
37. I picked questions that I felt applied to my major area of study.

## **Appendix B - Spring Attitude Survey**

### **Likert-Scale Questions**

For each of the following statements, please answer with the response that best reflects your opinion of the homework assignment 6 over sections 3.3-3.5.

Would you say you:

- (1) Strongly agree
- (2) Somewhat agree
- (3) Ambivalent
- (4) Disagree
- (5) Strongly disagree

- 1. This lesson was more complicated than usual written homework.
- 2. I like the option of choosing which type of problems I complete.
- 3. I prefer turning in my homework online over handing in written homework.
- 4. I see value in the material I learned.
- 5. The material learned will better prepare me for my area of study (major).
- 6. What I learned in this lesson will be useful in my career.
- 7. This lesson is irrelevant to my life.
- 8. I can learn math.

### **Free-Response**

#### *Questions*

- 9. How did you select the problems you chose to complete?
- 10. What did you like or dislike about this assignment?
- 11. Do you have any suggestions for further assignments of this type?

## *Responses*

Student 1:

9. I chose which problems seemed easier.
10. I do not like turning assignments in online.
11. Not to turn in assignments in online anymore. It is better to have written homework, and then also to “online homework”.

Student 2:

9. Which I fell [is] interesting.
10. I like the assignment. It helps me to understand more and learn how to actually use the knowledge from the lecture
11. Not so far.

Student 3:

9. I didn't have a choice. When I downloaded the spreadsheet the tabs did not show up so I therefore had to do the first question.
10. I don't like doing it online. I hate the way the computer jams everything together and I have a harder time of showing my work.

Student 4:

9. Whatever was first.
10. I understood it. I have problems with math, so I like this area.
11. I like it online. It is easier to turn in and saves paper

Student 5:

9. I went with the one that seemed easier to understand.
10. I can understand the problems, but I can't compare them with problems in the book to try and make sense of them

Student 6:

9. My major
10. It is way too hard to complete online. I like written much better
11. Yes, I really do not ever want to take online written homework again. I like the online regular assignments because it shows the worked problems, but it is too hard to type out work online, and it is much more complicated.

Student 7:

9. Which ever one looked less complicated. I didn't want to confuse myself.
10. I didn't understand any of it but I prefer this method over sliding papers in a mailbox.
11. No. It was straightforward.

Student 8:

9. If they are odds.
10. The spreadsheet problems. I cannot access them.
11. No spreadsheet questions. That is what we do in studio not for recitation and lecture.

Student 9:

9. Tried to pick out the easiest ones.
10. There was no explanation or examples.

Student 10:

9. Major.
10. I hate typing the equations online. It is not fun!
11. No more assignments of this type!

Student 11:

9. I am more interested in the business side of things.
10. I do not like how I cannot show my work. This was the assignment is based only on my answer and does not recognize how much effort I put forth.
11. Sorry, no suggestions.

Student 12:

9. I chose the problems I complete to my major and can relate better to it.
10. Of course I'm not a math major and not very good at math so I don't like it but I do like being able to turn it in online. It is easier for me to remember to turn it in instead of having to go back to the math hall to turn it in.
11. N/A

Student 13:

9. Fine
10. I prefer to do the written homework
11. I feel good for now.

Student 14:

9. I do not have Excel or any programs like Excel. This made it very difficult to complete the portion of the homework that required it. It was my mistake to wait til the night before the assignment was due to see that Excel was required to complete it, but it seems unfair nonetheless.
10. I disliked the necessity of Excel and also the inability to see example right in front of you (as the book does). I purchased the book already and it annoyed me that I would have to buy Excel in addition to the book just to complete regular homework assignments. It seems unfair to have to buy the book and Excel in order to complete homework assignments.
11. I suggest that the assignments we complete all be in either online or the book

Student 15:

9. What I was most familiar with
10. I would rather work my answers out on paper and turn them in.
11. Let us choose whether we would like to submit the assignment online or in the box.

Student 16:

9. I just did the first problems that came up.
10. I disliked the whole internet assignment. I do better with written assignments that can be linked with parts of the lessons in the book.
11. N/A

Student 17:

9. Knowledge, interest
10. I don't like using Excel for written homework.
11. I do not like turning written homework in online.

Student 18:

9. First ones
10. I dislike because it is hard to show all the work I did

Student 19:

9. What was easier for me to understand in situations that I could relate to.
10. I liked being able to choose the types of problems I wanted to solve.

Student 20:

10. That it was online. I lost my work *three* times because of faulty internet and since most of my work was online in the boxes, I lost it every time. This is an extremely frustrating and time consuming way of doing homework and I hope we never do it again. I'm going to take a low score instead of letting it consume more of my time.

## **Appendix C - Interview Protocol**

*Prepare for the interview at least 5 minutes before the scheduled time. Unlock the conference room (Reta has the key) and leave the door open. Set out the IC Recorder, two copies of the Informed Consent form and a pad of paper for students to write or draw on as needed when they answer the questions. Have a calculator and a copy of the student's recent Studio College Algebra Exam available.*

*When the student arrives, introduce yourself and welcome the student by name. Close the door to the conference room. Ask for permission to record the interview. If permission is granted, start the recorder.*

*Explain the purpose of the interview:*

We are interviewing students in Studio College Algebra to better describe the characteristics of students enrolled in the class. This is prompted by a desire to understand how different students react to certain aspects of the course, how they set about learning the material, and their level of conceptual understanding. The general goal is to use this information to improve teaching and assessment. This interview should take approximately 20-45 minutes. Your participation is completely voluntary and your grade will not be affected by your answers in this interview. You will receive \$10 for your time for participating in this interview and you may also benefit by improvements in instruction in mathematics and by having a chance to go over the most recent exam with an instructor. In the event we include any of your comments in a discussion or publication about our findings, your privacy will be maintained by the use of a pseudonym. We have two copies of an Informed Consent Form for you to sign, one for our records and one for you to keep.

*Have them read and sign the form. If they decline to sign the form, thank them for their time and terminate the interview. Otherwise sign and date the form as witness and then proceed to the questions below.*

*Background/Attitude Questions. Stay aware of the time and try not to let this section exceed 20 minutes so you have time for the rest of the material. In the (unusual) event that a student wants to spend more than 20 minutes on this, explain politely that you need to get to*



*some additional questions and promise them they will have a chance to make more comments at the end.*

1. Describe your feelings towards mathematics at the beginning of the semester as you entered into this course.
2. What is your view about mathematics? Learning mathematics?
3. How do you usually study for math assessments?
4. Did you study differently for assessments in this course? Explain.
5. If you get stuck on a problem or have trouble understanding a concept, what do you do? *Ask them to explain why they choose to seek help or not.*
6. How did you prepare for the most recent exam? *If necessary, ask for elaboration: memorizing formulas, going through previous exams, redoing online homework, etc.*
7. How much time outside of class do you normally spend each week on College Algebra- related work? Ask them to specify which activities make up this time.
8. How did you study for the online assessments in this course?
9. Did you utilize the written help tutorials in the online homework assignments?
10. Do you feel the written tutorials were beneficial? Why and/or how were they beneficial?
11. What changes would you suggest to be made to the written tutorials to make them more beneficial?
12. In the future, would you be more or less likely to view written tutorials for assistance on assessments or other course work?
13. Did you utilize the video help tutorials in the online homework assignments?
14. Do you feel the video tutorials were beneficial? Why and/or how were they beneficial?
15. What changes would you suggest to be made to the video tutorials to make them more beneficial?
16. In the future, would you be more or less likely to view video tutorials for assistance on assessments or other course work?
17. Recently you completed a written homework online. How did you select which problems to complete?

18. What did/didn't you like about the assignment?
19. What suggestions would you make in order to improve the assignment?
20. What are your future career goals?
21. Do the online assessments cover information that you feel is important to know for your future? Explain why/why not.
22. What aspect of the algebra class (lecture, recitation, written homework, online homework, studio) have you found most helpful? Ask them to explain why this has been helpful.
23. What aspect of class (lecture, recitation, written homework, online homework, studio) have you found least helpful? *Ask them to explain what the problems with this aspect of the class are.*
24. Is there any questions that I have forgotten to ask or do you have any other comments you would like to make?

I will now hand over short survey for you to complete about your confidence levels and learning environment preferences. Please read the directions and feel free to ask questions. Answer any questions the student has about the survey. *After they finish, ask if they have any comments they want to make about their answers.*

Concept Questions. *This section should take 5 – 10 minutes.*

25. Now I want to ask you a few questions about some basic mathematical concepts.
26. What is a function?
27. What are the different ways you know to represent a function? (Ask for up to 3 representations, or until the student runs out of ideas)?
28. Can you explain how [definition 1] and [definition 2] are related? Ask this question for a particular pair of definitions.
29. Can you give me a few examples of how functions are useful? If the student gets stuck, ask them to name a few specific functions and describe their important characteristics.

Problem Solving. *This section should take 15 minutes or less.*

I will now hand you a copy of your previous exam. The exam was designed to encourage students to use several different methods of problem solving. So that I can get a better understanding of your thought process, please explain how you approached and worked through

each circled problem. Feel free to make notes on the paper, and please talk through your approach out loud for the recorder.

*After the student has explained how they attempted each of the three circled problems, remind them that they can ask other questions they have about the exam.*

*Other comments.*

*Are there any comments or questions you would like to make about learning algebra?  
Ask follow-up questions or provide answers (if you know the answers) as appropriate.*

*Thank the student for participating. Let them know they are always welcome to email any additional comments or suggestions for the course the researcher.*

*Stop the recorder. Fill out the receipt.*

## Appendix D - Interview Responses to Questions 17-24

### Interview 1

RESEARCHER: ...Alright, so do you remember the homework assignment... it was a written homework assignment, but you did it online?

STUDENT: Yeah.

RESEARCHER: Where you had the four choices of different problems you could do?

STUDENT: Hmhmm.

RESEARCHER: You had a Agriculture, Business, Education, a Social Science. Do you remember which one you did?

STUDENT: I think I did education.

RESEARCHER: Do you know why you picked that?

STUDENT: Because I'm going into education.

RESEARCHER: OK, so what did you think of the problem? Was it interesting, helpful, useless, what?

STUDENT: I... don't really remember to be honest (laughs).

RESEARCHER: Okay.

STUDENT: It was probably more useful than if I'd picked Ag or something, but I really don't remember.

RESEARCHER: Would you like to see more assignments like that, or did it not really matter?

STUDENT: Um, online is too hard to put in work. Like, show everything. Couldn't explain what I did. I like written.

RESEARCHER: Okay. Um, what are your... well you already told me a little bit, but what are your future career goals?

STUDENT: Um, I'm going to major in education and minor in music and hopefully do history education in high school.

RESEARCHER: Okay, uh, do you feel that any of these assignments or anything from this class will be useful in your future career?

STUDENT: So far, mostly just the tax stuff, and like the things that they actually give us situations that would show up in real life, that we'd have to use these things to solve.

RESEARCHER: Like what?

STUDENT: Um, like we're doing some Excel stuff, so if I have to do sheets on those for school grades or something, and then the tax stuff and setting up equations for those kinds of things.

RESEARCHER: Okay. Um, just kind of in general, what aspect of this class have you found the most helpful? And I'll go through the ones I'm talking about: lecture, recitation, written homework, online homework, studio, what's been the best for you?

STUDENT: Probably recitation.

RESEARCHER: Why's that?

STUDENT: 'Cause... in it we go through the book homework and I can go back and make sure that get at least a decent grade. And she goes over them, and she explains stuff more in detail than in lecture, so I get it more.

RESEARCHER: Okay, what have you found the least helpful?

STUDENT: Studio.

RESEARCHER: Studio?

STUDENT: I didn't know what I was signing up for, I thought it was required. So...

RESEARCHER: So you think you would have liked the other section better?

STUDENT: Probably. It... it's not hard, it's not much extra work, so... probably.

RESEARCHER: Okay, um... do you have any suggestions for how to improve the class? This is still a fairly new class and we're adjusting it and do you have any suggestions for making it better?

STUDENT: I don't think so... it's... it fairly works for me, so.

RESEARCHER: Okay.

## Interview 2

RESEARCHER: Okay. Um, you've had two written assignments in this class where you've turned them in online. You know what talking about? I think it was section 2.5 and 3.3. And each assignment gave you the option of choosing the context of your problem. You could do, like, an agriculture, business, education, social science. I think you had something like health and one other thing.

STUDENT: Yeah I think so.

RESEARCHER: Do you remember what problems you chose for the second... or for the first assignment? What problem you chose?

STUDENT: Um... I think it had to do with business.

RESEARCHER: Alright, do you remember which ones you picked for the second assignment?

STUDENT: (Pause) Actually, I think for the second assignment, I think, I... yeah, I freaked out at 11:30 at night realized I hadn't done it, so I opened it up and realized there was no point. I did not have a chance to get it done in 30 minutes.

RESEARCHER: Okay.

STUDENT: So... I... I would... I probably would have picked business... I probably wouldn't have done Ag or the other one.

RESEARCHER: Alright, so why would you have chosen business, or why did you choose business for the first one?

STUDENT: Um, for one... because I'm in economics now and so I thought maybe there's a chance that I could kinda combine the two and learn something.

RESEARCHER: Oh, okay.

STUDENT: And, um, (makes sense to me) for whatever reason. I know what they're talking about.

RESEARCHER: Um, so what did you think of the assignment?

STUDENT: Um... the first one... there was quite a bit of work involved in it. More so than in the book. Um... I didn't like it because, I had done it... I had logged into KSOL and done all my work and then I plugged all my stuff in and I hit submit and it said you've been logged out, so I had to go back to the page and it didn't save anything that I put in.

RESEARCHER: Oh.

STUDENT: And I didn't write it down on paper, each answer. I just wrote... I just typed it up.  
Um... So I didn't like that sense of it.

RESEARCHER: So if you got the... if we got the technical issues worked out what would you think?

STUDENT: Um, I think it would be good. I wouldn't have any problem with it.

RESEARCHER: Okay. Would you like seeing more or less assignments like this?

STUDENT: Um... (with math) I'm a little more partial to the bookwork I think 'cause it's what I'm used to. What I've done forever.

RESEARCHER: Okay.

STUDENT: Yeah... I like the bookwork a little better, but I wouldn't have any problem with... I guess technology changes and everything, so adapt with it.

RESEARCHER: Alright, well... I mean the big reason for doing this assignment online was so you could choose your context. And if choosing a context is important to you, then that would be a good assignment to continue. If it's not so much, then bookwork is fine. So, what do you think about that aspect?

STUDENT: Um... I think the context... if you could choose your own context that definitely helps. Um... for one, I mean, like I said, you know what you're talking about, you have an idea of what's going on. And if I'm slightly interested in whatever they're saying even though it may not be real, um, it keeps me involved, a lot more studious in it.

RESEARCHER: Okay.

STUDENT: So...

RESEARCHER: Alright. Um, what are your future career goals? I know you said you... are in economics?

STUDENT: Uh, yeah, I'm gonna have... when I graduate from here, I'll have a kinesiology major with a business minor.

RESEARCHER: Okay.

STUDENT: And then, um, then I'll go to chiropractic school for another four years.

RESEARCHER: Okay. That's cool. Um... do you think that anything in this class has helped your future career or would be applicable?

STUDENT: Um... (pause) I don't know if just the career since it would be some help any of my other classes that would help me get to that final destination.

RESEARCHER: Okay.

STUDENT: But, I don't... the career just itself, I wouldn't say so, no.

RESEARCHER: Alright, in general, what aspect of the class has... have you found the most helpful? And I'll go through a list of what I'm talking about. Um, lecture, recitation, written homework, online homework, and studio.

STUDENT: I'd say... lecture, written homework. And um... then probably a tie between the, um, online homework and the recitation.

RESEARCHER: So why's that?

STUDENT: Um... I don't know, I never seem to get much out of recitation. Most of the questions asked aren't the ones I've struggled with on my homework myself. Um... I just don't get much out of recitation.

### **Interview 3**

RESEARCHER: Alright. Um, you have... you've have two written assignments that have been online...

STUDENT: Hmhmm.

RESEARCHER: ... where you could choose what type of problem you wanted to do.

STUDENT: Hmhmm.

RESEARCHER: And they had, like, different contexts, like, Agriculture, Business, Education... I think there was a Health, and something else.

STUDENT: Hmhmm.

RESEARCHER: Do you remember what you did for these assignments? What you chose?

STUDENT: Um, yeah, I did Education.

RESEARCHER: For all of them?

STUDENT: Yeah.

RESEARCHER: Why did you choose that?

STUDENT: Because I don't have anything really to do with Ag, so I didn't really want to pick that. And then, I was just interested in, like, Education 'cause I thought about minoring... or majoring in that. So...



RESEARCHER: That's cool. Um, what aspects of this assignment did you like and did you not like?

STUDENT: Um, I like that you got to pick, like, something, I guess, you know... if you were majoring in Ag, you got to pick that, or if you were majoring in Business, you got to choose that option. It was just kind of something that, like, you could relate to.

RESEARCHER: Okay. Is there anything that you would change or improve?

STUDENT: About any of, like, the written....?

RESEARCHER: Just this assignment.

STUDENT: Oh, just this assignment?

RESEARCHER: Yeah.

STUDENT: Um, no. I don't.

RESEARCHER: Okay, would you like to see more like... assignments like that in the future? Or is it not really...

STUDENT: You mean, of the options, like...?

RESEARCHER: Hmhm.

STUDENT: Yeah, I think it's a good thing to have.

RESEARCHER: Okay. Um, what are your future career goals?

STUDENT: Um, well, I'm open option 'cause I'm still trying to figure that out.

RESEARCHER: Alright.

STUDENT: But, I think I might do FSHS or...

RESEARCHER: What's that?

STUDENT: It's family studies and human services.

RESEARCHER: Oh, okay.

STUDENT: Or human resource management. Or, I might minor in one and major in the other.

RESEARCHER: Alright, um... do you feel that anything you do in College Algebra might be useful for those careers?

STUDENT: Maybe more human resources than FSHS.

RESEARCHER: What part of the class would be useful for that?

STUDENT: Um... because some of the word problems relate to more situations that I might be in rather than FSHS. I don't know of any that would relate to each other.

RESEARCHER: Alright, so in general, what part of the class have you like the most, have you found the most helpful? And I'll list what I'm talking about.

STUDENT: Okay.

RESEARCHER: Lecture, recitation, written homework, online homework, and studio.

STUDENT: Um, definitely... well... I think that studio's the only thing that's helping my grade right now.

RESEARCHER: Okay.

STUDENT: 'Cause I feel like I understand that, but I think recitation because my teacher will go over... he/she's like, do you guys have any questions, and then he/she'll work out the problems for our homework that we need help with.

RESEARCHER: So you like that part the best?

STUDENT: Hmhhh, yeah.

RESEARCHER: What part do you like the least?

STUDENT: Um... probably online homework.

RESEARCHER: Okay. And you said you think it's difficult.

STUDENT: I think it's really difficult, yeah. Or, if we have to do the written homework online, I just think that it's a mess (laughs).

RESEARCHER: (laughs) Okay.

STUDENT: Because I've had, like, one of my assignments didn't submit and then...

RESEARCHER: Oh.

STUDENT: It just lost the whole thing and it took me a really long time to do. To just write down every single step is just really time consuming.

#### **Interview 4**

RESEARCHER: Okay. Um, the homework assignment covering section 2.5 was different from the rest. It was the one you turned in online. It was the written homework that you turned in online.

STUDENT: Yes

RESEARCHERS: You got to choose which type of problem you wanted to do. Either the Agriculture, Business, Education, or Social Science problem. Do you remember that?

STUDENT: I remember that.

RESEARCHER: Which problem did you choose?

STUDENT: I'm pretty sure I chose the education just because I was secondary ed. So like, part of the education was suppose to be about would be the most applicable.

RESEARCHER: Okay. Do you have any suggestions to make in order to improve that assignment?

STUDENT: No. I think that was really cool because, when people are able, because it is the studio Algebra, they're able to see the field and make it, you know, like, more like practical and stuff, so they might actually use in life.

RESEARCHER: Okay. Um, what are your future goals? You mentioned them a bit earlier, but what are your...

STUDENT: Um, sort of, make babies and make casseroles, and so...I don't see how math plays into that really, apart from like, just the basic stuff. But, I'm here so...

RESEARCHER: Okay, so do you see...um...any of the assessments that cover information, do you feel that any of them are important to your future goals?

STUDENT: No.

RESEARCHER: Okay.

STUDENT: I know they probably will be but I'm very, like, I don't see that at all, but...

RESEARCHER: Okay. Um, what aspects of the Algebra class, um, have you found to be the most helpful? There's, you know, the lectures, the recitations, the homework, the online homework, and the studio. Which ones do you find to be the most helpful?

STUDENT: I like the studio *a lot*, because you're with everyone else, and you're talking, and you're asking them for help, and all the people are there, and they come and help you out and explain it.

RESEARCHER: Okay.

STUDENT: And I like that a lot.

RESEARCHER: Okay. Um, which aspects of the class, those same ones, are the least helpful?

STUDENT: Um, probably the recitation. I dread going to it. I don't know what it is about that woman's voice. Its kinda like nails screeching on the chalkboard, because it's the oddest accent I've ever heard. Its *so* hard to understand and stuff. It takes so much

attention trying to understand what she's saying and so I can't comprehend, like what she's teaching.

RESEARCHER: Okay.

STUDENT: And so, that's probably my least favorite part.

### **Interview 5**

RESEARCHER: Okay. Do you remember, I guess there were a couple of assignments that were written homework assignments, but you turned them in online? Where you could, um, choose the context of the problem? Like, you could do an agriculture problem, or a business problem, an education.... Do you remember doing that?

STUDENT: Yeah.

RESEARCHER: Do you remember what you chose for the first one?

STUDENT: Uh, like, agriculture? Business? I don't really remember.

RESEARCHER: Okay. Do... do you remember what you chose for the other?

STUDENT: Uh...

RESEARCHER: Do you remember why you chose which ones you did?

STUDENT: Um, I think I picked... I don't know, I think I did, like, one business, one agriculture, one...

RESEARCHER: Okay.

STUDENT: I just...

RESEARCHER: So, why? Why did you choose that?

STUDENT: Uh, I don't know. It's probably just read them.

RESEARCHER: Okay.

STUDENT: Just probably picked it off of reading.

RESEARCHER: That's a way to choose.

STUDENT: Yeah.

RESEARCHER: Um, so did you go through the problems and kind of picked the one that kinda looked the easiest, or did you just randomly pick one of the ones without looking at the problem, what did you do?

STUDENT: I... uh, I really don't remember.

RESEARCHER: (Laughs) You don't remember, ok. Um, what aspects of that assignment did you like or did you not like?

STUDENT: Of the turn in the written homework?

RESEARCHER: Yeah.

STUDENT: I don't know, I... I don't know, like, I didn't understand, like, how to show work or whatever. And like, how you're supposed to show work... it's probably in the directions, I probably just missed it.

RESEARCHER: Okay.

STUDENT: Like, I didn't know if you, like, should show, like, every step, or, like, what you were supposed to do, like, for the answer, and, like, right or wrong.

RESEARCHER: Right.

STUDENT: And, uh, I don't know, I don't really remember. I think I might have just, like, half put answers in, half showed... try to show a little work or something.

RESEARCHER: Um, would you care to see more assignments like that in the future? Or, not really?

STUDENT: I don't know, say... say it, like, better explained it would probably be easier, and I know what to do. Then it probably wouldn't bother me to do it.

RESEARCHER: Alright, um... what are your future career goals?

STUDENT: Well... for math... math wise?

RESEARCHER: No, just in general. What do you plan to do?

STUDENT: Um, become a park ranger.

RESEARCHER: Alright, yeah... yeah you said something about that.

STUDENT: Work for kind of the state. I don't know, I kind of want to go somewhere other than Kansas.

RESEARCHER: Okay.

STUDENT: Anywhere, though. Doesn't matter.

RESEARCHER: Um, is there anything that you do in College Algebra that you think will apply to that?

STUDENT: Um, I really don't know. Like, probably not, like, my job, what I'll be doing, like, like maybe like outside of my job, I might maybe be using math.

RESEARCHER: Like, for what, do you think?

STUDENT: Bills, taxes, I don't know. Trying to buy a car or something.

RESEARCHER: Alright.

STUDENT: Buying stuff.

RESEARCHER: Um, in general, what part of the algebra class have you found the most helpful? And I'll go through a list of what I'm talking about: uh, lecture, recitation, written homework, online homework, and studio. What have you liked the most?

STUDENT: Um, I don't know... the... the studio's can be fun. And uh... the other class, the Monday one, recitation, that class... that class, I like that class 'cause it's small, and like, teacher's nice. He/she does good at teaching and uh, I don't know. I'm not a big fan of the Wednesday class. Like, the i-clickers are fine, but, I don't know, just.... I don't know, I'm a slow writer.

RESEARCHER: Okay.

STUDENT: I don't know, just like, sometimes I get lost. Can't ask quest... er... like, you could ask questions, but...

RESEARCHER: Kind of intimidating in a big lecture?

STUDENT: Well, no... not really intimidating. Just, so far behind.

RESEARCHER: Okay.

STUDENT: I feel like, maybe asking some, like, have her scroll to another page, or something.

RESEARCHER: Alright.

STUDENT: Asking a question about that, trying to figure that out. I mean, she puts... she puts it online, like on the internet and stuff, so I just look it up when I get back.

RESEARCHER: You look at it later? Okay, um, kind of in general, do you have any suggestions for improving the class?

STUDENT: Um, I don't...

RESEARCHER: Like if this could be your ideal College Algebra class, what would it be like?

STUDENT: Everyone gets A's, more points? I don't know. Um, uh, I guess... um, I don't know. Make it better? Uh, probably less homework.

RESEARCHER: Okay.

STUDENT: Maybe, like, I don't know, it seems like all the written homework we do is all, like, word problems, like, mixed in with the other ones.

## Interview 6

RESEARCHER: Alright, um, you mentioned the two written assignments that you turned in online.

STUDENT: Hmhmm.

RESEARCHER: Where you had to... where you got to choose the context of the problem, which one...

STUDENT: Oh, yeah.

RESEARCHER: Like, agriculture, education, all that stuff. Do you remember which ones you chose for those two problems? Or, those two assignments?

STUDENT: Probably the social science one. Um, I'm undeclared as a major, so I don't really have a... but I'm leaning towards social science, so....

RESEARCHER: Okay.

STUDENT: It was probably one of those.

RESEARCHER: Alright, so you chose based on... your interest?

STUDENT: Hmhmm... or if there was... there was something out there that I didn't... like, I wasn't necessarily interested in it. I was looking at... actually I would choose something I didn't know very much about. So I could learn it.

RESEARCHER: Oh, okay. Cool. Alright. Um, you told me a little bit about what you didn't like about the assignment, but can you be... go into more detail about that? What did you like, what do you not like about the assignment?

STUDENT: The online assignment?

RESEARCHER: Hmhmm.

STUDENT: Um... I just... I... I personally don't really like the context problems... um, doing homework online, which I know makes things a lot easier for you guys 'cause there's no paper and things like that. So, that's... there's the give and take of that. So, um... myself, personally, I feel like I'm not actually doing the work, and I don't know why I feel that way. I just um... that's how... I never liked doing things.... I'm attached to my computer as most students are, but, when it comes to, like, math problems or reading things online, I don't get anything from it and I feel like I'm not actually learning anything from it. Um,... so, I guess that the thing, and... I feel like, I think I could.... It's so hard 'cause I almost kind of got mixed up with the

other online homework. You know, it's like... it's online and then you think, "oh well, I can go back and choose it if you need to." And then you don't have the second chance in this one. And also if you... if you don't show all the steps on your screen? Or you... I mean... I didn't realize you were supposed to show all the steps you were seeing. The second assignment they told us to write out all of our steps, so I did the second assignment. I just remember that was kind of confusing 'cause you'd write one answer down, but I guess if it was wrong you couldn't get all the points if you'd done it right.

RESEARCHER: Okay. So you... you didn't like that you didn't have multiple chances to...

STUDENT: Yeah... well, I mean... you don't when you have the... on the first assignment anyways, but, um... I don't know... I didn't bring my computer into recitation, so if I have questions over it, then...

RESEARCHER: Okay.

STUDENT: I don't know if that helps at all.

RESEARCHER: Yeah. Um, does it... I mean, the reason really that it was online was so you could have that choice of context. So, would you say that the benefit of being able to choose the context of the problem outweighs the technical issues, or vice versa? That it's not worth it?

STUDENT: No... I... that part didn't really matter to me. I would be happy, you know I would be fine doing it with.... I mean, the four choices, I would have been happy doing it with any of the four.

RESEARCHER: Okay.

STUDENT: I don't think that the specific topic, you know, really, like, helped my... or increased my understanding of what I was doing.

RESEARCHER: Okay.

STUDENT: But, it also didn't decrease it, so... that part, though was kind of... to me, it weighed itself out.

RESEARCHER: Okay. Um, what are... well, you said you are undecided, but what are your future career goals, or what can you tell me about what you want to do?

STUDENT: Um, well, I don't have a major, like I said. I'm looking into sociology/anthropology. Um, I'm really... um, passionate about, um... social



justice and the inner city and also, kind of, global things. And so I'll probably... obviously I can see myself owning a homeless shelter and running that and things like that. Or being overseas, and you know, helping people who live in... who don't have homes and helping them have homes. I'm thinking about going into nursing school.

RESEARCHER: Okay.

STUDENT: After undergrad and then go to nursing school after that. And you can do a lot as a nurse.

RESEARCHER: Right.

STUDENT: Anywhere, and especially in places that have no medical professions at all. Professionals at all. So, I don't know, something like that.

RESEARCHER: That's cool. Um, do you think that anything you do in this College Algebra class will be beneficial to that career, or your future career?

STUDENT: Yeah, I mean... College Algebra I feel is a lot of... um, it's basic algebra but it's also kind of a step up from that, so you can take what you've learned and apply it to different situations and, you know, probably.... I won't be sitting at a desk probably, you know, or figuring out, um,  $y$  equals  $x$  plus  $b$  problems, but, um.... Yeah, I'm sure it will come in handy even, um, last year when I wasn't in math, I found myself doing math.

RESEARCHER: Okay. What... what did you do? Like, I'm curious, just what situations you had.

STUDENT: Well I mean, like... I probably can't really think of any, but, I just remember... I remember thinking to myself, oh yeah, I remember doing this in math class a few years ago. And, um, I mean it wasn't anything exciting (laughs). But it was just, little things that would come up and I'd think, oh great. And it even just could have been helping people with homework, that kind of showed up. But, I hope that was enough to answer that part of your question.

RESEARCHER: Yeah. Um, so in general, what part of the class have you found the most helpful? And I'll go through a list of what I'm talking about: um, lecture, recitation, written homework, online homework, and studio.

STUDENT: Um, I'd say the... recitation and written homework have been really helpful to me. Um, 'cause you can go in there with questions that we... with recitation you can go in with questions, the things that we specifically do not understand.

RESEARCHER: Hmhmm.

STUDENT: And he/she'll help us. And he/she'll give examples of what it is and he/she'll say, do you understand this, is this...? Yeah, and, you know, everyone else is also learning from that and then a lot of times we all have the same questions and so.... Or, you know, might be a different problem but the same kind of thing, and so together and yeah...

RESEARCHER: Okay, that's cool. Um, what aspect of the class have you found the least helpful?

STUDENT: Um, probably the written online homework. I don't know why that... really messed with me, but it really did (laughs). That's why I keep bringing it up. But, uh, I just really don't like it. Um, and... probably the online homework too.

RESEARCHER: Okay.

STUDENT: Just because sometimes it's confusing. But what... what's been helpful recently has been in, um... 'cause a lot of times it's been, like, with the online homework, I'd look at it and think, "Wait... did we even learn this?" But, um, in lecture she's been saying, "Remember this for your online homework. This is probably something you should..." You know, "Put a star by this so you can come back and look at it sometime." And we actually do problems from homework, so...

RESEARCHER: Alright.

STUDENT: It's gotten easier. Well, not easier, but it's gotten more helpful.

## Interview 7

RESEARCHER: Alright, um... how... oh, ok. This last homework assignment, well I guess it wasn't the most recent but it was assignment 2.5. And it was a written assignment, but it was online. You know what I'm talking about?

STUDENT: Umhmm.

RESEARCHER: Okay, so... you could choose what type of problem you wanted to do.... Agricultural, education, business, social science. Do you remember which one you did?

STUDENT: I did the agriculture one.

RESEARCHER: You know why you chose that?

STUDENT: Because it was the first one on the list.

RESEARCHER: Okay.

STUDENT: So... yeah, that was,... that was an interesting week for me because I was sick, so I couldn't go to recitation so I had to email my questions, but...

RESEARCHER: Okay.

STUDENT: I got everything worked out, so.

RESEARCHER: Alright, um... do you have any suggestions for how to make that assignment better... or, I mean, you said you picked because it was the first one on the list. Was it just because that week was bad or did you not think it was really relevant? Just your thoughts.

STUDENT: Um... well like I said, I was stumped and I couldn't make it to the recitation, so one way to make it better... I mean obviously since this is new... it probably wouldn't necessarily work right now, but, maybe talk to the recitation teachers after recitation. Figure out what were some common questions, and maybe even put, like, a frequently asked questions type of thing on there.

RESEARCHER: Oh, okay.

STUDENT: Because... you know... I guess, in all honesty most kids, if they have an online assignment they're not going to have their book right there with them, so... I mean for convenience it would have been nice to have, you know, like, this is where some people make mistakes. Not necessarily notes on how to do the whole problem.

RESEARCHER: Okay.

STUDENT: But just... this is where people made mistakes in the past, how to get around it.

RESEARCHER: Alright, so... are you suggesting we make it more like the regular online homework assignments, where they have help links?

STUDENT: Um... I guess, yeah. But, maybe that's just cause I like the online homework assignments, so...

RESEARCHER: Alright, um... what are your future career goals?

STUDENT: Um... I'm journalism/mass communications. Uh... in a perfect world, I'd do, uh, broadcasting. But that's such a small business, tough business to get into, because there's so few positions. I'll most likely get into law school somewhere.

RESEARCHER: Okay.

STUDENT: So, one of those two career paths right now. Not a lot of math involved, but...

RESEARCHER: It depends on what type of law you go into.

STUDENT: Exactly... exactly. So.

RESEARCHER: Do you feel that the different assessments in this class... by assessments, I mean just any assignment you had. Do, um, do they apply to what you think you'll do in the future, or ... specifically or generally or not at all.

STUDENT: I wouldn't say they specifically apply to my career choice... or career hopes, but they definitely apply to the future of my life, just because, you know... this last one we did the different tax brackets and stuff like that.

RESEARCHER: Okay.

STUDENT: And to understand those concepts, like, I mean, they're concepts about just life and not necessarily careers. So... definitely could use some of the stuff I'm learning.

RESEARCHER: Okay. So, in general, what aspects of this class do you find the most helpful? And by aspects, I mean lecture, recitation, written homework, online homework, studio.

STUDENT: Um... definitely recitation, because, like I said, I like working alone and in small groups, so kind of the personal interaction with the people in recitation and being able to ask questions and that kind of stuff with the recitation instructor's really nice to have that. I guess, back in my own comfort zone there.

RESEARCHER: Okay

STUDENT: Just because it's, you know...

RESEARCHER: Smaller class?

STUDENT: Exactly.

RESEARCHER: Um... what was the least helpful? What don't you like?

STUDENT: Um...

RESEARCHER: Or, do you think could change?

STUDENT: I guess I'd say that the hardest thing for me to do is go to lecture. Just because, it's... it's just... it seems like I'm getting talked at more than talked to. Which I understand it's the way it has to be when you've got 300 or whatever students in there. But I guess that's just something that I would enjoy more is the personal one on one.

RESEARCHER: Okay.

STUDENT: Stuff, so.

RESEARCHER: Um, this year they're trying out the i-clickers for the first time. What do you think of those?

STUDENT: I think it's expensive, but... it... it's very effective. It... I mean, that's one of the main things... it's a good incentive to go to class.

RESEARCHER: Okay.

STUDENT: Um... cause it's... in all honesty it's easy points. And, I haven't run into any problems. I mean, I guess I've heard stories about people whose i-clickers don't register sometimes, but...

RESEARCHER: It happens, but they usually get it worked out.

STUDENT: Yeah, I think that, like, I don't see anything wrong with it. It's funny... actually one of the people I sit next to, we calculated once... cause it was the most who'd clicked in at like \$40 a piece is, like, 10 thousand dollars from our lecture alone, so. They're expensive,...

RESEARCHER: Yeah.

STUDENT: But, I mean, you invest in one for college and other classes are going to use them, so. I think that they're an effective tool to use.

RESEARCHER: Okay. Um... is there other... any other suggestions you have for improving the class or anything that you think I should have asked you, but I didn't?

STUDENT: No.... can't think of much, no. I mean, like I said, I enjoy the class... and the studio aspect of it over just College Algebra is a very nice touch, so.

### **Interview 8**

RESEARCHER: So, the homework assignment covering section 2.5 was different from all the rest of them. It's, uh... it was the... the written problem, er, written homework problem that was online.

STUDENT: Hmhmm.

RESEARCHER: You know what I'm talking about?

STUDENT: Hmhmm.

RESEARCHER: Okay, so you could do... you could choose what problem you did, either an Agricultural, Business, Education, or Social Science problem. Which one did you do?

STUDENT: I chose the Social Science one. Just because my major is Political Science.

RESEARCHER: Okay. Did you find the problem interesting or helpful?

STUDENT: Yeah, I think it would have been more, like... it was easier to understand, solve, it was a social science problem than, say, an agricultural problem, which I really wouldn't have cared about or been interested in.

RESEARCHER: Okay, so would you like to see more of these types of problems in the future? Would you be interested in that or do you not really care?

STUDENT: It doesn't really matter, but it would be nice to, like, have a choice for once.

RESEARCHER: Okay. If you could make a suggestion on how to improve that assignment, what would you say?

STUDENT: Um... well... I know it was online because it was, like, new, but I wish it would have been out of a book so there would have been, like, examples.

RESEARCHER: Okay. So you'd like to see other examples to look off of.

STUDENT: Yes, examples.

RESEARCHER: Alright. Um, in... in summary, what aspect of the class have you found the most helpful? And then by that I mean, lecture, recitation, written homework, online homework, and studio.

STUDENT: Well, lecture. I like how she posts notes online. Like, if you don't get it you can go back and look. And, recitation helps a lot.

RESEARCHER: Okay.

STUDENT: To, like, clarify the things you learn. Ask questions and get help.

RESEARCHER: So is there... I said what part's the most helpful... is there... is it different from what you liked the best? Or are they the same thing?

STUDENT: The same, because whatever is most helpful I like the best.

RESEARCHER: Okay. What aspect of the class have you found the least helpful? And do you not like?

STUDENT: The least helpful would be studio.

RESEARCHER: Okay.

STUDENT: Just because it seems like going into studio... I don't know, but usually, like, I don't understand and those are, like, really hard for me.

RESEARCHER: Okay. What... what don't you understand?

STUDENT: Hm... I don't know. It's hard to explain, like... I don't know if we do studios before we, like, learn the lesson in lecture or after. But, usually, like, bef... when we do studio, I don't get it, but after we hear the lecture I get it... I understand better.

RESEARCHER: Okay. So you don't like that you haven't seen the material before.

STUDENT: Yeah. That's what it is.

RESEARCHER: Alright. What suggestions do you have for improving the class overall? If this were your ideal College Algebra class, what would it look like, what would it be?

STUDENT: The only thing I would get rid of is studio.

RESEARCHER: Okay.

STUDENT: Because lecture, like, the notes really help. And recitation it helps, like, if you do your homework and then you have a question, you can get help in there. And the online homeworks, and the book homeworks are both fine.

RESEARCHER: Okay. Um, so I've been asking a bunch of questions to try and get at, you know, what you think about College Algebra. Is there anything that I should have

asked you and I didn't? That would have... would have helped my research if I had asked you?

STUDENT: Maybe why people chose to take Studio College Algebra?

RESEARCHER: Okay.

STUDENT: I don't know... mainly just because you get more help, I guess.

RESEARCHER: Alright, anything else?

STUDENT: No.

### Interview 9

RESEARCHER: Do you remember the written homework assignment that was actually online?

That, um, you had to choose the type of problem you wanted to do? Agriculture, business, education, social science? And, you wrote out the answer longhand and submitted it?

STUDENT: No....

RESEARCHER: Did you not do that problem?

STUDENT: I'm guessing I didn't. (laughs)

RESEARCHER: Okay, that's fine. Um...

STUDENT: Sorry...

RESEARCHER: So I don't need to ask you those questions... because you didn't do it.

STUDENT: (laughs)

RESEARCHER: Uh, what are your future career goals?

STUDENT: Um... oh, I don't know. I'm not very organized, and so. It kind of shuts down a lot of things for me, but uh. I'd really like, to, I'd really like to do architecture, 'cause, um, I love geometry. And, um, so like, uh, I think it's just the love of math. I like math. Um... and so, I... I really... I think that's why I've gone towards architecture. But I'm really artistic too. So, um, I kind of just like, more artistic. I like math, so I put them together and decided architecture. To go for that, and um, it kind of runs through my family. So, uh, and that's weird, cause of how my grade in this class, but uh. Um, yeah architecture's really where I wanna go. I kinda, just, uh, it's something that I think I would enjoy. You know, and see that it combines



multiple different things to it, because I don't just like the same thing. I like structure, but not routine, so.

RESEARCHER: Okay.

STUDENT: It gives me variety, I think.

RESEARCHER: So, do you feel that the things you do in this class, the different assessments, like homework problems and tests and stuff, does any of that really apply to your future career goals?

STUDENT: Um... it definitely does, um... deadlines are really a problem for me. And that's something I really need to get on top of ASAP. (Laughs) Um... so, uh, in making sure, uh, let's see, the... the kind of, going back and checking and making sure things are right and exact is... is something that, you know, you need to apply. Especially to architecture. 'Cause other people are relying on that, not just the... not just your grade. Or your name, other people are relying on that to be, you know, correct, so uh. And then, um, you know just the small... I guess it's just kinda the smallest things, I don't see myself working out quadratic equations anytime soon, but uh. I might... I might apply it sooner or later. Um... I definitely think that College Algebra, with the goals I have for my career would apply to me more than others, I think.

RESEARCHER: Okay.

STUDENT: Because of the type of, you know, architecture, so. (Laughs)

RESEARCHER: Alright.

STUDENT: I don't know if I answered your question.

RESEARCHER: You definitely did. You did very well. Um... so just kind of a sum up, what is the aspect of Algebra, or this class, that you found the most helpful? And I'll go through... lecture, recitation, written homework, online homework, studio.... What's been the best for you?

STUDENT: I'd say the, um, the online homework. Even though I, you know, struggle to get it done, I'd say it's the most helpful because it's... it's me alone, going through it. Seeing why I got it wrong, um. And then, seeing where I can correct it. And, maybe, uh, when I go to my friends, they might have a different way of doing it.

RESEARCHER: Umhmm.

STUDENT: And, so I can even find a faster way... a quicker way, or a way I might understand more. And, it might not be faster, but it's more understandable to myself, so I think the online homework is, kind of the way I work through it myself without someone else saying, "Do it like this, do it like this."

RESEARCHER: Okay.

STUDENT: So, I'd say the online homework.

RESEARCHER: Alright, then what have you found the least helpful?

STUDENT: Ummmm.... I'd say, the uh, the lecture. Only because, uh, the notes are put online, so I almost feel like I'm wasting my time in the class.

RESEARCHER: Okay.

STUDENT: Um... uh, because she writes out the notes so well. (laughs) It's uh, you know, uh she writes... she pretty much writes down anything she'd say... during the class, and so I feel like I could just not show up and still have the same... come out with the same.... Although, I guess there's sometimes I know during class, she might, um,... people might ask questions that you might have had, and she'll um... she'll answer them. Um... but, it's kind of rare, so. Basically it's the same, so... I'm like wasting an hour of my life. (laugh)

RESEARCHER: That's fine. (laughs) And like I said, this is completely confidential. She'll never hear about this...

STUDENT: Okay.

## **Interview 10**

RESEARCHER: Okay. Um... do you remember the... well it was the written homework assignment but it was online?

STUDENT: Oh yeah, I remember that.

RESEARCHER: Where you had the different choices of what, like, type of problem you could choose?

STUDENT: Umhmm.

RESEARCHER: I think there was, um, agriculture, business, education, and social science. So, which one did you choose?

STUDENT: I did the education one.

RESEARCHER: Why did you choose that one?

STUDENT: Um... it was pretty random. I didn't, like, look at all of them, I just picked education (laugh).

RESEARCHER: Okay, um... do you have any suggestions for how you could improve this assignment or do you not... did you like it? Did you not like it? Would you like to see more like that?

STUDENT: I kind of liked the online homework, well the book homework you do online, cause you could just submit it and you didn't have to go all the way to Cardwell and drop it off in the teachers box. So... that was pretty cool.

RESEARCHER: Okay, so what are your future career goals?

STUDENT: Um... I'm undecided on my major. Right now I'm pre-vet.

RESEARCHER: Okay.

STUDENT: I'm not for sure where I'm going to go. But either pre-vet or pre-med or family studies. I'm not sure, though, so... I couldn't really say.

RESEARCHER: Okay, um... even though you're not quite sure what you want to do, do you think that anything in this class is going to help with your future? Like, does it apply... do the problems apply?

STUDENT: (Laughs) I don't know, like, in my daily life, I don't really use, like, math formulas, but I don't know, like, being a doctor, if they have to use, like, math problems, so.... Like, in my every day life, there's no math equations that come up with like adding and subtracting any.... I don't see, like, many functions coming up.

RESEARCHER: Um.. so kind of like, in general, in summary, what aspect of this class was the most helpful? And I'll go ahead and list the ones I was thinking of: Lecture, Recitation, Written Homework, Online Homework, and Studio. So what did you like the best? What was the most helpful?

STUDENT: Um... recitation.

RESEARCHER: Why? Why do you like that the best?

STUDENT: Um... well cause basically you could ask any question that you need help with on the homework. And she just goes over anything we need help with.

RESEARCHER: Okay, what do you not like? What's the least helpful? Studio?

STUDENT: Yeah, umhmm. Yeah, I just they try to put, like, problems in the really life scenes, but I just don't think it helps that much.

RESEARCHER: Okay. Um... do you have any suggestions for how you can improve this class? If this were, like, your ideal College Algebra class, what would it be like?

STUDENT: Um... take away studio. (laughs) um.... I don't know. Lecture's pretty good so I wouldn't say you need to change that....

RESEARCHER: Okay.

STUDENT: Hmm... I don't know. I don't think anything's really wrong with it, so...

RESEARCHER: Alright. So, with these questions I was obviously trying to get at your opinions about the class and everything. Is there any question that I missed? Like, that I should have asked you and I didn't?

STUDENT: Hmm... Not that I know of. I don't really have questions about College Algebra.

### **Interview 11**

RESEARCHER: Okay. The homework assignment covering section 2.5 was a little bit different from the rest. That was the written homework that was posted online.

STUDENT: Yeah.

RESEARCHER: Um... you got to choose the type of problem you wanted to do: either an Agriculture, a Business, an Education, or Social Science problem. Um... which problem did you choose?

STUDENT: Um... what were the choices?

RESEARCHER: It was an Ag problem, a Business problem, an Education problem, or a Social Science problem.

STUDENT: I think, education's the one I did.

RESEARCHER: And how did you decide to choose that one?

STUDENT: Not sure... I think I just randomly picked one. Just...

RESEARCHER: Okay. Um... did you... um... do you have any suggestions in order to improve that assignment?

STUDENT: Nope, keep doing the online stuff. (Laughs)

RESEARCHER: Keep doing the online stuff?

STUDENT: Yeah (Laughs)

RESEARCHER: You prefer that over the...

STUDENT: Current stuff.

RESEARCHER: Current stuff?

STUDENT: Yeah.

RESEARCHER: Alright, um... when you were doing the written homework online, did you work it out separately and then enter your answers, or did you...

STUDENT: Yeah... I did that.

RESEARCHER: Okay. Um... what are your future career goals?

STUDENT: Criminology.

RESEARCHER: Okay, and which assessments or things that you do in class, types of problems, things like that... do you feel is important to know for your future... for your career?

STUDENT: Um...

RESEARCHER: And can you explain, if any, why or why not?

STUDENT: Um... probably mostly all of it that we've done so far. Cause, you have to have statistics for criminology, you know. What occurs often, what doesn't.

RESEARCHER: And the things that we're doing now....

STUDENT: Yeah, they, they help.

RESEARCHER: Okay. Um... what aspects of the algebra class, the lecture, recitation, written homework, online homework, or studio have you found most helpful? And can you explain why this might be...?

STUDENT: Uh... most helpful? Hm... I don't know about that. Uh... I'd say... well I don't go to studio ever, so I don't know about that. I'd say the rec would be the most helpful.

RESEARCHER: Um... I'm sorry I didn't hear that.

STUDENT: The rec- sitation.

RESEARCHER: Oh, the recitation.

STUDENT: Yeah, cause he/she actually goes over problems that, like, are already in the exam or are somewhat in the exam or on your homework.

RESEARCHER: Okay.

STUDENT: So it helps.

RESEARCHER: Okay... um, what aspect of class out of those same areas, um, do you find the least helpful?

STUDENT: Lecture (laughs).

RESEARCHER: Lecture? Okay.

STUDENT: Yeah (laughs).

RESEARCHER: And why's... ?

STUDENT: Uh...

RESEARCHER: Do you think that is?

STUDENT: Probably 'cause I can't understand her most of the time.

RESEARCHER: Okay.

STUDENT: And I don't know... she goes by really quick, so, like, it's hard to get everything in.

RESEARCHER: Okay... um, what suggestions do you have for improving the course?

STUDENT: Less homework? (laughs)

RESEARCHER: (Laughs)

STUDENT: But that won't happen... um... I don't know. I think it works pretty good.

RESEARCHER: Okay. Any other suggestions?

STUDENT: Um... slow down in lecture.

RESEARCHER: Slow down in lecture?

STUDENT: Yeah, a little bit.

RESEARCHER: Um... what about the structure of the course? Do you have any suggestions for improving that?

STUDENT: Um... no.

## **Interview 12**

RESEARCHER: Okay. Um, you've had two written assignments in the class that you turned in online. The one where you got to choose which context you wanted the problem to be in. You know what I'm talking about? You could choose, like, agriculture, business, education, health, or social science. You had the different options for problems you could do.

STUDENT: Hmhmm.

RESEARCHER: Do you remember what problem you chose for the first assignment?

STUDENT: I don't remember.

RESEARCHER: Or the second?

STUDENT: Umhmm (*negative*).

RESEARCHER: Okay. So did... how did you decide what problem to do? Even though you don't remember what it was.

STUDENT: It was probably just one that I thought I'd be interested in. What were the options?

RESEARCHER: Um, the first exam... or the first homework assignment was agriculture, business, education, and social science. And the second one there were two problems and they had slightly different... I think there was one that was, like, political science, and one that was, like, health, maybe?

STUDENT: Okay. Yeah I kinda remember one that... like I would have chosen education or health. Something where I can relate to people. Not really, like, a lot of numbers.

RESEARCHER: Okay. Um, what aspects did you... of this assignment did you like and not like?

STUDENT: I really um (laughs) don't remember.

RESEARCHER: Don't remember. It didn't make that big of an impression?

STUDENT: No.

RESEARCHER: So, would you be interested in seeing more problems like this in class, or not... doesn't matter.

STUDENT: Um... they were word problems?

RESEARCHER: Yes.... You don't like word problems?

STUDENT: I don't like word problems, Uhuh (*negative*). (laughs) No, usually, like, the actual equations I can figure out, it's the word problems that was... like finding the information in the word problems that I mean. Using the equation... yeah I don't really like...

RESEARCHER: That gives you trouble?

STUDENT: Yeah (laughs). Like how to set it up... like, once it's set up, I can usually work it out. But... I mean, that's why I don't really like word problems that much.

RESEARCHER: Alright, um, what are your future career goals?

STUDENT: Um... well right now, I'm going into education for English and then a second major in Spanish.

RESEARCHER: Nice.

STUDENT: So... I'm gonna make sure I work with words not numbers (laughs).

RESEARCHER: So do you see any part of this class that might important to that career?

STUDENT: Um... maybe in the education aspect. If someone asks me for help or something then I won't feel like I can't help them at all.

RESEARCHER: Okay.

STUDENT: But, I don't know too much about Spanish. Um, I don't know, it could maybe... like some of the equations we've talked about, if I knew how to, like, set it up I could set it up to where I could figure out, like, how many students need to get a certain score on something for it to be, like, acceptable for passing. Or if I... if I needed to do something different where they understand it more.... Um, sometimes, yeah, it could tie in.

RESEARCHER: Alright. Um, in general, what aspect of this class have you found the most helpful? And I'll go through and list what I mean: um, lecture, recitation, written homework, online homework, and studio. What have you liked doing the most? What's the most helpful.

STUDENT: Recitation.

RESEARCHER: Recitation?

STUDENT: Hmhmm.

RESEARCHER: Why's that?

STUDENT: Um, well I don't... I don't know about the other recitation teachers, but mine is really helpful and he/she always works through the problems. And he/she doesn't give you the answers, which is nice, but he/she can, like, work you through the questions that you have, I guess.

RESEARCHER: Okay.

STUDENT: So instead of just giving you the easy way out, he/she actually makes you work for it, which is good, cause then, um, you just get a better idea of how to do it, but he/she's always eager to help us.

RESEARCHER: Alright.



STUDENT: That's good.

RESEARCHER: That is good. What aspects have you found the least helpful?

STUDENT: Um... probably studio. Studio kind of... it's good, like, when you're in the studio, but I never know how to relate it back to the homework that we actually have to do.

RESEARCHER: Okay. So, what suggestions would you have for improving that?

STUDENT: I don't know, maybe... I don't know, maybe tie it in to the online homework, or something, to where, like, I don't know... 'cause the earlier ones... like, sometimes it kinda like, connects to what she talked about in lecture, but it doesn't really.

RESEARCHER: Okay.

STUDENT: It's not something that we use on any of the homework or anything.

RESEARCHER: So, you don't have a problem with the actual assignment, you just don't like that it doesn't tie in as well to the rest of the class?

STUDENT: Yeah.

RESEARCHER: Okay. Um... obviously, I've tried to kind of get at what type of student you are, what you like, what you don't like, with these questions. Is there anything that I should have asked you, that I missed? That I... that would give me a better idea of what you're like?

STUDENT: I don't think so.

### **Interview 13**

RESEARCHER: Okay. Ummm...there were homework assignments covering section 2.5 was different, you know the written homework which was actually online. Do you know what I'm talking about? Where you got to choose whether you did agriculture, business, education, all that stuff. What did you choose?

STUDENT: Ummmm...

RESEARCHER: Do you remember?

STUDENT: No...I don't know if I actually... I was thinking that one was the one where in Studio, we uh.. It was like one of the studios was really simple and so there was time afterwards and we could finish it up. I think that was the one

RESEARCHER: Okay. That might have been it.

STUDENT: But, um, I thought that was the one where I was suppose to select off the function where the points were moving on the graph.

RESEARCHER: Um...You mean for the studio or for the assignment?

STUDENT: I think I'm thinking of the studio. It was, it was the written homework but it was online

RESEARCHER: Right. That's what I'm talking about.

STUDENT: It was the one that only happened once.

RESEARCHER: So I did...

STUDENT: I don't remember choosing anything. Not like that. I remember shifting a graph.

RESEARCHER: Okay. So for that assignment, you could choose to do an agricultural question, a business question, a social science....

STUDENT: Oh, okay

RESEARCHER: or education.

STUDENT: It was social science.

RESEARCHER: You chose the social science. Why did you choose that one?

STUDENT: Because I have a major in it. I have a bachelor in it.

RESEARCHER: Okay. Do you have any suggestions for how to improve that assignment? or...Did you like it? Did you think it was a good idea?

STUDENT: Um, I don't know if I could have any like positive feedback on it because I didn't see other examples of it. But, I mean, I thought that it was relevant. I guess the assignment...I really couldn't offer anything else on that.

RESEARCHER: Okay. Then, just some kind of biographical information. What are your future career goals?

STUDENT: I would like to work in, um, open source technology, because it is going to change the face of education in the world.

RESEARCHER: Okay

STUDENT: That's, that's my view on it. I...maybe it will, maybe it won't but I think that, uh, it is a pretty small field. Not a lot of people are in it, and, uh, you know, if I have a chance to help people who are disadvantaged overseas, I guess, especially in third world countries, I would.

RESEARCHER: Um. Do you feel that the assessments and the different activities in this course are relevant to your future career, or not really and why?

STUDENT: I guess it's yet to be seen, because, with computer engineering, um, I still have yet to manipulate functions the way that we are doing right now. I think we will. I mean, parabolas, and especially in communication. The uh...you know just wave forms. So, I think eventually I will, but not right now.

RESEARCHER: Right. Um...and this question isn't actually on here, but you brought up looking on Youtube. Do you ever look at the online videos that are available through this course?

STUDENT: There are?

RESEARCHER: Yea. We actually have, um, posted sections of the lecture. All the lectures are posted online, videos of the lecture.

STUDENT: Is that just through my organizer? My course organizer?

RESEARCHER: Yea. I think its just through Rehka.

STUDENT: My files and....

RESEARCHER: On the College Algebra web page they should have links to them. They are available.

STUDENT: I have not seen them.

RESEARCHER: Yea. Would you be interested in seeing those?

STUDENT: Yea.

RESEARCHER: Definitely?

STUDENT: Yea. Just anything. I have ADD

RESEARCHER: chuckle

STUDENT: I've been diagnosed, so that I have a hard time concentrating, especially in College Algebra class, where I'm kinda...I don't know. Especially in class. I have a hard time following people's concepts and all that stuff, but if I could rewind and listen to it again, I usually pick up on it.

RESEARCHER: So I guess your suggestion would be to make them easier to find...or?

STUDENT: Yea. I have not seen them.

RESEARCHER: Okay

STUDENT: Are they at the bottom of the page?

RESEARCHER: I'm not, I'm not sure.

STUDENT: I think the page...the layout of the page itself...its just that one page as you know. If you have some links to like the specific parts to the page,

RESEARCHER: okay

STUDENT: it would make it, it would make the interface more, um, efficient for a person like me who has to have everything structured and I know where everything is. You know, I click on exams, it shows me all the different exams. If I click on assignments it shows me a list of assignments. Its not just this...or news. Anything.

RESEARCHER: Okay

STUDENT: It would just make it more...I guess, it would make it easier to navigate. And right now everything seems jumbled together.

RESEARCHER: Okay. Um, kinda in summary, what aspect of this class have you found the most helpful? And by that I mean lecture, recitation, online homework, studio....

STUDENT: I'm honestly kinda struggling right now. I don't know if you saw my test score...I think I...

RESEARCHER: No. I didn't

STUDENT: I think I did really poorly on the second test.

RESEARCHER: Okay.

STUDENT: I obviously didn't do that well on the first one either. Um, but probably the studio, because the person I'm working with is really helpful and he knows everything about math and that...[my recitation instructor] has been trying to coax him into joining the math department even, so...

RESEARCHER: Okay.

STUDENT: I mean its really nice to have someone who knows what they are talking about. Which I guess isn't the case for everybody, but it is the case for me.

RESEARCHER: Alright. And then what have you found the least helpful?

STUDENT: Um, the recitation class.

RESEARCHER: Okay.

STUDENT: It's...the recitation class is the huge class right?

RESEARCHER: No. That's the lecture.

STUDENT: The lecture class. That's the least helpful for me. But, then again, its my style of learning. You know, where I have to rewind and listen to things over and over.

RESEARCHER: Okay

STUDENT: I mean I just don't get anything out of it and I *have to* show up for an attendance grade and I just don't get anything out of it. And I honestly don't do very well on the I-clicker questions

RESEARCHER: The I-clicker?

STUDENT: It seems like a waste of money to me (emphasis) because I just can't follow what she's talking about. And, you know, those questions come up and I have to answer regardless, just for my attendance grade. And I do poorly on every single one, so...

RESEARCHER: Alright. Anything else you have to say about the class? Or suggestions for improving the course? Maybe a question I should have asked you and I missed?

STUDENT: Mmm. Not really. I just think the whole thing needs to be more structured. Uh, visually, for students...I mean like if you look at the way K-State Online is structured, it is really, um... It is really simple to navigate. You know were every single thing is. All the...Its kinda like a template. Every single course, every single course you have has basically a template of the way, you know, you have your assignments, your files, have your drop box. All that stuff. You know, it would be nice to be able to find everything more efficiently. And that's really my only suggestion.

## **Interview 14**

RESEARCHER: Alright, um... do you remember the online homework assignment where it was a written homework assignment but you turned it in...

STUDENT: Online?

RESEARCHER: Online, yeah. And you had the four different choices you could make, either Agriculture, Business, Education, or Social Science.

STUDENT: Hmhmm.

RESEARCHER: Which one did you choose?

STUDENT: Education.

RESEARCHER: Why did you choose that?

STUDENT: It just seemed interesting... I don't really know much about agriculture or social science (laughs) so I was like, education, kinda know something about that. So...

RESEARCHER: Did you like having that choice?

STUDENT: Hmhm.

RESEARCHER: Would you like to see more problems like that, or...

STUDENT: Yeah.

RESEARCHER: Oh, ok. Um... do you have any suggestions to improve that assignment?

STUDENT: No, it's pretty good. I enjoyed it.

RESEARCHER: Alright...

STUDENT: But... we actually got... it was due on a night K-State... the whole website...

RESEARCHER: Oh, yeah, I heard about that... there were technical issues for that whole night.

STUDENT: (laughs)

RESEARCHER: Um... let's see. Oh, so what are your future career goals?

STUDENT: Pre-nursing.

RESEARCHER: Oh, that's neat. That's the first person I've heard that has that.

STUDENT: Really? Wow.

RESEARCHER: Yeah.

STUDENT: I hear they don't have a degree here, so...

RESEARCHER: Oh, okay.

STUDENT: Probably why (laughs)

RESEARCHER: Um... do you feel that any of the assignments that you've done so far in College Algebra can help you with your future career goals?

STUDENT: Um... no, not really. Not as of now. I guess in higher math maybe.

RESEARCHER: Okay

STUDENT: (Laughs)

RESEARCHER: So kind of in general, what is the aspect of College Algebra that has helped you the most? Or that you've found the most helpful? And I'll give you a list... just a breakdown, so, like, Lecture, Recitation, Written Homework, Online Homework, Studio.

STUDENT: I like recitation. I don't like lecture, I don't... I went to a Catholic high school so it was fairly small, so the teacher to student ratio was, like maybe, one to fifteen and now coming to this lecture of student ratio to, like, teachers one to three hundred (laughs), wow. I like recitation because it's like 20 students... 20, 30 students and you get the chance to ask him/her what questions you have on the homework and he/she works them out on the board, so.

RESEARCHER: Okay. What do you not like the most? And you said...

STUDENT: Lecture.

RESEARCHER: ... you said you don't like lecture. What do you think of the studio part of the class?

STUDENT: Um... it's kind of like a smaller lecture, I think. Kinda... 'cause we do the same concepts, so. (Laughs)

RESEARCHER: So you enjoy the studio?

STUDENT: Hmhmm.

RESEARCHER: Okay... um, we went through all these questions really quickly and I feel like there might be something I've missed. Is there anything that I... I should have asked you and I forgot?

STUDENT: No, not that I can think of (laughs).

RESEARCHER: Okay. Do you have any suggestions for improving the class? If this could be, like, your ideal College Algebra course, what would it be like?

STUDENT: I don't know... I'm kind of confused what's the difference between Studio College Algebra and Regular College Algebra. I didn't really get the difference... I was kinda confused and my advisor was just kinda like... here, here's your class. (laughs)

RESEARCHER: Okay Well, I can tell you what, kind of the official, you know, standards are. I don't know how students perceive it, but, um, Studio College Algebra, you've got one recitation, one lecture, and uh, one studio.

STUDENT: Uhuh.

RESEARCHER: And so the stu... and then Traditional College Algebra you've got two lectures and one recitation.

STUDENT: Hmhmm.

RESEARCHER: And the studio... so the studio focuses more on, like, Excel and real life applications and um, College... so Traditional College Algebra is more like a Pre-Calc prep. You know, it's more the functions and the different manipulations of the functions and how... preparing you for calculus. So...

STUDENT: Oh, okay. That makes sense now (laughs).

RESEARCHER: So that's supposed to be kind of the breakdown, and part of what I'm doing here is trying to figure out what the students are like in the different sections.

STUDENT: Right.

RESEARCHER: And maybe some people fit better in the other section than they fit in studio, so...

STUDENT: Right.

RESEARCHER: So that just kinda what I'm trying to get at here. Alright, so like I said, anything else that you...

STUDENT: No not that I can think of.

### **Interview 15**

RESEARCHER: Just... for those word problems where you got to choose which context you wanted to do. Um, what did you like, or how did you feel about those problems?

STUDENT: I like that we had a choice.

RESEARCHER: Okay.

STUDENT: That was... that was nice. That we got to choose what kind of context problem we're doing.

RESEARCHER: So do you have any suggestions that you think would improve that assignment?

STUDENT: Mmmm.... Not really.

RESEARCHER: Would you like to see more assignments like that?

STUDENT: Um, I mean one a week is fine.

RESEARCHER: Okay.

STUDENT: But... uh, I think they're... I think that they're pretty good. 'Cause those... those are the problems that I think are more tricky than the bookwork. The bookwork are usually pretty easy, and there's never any problem.



RESEARCHER: Hmhmm.

STUDENT: But those assignments are usually, they're like... more complex problems than the same... like...

RESEARCHER: And you like them or you don't like them?

STUDENT: Ah, well like,... That's why I think it's ok and doesn't really need to be changed.

RESEARCHER: Okay.

STUDENT: It gives you pretty tough problems but that's as hard as it's going to be on the test, so that's pretty fair.

RESEARCHER: Alright. Um, what are your future career goals? I know you said you were in agriculture.

STUDENT: Um, I don't know what I'm going to do (*unintelligible*). I have no clue. Currently I have a major in agronomy, uh, major in agronomy science with a secondary major in natural resources.

RESEARCHER: Okay.

STUDENT: Um, I'll probably be a soil scientist of some sort. And, solve Mother Nature's problems with humans.

RESEARCHER: Alright.

STUDENT: Um, yeah, or I'll be a.... I'll probably end up having enough land that I can grow my food and have bees and get honey, make soap, do everything I can on the land. And live in a community that could benefit from having me there, 'cause I'll have local produce, local meat, local honey. Local all kinds of stuff.

RESEARCHER: Alright, um, do you think that anything you do in College Algebra is beneficial to that? Or would be useful?

STUDENT: Only the... only the studio work.

RESEARCHER: Only the...

STUDENT: If I possibly wanted to make some graphs and do... kinda... kinda apply my agricultural economics with my Studio College Algebra and make some supply and demand curves, or something.

RESEARCHER: Okay. So the studio might be beneficial.

STUDENT: Yeah, being able to work, eh... work a computer and like, a program like Excel. Put in information, have it extrapolate out of that information, change it... do all kinds of cool stuff.

RESEARCHER: Okay.

STUDENT: Can't really do on paper.

RESEARCHER: Right. Okay. So, in general, what part of the class have you found the most helpful? And I'll go through and list what I'm talking about. Uh, lecture, recitation, written homework, online homework, and studio.

STUDENT: Studio.

RESEARCHER: Studio? Yeah, and you basically already described why you like that the best. What about... have you found the least helpful?

STUDENT: Uh, can you go through those again?

RESEARCHER: Uh, lecture, recitation, written homework, online homework, and studio.

STUDENT: Probably written homework. Or online homework.

RESEARCHER: Okay.

STUDENT: That... uh... just because Studio is so much help and recitation you have a person there. The online homework and the homework. Another thing I don't like about the bookwork, 'cause you don't have a way to, like, check or something unless you have a graphing calculator.

RESEARCHER: Okay.

STUDENT: With the books you can really check to make sure... like, say you do the first problem and you're not sure you're doing it right. You can do it and check in the back of the book and say I'm doing it right, I can do these other ones now.

RESEARCHER: So the online homework, you can't do that?

STUDENT: No. I mean you can go through it all, and test, try it again, get half and have it show you how to work the problems and then you can go through it another time.

RESEARCHER: Okay.

STUDENT: Now that you know how to work the problems. So I guess that's really nice 'cause there has been like one or two homework assignments where I wasn't positive how to do the problems and so I just failed the assignment, they showed me how to do it, and then I got 100%.

RESEARCHER: Oh, okay.

STUDENT: So, I guess that's the nice thing about the online homework. So, I'd say bookwork... yeah I don't know. Bookwork or online homework.

RESEARCHER: Alright. Um, so obviously with these questions I'm trying to get a good idea of what you're like as a student, right?

STUDENT: Hmhmm.

RESEARCHER: What you like, what you don't like, all that stuff. Is there anything I, like, should have asked you and I missed, that I didn't think of?

STUDENT: Hmm... no. I don't think so.

RESEARCHER: Okay. Um, and in general, if this were your ideal College Algebra course, what would it be like?

STUDENT: If what was?

RESEARCHER: If Studio College Algebra was, like, the ideal college Algebra course...

STUDENT: Perfectly what I had in mind?

RESEARCHER: Perfect... exactly. What would it be like?

STUDENT: I would have 100%.

RESEARCHER: (Laughs)

STUDENT: I don't know... um... I think it's... I think it's pretty good how it is.

RESEARCHER: Okay.

STUDENT: I'd probably work on, let's see... in the beginning of the year I felt like it was really confusing, kind of like, what we're supposed to be doing.

RESEARCHER: Hmhmm.

STUDENT: Where we were... Studio's broken up into so many different parts.

RESEARCHER: Okay.

STUDENT: With different people running each part. So, um, I felt like that was a little confusing. Especially if you were, like, a foreigner or something. And you weren't keeping up with the language and stuff, so...

RESEARCHER: Right.

STUDENT: You might not know were to go on these certain days or I don't know.

RESEARCHER: Uhuh.

STUDENT: And I think that would be all.

RESEARCHER: Okay.

STUDENT: That's really the only thing... not that bad of a class.

## **Interview 16**

RESEARCHER: Okay. Um, recently you had a homework assignment that was a written homework assignment that you turned in online.

STUDENT: Hmhmm.

RESEARCHER: Um... and you had... you were given the opportunity to choose which type of problem you had, whether it was business, um... education, social science, or agriculture.

STUDENT: Hmhmm.

RESEARCHER: Um... how did... well, first of all, do you remember which problems you chose?

STUDENT: Um... I remember distinctly on that assignment that, um, the first time I tried to do it, when I opened up the, uh,... the Excel program, it deleted all my answers and closed the... the whole assignment.

RESEARCHER: Oh, man!

STUDENT: And so I did it again, and it did that again, and so... (Laughs). It didn't want to work. Um... I'm sorry, what was the question, again?

RESEARCHER: (Laughs). Just um... Okay, you actually had two of them.

STUDENT: Yeah.

RESEARCHER: Um... which problems did you choose?

STUDENT: I remember I picked the agriculture ones just because it... I don't know, I'm a farm girl, so it's what I know (laughs).

RESEARCHER: Okay.

STUDENT: So...

RESEARCHER: OK, and you... did you choose the same ones on the first... we had two assignments like this, like I said.

STUDENT: Yeah.

RESEARCHER: Did you choose the Ag one on both of them?

STUDENT: I think probably... it was just the one that seemed more relevant to me. I mean, if you understand, you know... if... if someone gave you something.... I... the point is, I understand it more. You know, I understand that, oh, ok, I can... because it's agriculture stuff, I can, you know... I can relate to the situation. Or if it...

RESEARCHER: Hmhmm.

STUDENT: If it was business, I... I'd be completely lost. I wouldn't know, so it just... if I can relate to it more, then I... I think it's easier.

RESEARCHER: Okay. Um, what aspects of the assignment specifically did you like or dislike?

STUDENT: Dislike was having problems that I did... um... I don't know. I don't know why, I just for some tried to open it,...

RESEARCHER: Hmhmm.

STUDENT: It deleted all my answers, so I thought, "Well, this is kind of ridiculous."

RESEARCHER: Hmhmm.

STUDENT: So, I just think... you know, if you can get all the tweaks out, then it's great. It's perfect, it... you know?

RESEARCHER: Hmhmm.

STUDENT: It saves people, you know... supplies, paper, and this and that. So, if you can just do it all online, then yeah, that's good. So...

RESEARCHER: Okay. Um... what are your future goals?

STUDENT: For?

RESEARCHER: For, um, school and maybe career beyond school? Just in general.

STUDENT: Um...

RESEARCHER: However you want to go with it (laughs).

STUDENT: (Laughs) Trophy wife. Um... I... well, I'm a hotel/restaurant management, um, major.

RESEARCHER: Okay.

STUDENT: I would really like... probably an ideal situation would be some type of management in a catering business.

RESEARCHER: Okay.

STUDENT: That would be really cool for me. So... definitely more the restaurant and food side than the hotel side.

RESEARCHER: Okay. Um, which assessments in the course, um, do you feel are important for your future, that it was important that you went over these type of things for your future?

STUDENT: Um...

RESEARCHER: Or do you see any?

STUDENT: Um... well, I... I don't know, just.... Gosh. Well, I mean, it's all... it all can be relevant, but of course, you know it just depends on what you're going into. Like, I don't know... like the thing I mentioned earlier about, um, investment of money and stuff like that. I mean... that would be relevant. Um... I don't know. (laughs) I don't know what I can do to give a specific example.

RESEARCHER: Okay

STUDENT: But, stuff like that, I guess.

RESEARCHER: Okay. That's fine (laughs). Um... which aspect of the algebra class have you found the most useful?

STUDENT: Most useful? (Pause) Um... (laughs).

RESEARCHER: Lecture, recitation, written homework, online homework, studio...

STUDENT: Um...

RESEARCHER: Which...

STUDENT: I think... probably lecture. I mean, that's when you learn the most. I mean, that's when you're given all the information, so I'd say that would be the most beneficial. Um, I mean, lab is also beneficial for, like I said, I mean... nowadays, I sound like such an old person, though. Nowadays, you know, a lot of stuff is using computer programs, so... you know, in the 5 that will be the only way to do it, so.... You know?

RESEARCHER: Hmhmm.

STUDENT: That's useful. I mean, pretty much a lot of business you're going to do, you're going to have to deal with math and this and that. But if you can do it on the computer, and, you know, take away all the mistakes you might make on paper.

RESEARCHER: Hmhmm.

STUDENT: And that would help, so....

RESEARCHER: Okay.

STUDENT: I'd say that was beneficial too.

RESEARCHER: OK. Do you have any suggestions for improving the course?

STUDENT: Um... I think... (laughs) I'd say almost too easy. Like, there's too many bonus points given.

RESEARCHER: Hmhmm.

STUDENT: I mean, I don't know if this is the best thing to say, but you want me to be honest.

RESEARCHER: Yeah. Go... honest.

STUDENT: So, um... you know, I believe people have... you have to work for your grade. I think there's just, you know... even... I was figuring stuff out the other day. Like, I almost didn't get an assignment done and I factored it into my grade and it didn't hardly mean anything because I had so much bonus.

RESEARCHER: Hmhmm.

STUDENT: Like, all the labs have bonus points on them. You get an extra point just for being in class. You know, maybe... I'm a pretty old fashioned person. (laughs). You know, maybe I think, you know, you... you should be expected to go to class and you shouldn't be rewarded for going all the time, but...

RESEARCHER: Okay.

STUDENT: I'd say there's just... just a tiny bit... it's just a tiny bit too easy in that aspect.

RESEARCHER: Hmhmm.

STUDENT: 'Cause there's too many points given for, you know, you always have... you always have the chance of extra points.

RESEARCHER: Hmhmm.

STUDENT: So... I don't know.

RESEARCHER: That's good. It's good to have a lot of feedback.

STUDENT: That's my opinion, I guess.

## Interview 17

RESEARCHER: Alright. Um, you've had two written assignments that you turned in online.

STUDENT: Hmhmm.

RESEARCHER: You know what I'm talking about?

STUDENT: Hmhmm.

RESEARCHER: Uh, the assignments, you were given the option of choosing the context of the problem.

STUDENT: Hmhmm.

RESEARCHER: Either Agriculture, Business, Education, Social Science, I think there was a Health Question. Do you remember what problem you chose for the first assignment?

STUDENT: Agriculture. The first one.

RESEARCHER: Okay, then what about the second one?

STUDENT: The same one as well.

RESEARCHER: OK. Why did you choose those two?

STUDENT: Because it was the first one (Laughs).

RESEARCHER: It was the first one on the list?

STUDENT: Yeah. I wasn't thinking too much 'cause these are all the same. I just choose...

RESEARCHER: OK. Um, so... what aspects of the assignment did you like, did you not like?

STUDENT: I prefer written... I prefer written homework, like, the normal written homework.

RESEARCHER: Okay.

STUDENT: I just not so into this online thing. 'Cause it... I need to write it.

RESEARCHER: Okay.

STUDENT: (Laughs)

RESEARCHER: What about being able to choose the context? Did you enjoy that, is it not really important?

STUDENT: Not so important for me I guess. Basically they're... they're testing the same, uh... the same thing.

RESEARCHER: Okay.

STUDENT: Hmhmm.

RESEARCHER: Alright. Um, do you have any suggestions to improve this assignment?



STUDENT: Well... three times or four times a semester is enough. (Laughs)

RESEARCHER: Okay. No more than that?

STUDENT: Not too much.

RESEARCHER: Okay. Uh, what are your future career goals?

STUDENT: Like, what I'm taking next semester?

RESEARCHER: What would you like to do with your life?

STUDENT: Oh. (Laughs) Um,... I'm majoring in Psychology.

RESEARCHER: Okay.

STUDENT: And, I might be a advisor or counseling, something like that. And I really don't think I can go to med school and graduate from there. (Laughs)

RESEARCHER: Okay.

STUDENT: Be a psychiatrist. (Laughs) So just some basic helping job like counseling.

RESEARCHER: OK. Um, do you think that anything we've done in Studio College Algebra can help prepare for that?

STUDENT: Some. (Laughs). I just... I think I can say some would be.

RESEARCHER: Like what?

STUDENT: Like... the... studio algebra?

RESEARCHER: Hmhmm.

STUDENT: Like, we use the, uh, the (spread) sheet for counting numbers.

RESEARCHER: Okay.

STUDENT: I think that might help.

RESEARCHER: So you think programs like Excel?

STUDENT: Yeah.

RESEARCHER: Might be useful?

STUDENT: That helps a lot.

RESEARCHER: Alright.

STUDENT: I couldn't use the... I couldn't use Excel that... that well before I take the Studio Algebra.

RESEARCHER: OK. Um, alright. So just in general, what aspect of the Algebra class have you found the most helpful? And by aspect, I mean the different parts, like Lecture, Recitation, Written Homework, Online Homework, and Studio.

STUDENT: I think Studio's the most important part. I... it influenced me a lot. Like, it, uh... I can do Excel, I can make, like, the curve...

RESEARCHER: Hmhhh.

STUDENT: Using Excel. And, um, do some basic...

RESEARCHER: Okay. And what have you found the least helpful?

STUDENT: Least helpful? Oh, um... the lecture is... is good. I like the lecture, but the recitation I think can be more interesting. Like, just, not limiting the homework. We could do something more, like, um... some... questions that students always making mistakes on.

RESEARCHER: Okay.

STUDENT: And, uh, doing some fun exercises like in Studio Algebra (laughs).

RESEARCHER: Oh, okay. Alright, that's good. Do you have any suggestions for improving the course?

STUDENT: I think this course is really good. Uh... let's see. I think we could expand the recitation class, like, we have... we can have, uh, more recitation classes.

RESEARCHER: Okay. And just do something different?

STUDENT: Yeah. 'Cause, uh, we can discuss and we can, uh, work together.

RESEARCHER: Okay.

STUDENT: 'Cause people here... or everywhere, they don't do much, uh, homework together. (Laughs).

RESEARCHER: Oh, okay.

STUDENT: And, uh, the lecture... I think the lecture is great. I like the lecture. I like the... the way the instructor... like, teaching how to solve problems.

RESEARCHER: Alright. Um, obviously with these questions I've just been trying to get at your opinions and how you think about the class.

STUDENT: Hmhhh.

RESEARCHER: Is there anything that I should have asked you and I missed, some question that I didn't get to?

STUDENT: I don't think so.

## Interview 18

RESEARCHER: Okay. Um, do you remember the... I guess you had two written assignments that you turned in online, where you could choose the context?

STUDENT: Hmhm.

RESEARCHER: What type of problem you wanted to do? Do you remember what you chose? (pause) I have the options: um, Agriculture, Business, Education, and then Social Science, but I think for one of them it was actually Health and one of them it was Political Science.

STUDENT: I think I might have done... Social Science on that first one and Agriculture on the second one?

RESEARCHER: Do you know why you picked those?

STUDENT: Um...

RESEARCHER: You don't remember why you picked those?

STUDENT: The first one I was actually really confused about what was going on and I was just kind of clicking around and then I clicked it and then it opens the question.

RESEARCHER: Yeah.

STUDENT: I think that's just... that happened to be the one I clicked on.

RESEARCHER: Okay.

STUDENT: Like, oh, okay. Here's a question.

RESEARCHER: (Laughs) Alright.

STUDENT: Um, the second one, I looked at the business one first 'cause that's my major. And I was like, I don't understand the wording. So then looked at the Ag one, and that's like, okay, I can kind of relate to this one more. And so... I did that one. I don't think I got it right, but I felt more confident when I was trying it.

RESEARCHER: Okay. Um, what parts of that assignment did you really like and really not like?

STUDENT: I don't... (pause) I don't know. Those were more confusing to me being online. Like, the online homework is, like, not simple in the way, like, the problems are simple. But, like how it's set up.

RESEARCHER: Okay.

STUDENT: When the book one were online, I don't know if it was this last one, and I was just, like, not with it at the time I took it for some reason? But, I didn't... were the numbers from the book? Like, with the problems? Were they? 'Cause I couldn't...

RESEARCHER: The first half was problems straight from the book.

STUDENT: Okay.

RESEARCHER: The second half where you got to choose what context... that was new. That was different.

STUDENT: Okay, okay.

RESEARCHER: This... I mean this is stuff that we're trying out. And that's just part of the reason why I'm asking so many questions about this. We're trying to see what the students thought of it. So... did you... would you like to see more problems like this in the future? Or you don't really care, or you wouldn't like to see them, or what?

STUDENT: Uh... I'm not a fan of doing the book homework online.

RESEARCHER: The reason those problems are online is because you could, you know, choose what type of problem you wanted.

STUDENT: Yeah.

RESEARCHER: And it's hard to do that if everything's written out. Um, the feature of being able to choose the type of problem, is that... does that outweigh the technical issues, or do the technical issues outweigh the benefits of being able to choose your context? What do you think?

STUDENT: Um, I don't know, I do like being able to choose the problem. So, I guess that would outweigh the technical issues with that.

RESEARCHER: Okay. Um, what... what are your future career goals?

STUDENT: I would like to be the executive vice president of a propane company.

RESEARCHER: (Laughs) That is the most specific career goal I've ever heard. Awesome.

STUDENT: Um, yeah. My, uh... I'm actually, like, third generation Propane business.

RESEARCHER: Okay.

STUDENT: Well, I won't be with the family business. I want to go more the state level and we'd go to convention every year and I meet people and I know what this job entails and, like, it's what I want to do. So...

RESEARCHER: Cool.

STUDENT: ... it's really easy for me to say that.

RESEARCHER: Uhuh.

STUDENT: Hopefully I'll get it someday, but...

RESEARCHER: Um, do you think anything in Studio College Algebra would be helpful for this? Or could be... would be useful for your future career goal?

STUDENT: Um, probably not. Um, kind of like I said earlier, solving, like, for unknowns...

RESEARCHER: Okay.

STUDENT: I don't know. Not that I know of. I'll probably come across it someday and I'll be like, Oh... this is why I took that class.

RESEARCHER: Alright. Just... so wrapping up in general, what aspect of these... of this College Algebra class have you found the most helpful? And I'll through what I'm talking about: Lecture, Recitation, Written Homework, Online Homework, and Studio. What have you liked the most?

STUDENT: Um, I really liked recitation, because, like, in high when we took math classes there was never enough time to be, like, I don't understand this. Will you go through this problem with me?

RESEARCHER: Okay.

STUDENT: And so, you know, like, being able to go. And that's, like... this is what the class is for. It's to help you. That's been really nice.

RESEARCHER: Okay.

STUDENT: And I've also liked the online homework a lot. But I've... I don't know. I kind of like more types of things online than, like, sitting in a classroom kind of thing?

RESEARCHER: Okay.

STUDENT: So that's probably more of it. Convenience.

RESEARCHER: Um, what about the aspect of the class that you've found the least helpful? What did you not really like?

STUDENT: Studio.

RESEARCHER: Studio?

STUDENT: Like I've been saying, Studio.

RESEARCHER: (Laughs) Okay. And you've been pretty specific about that. Um, so in general if this were, I guess, your ideal College Algebra class, what would it be like?

STUDENT: Um, I don't... I hate to be repetitive, but everything but studio?

RESEARCHER: Okay.

STUDENT: Basically... I just... I don't know. I feel, like, terrible for saying it 'cause I'm in the class, but I didn't realize what it was going to be and...

RESEARCHER: I... I am not judging anything you say. I'm just... I'm just trying to get at what your... what you're thinking and what you're like, so... That's just fine.

STUDENT: Okay (laughs).

RESEARCHER: Um, yeah. Obviously with these questions, I've just been trying to get at what you think about the class, your, kind of, study habits, who you are, um... is there anything that I should have asked you that I missed that would help me understand what you're like as a College Algebra student?

STUDENT: Hmm... I don't think so.

## **Interview 19**

RESEARCHER: Alright, we've had two written assignments so far that you actually did online, like, you turned it in online.

STUDENT: Hmhmm.

RESEARCHER: And they were the ones that you could choose the context of your problem. You could pick either Agriculture, Education, or one of those.

STUDENT: Hmhmm.

RESEARCHER: Do you remember what you picked for those problems?

STUDENT: No.

RESEARCHER: No?

STUDENT: No. Um, if I was given, like... if you actually had a list, like, which one the options were...

RESEARCHER: Um, the first problem you had the option of Agriculture, Business, Education, or Social Science.

STUDENT: I chose business for that one.

RESEARCHER: Do you know why? Do you remember why?

STUDENT: Um... no. Well, the easiest way for me to think about math is as if it's money.

RESEARCHER: Okay. That's a good reason. Um, then I think the other problems had the same choices except maybe instead of Social Science, it was Political Science in specific. Or instead of Social Science, it was Health. Do you remember what you did for that second assignment?

STUDENT: Actually, I don't think I did the second one.

RESEARCHER: Okay. So, you chose based on what you thought was interesting, or just, kind of, randomly choose problems? What did you do for that one?

STUDENT: For the first one or...?

RESEARCHER: Either... either of those.

STUDENT: Um... yeah. Interesting, like, that's where I think it has the most relevance.

RESEARCHER: Okay.

STUDENT: And, that's where I think about numbers (*unintelligible*)... so...

RESEARCHER: Um, what did you like or not like about that assignment? Those two?

STUDENT: Um, it was nice, I liked doing them all on the computer. As opposed to on paper. Um, seemed to have more technical difficulties with that. It seems to be, like, a new thing.

RESEARCHER: Yeah, they were trying it out and...

STUDENT: Other than the technical difficulties, I thought it was really good.

RESEARCHER: Okay. Would you like to see more assignments like this in the future?

STUDENT: Yeah.

RESEARCHER: You have any suggestions for how to make it better?

STUDENT: No, I mean, you get to choose your own category and give you a scenario, and... I don't know how you can improve on it much.

RESEARCHER: Okay. Uh, what are your future career goals?

STUDENT: Um, right now I'm actually going for a tech-theater major. So I want to run a shop. Past career goals have been restaurant management, or auto mechanic, so it's kind of all over the place.

RESEARCHER: Is there anything in College Algebra that you think would apply to any of those careers?

STUDENT: Uh, definitely. Like, the scene shop is constant, you know, problem solving and, I mean, the three dimensional graphing, especially. I'll use that to determine, like, how everything fits together.

RESEARCHER: Okay. That's cool. Um, in general, what aspect of this class have you found the most helpful? And I'll go ahead and list what I'm talking about: uh, lecture, recitation, written homework, online homework, and studio.

STUDENT: Uh, the studio definitely. Um... the recitation seems to be a bit like, they just kind of do the homework for you.

RESEARCHER: Okay.

STUDENT: On the board. So, I mean, it's not really helpful unless you're having problems with it. I mean, definitely the studio. And the lecture format with the, uh... the... what's it called? I-clicker thing.

RESEARCHER: Hmhmm.

STUDENT: And the... the way that she does that with the... like, how she writes the notes, instead of, like, pretype them on power point or whatever.

RESEARCHER: Okay.

STUDENT: Like, the writing program that, uh...

RESEARCHER: The tablet pc?

STUDENT: Yeah. That's really cool.

RESEARCHER: What do you think of the I-clicker? That's another thing they're kind of trying out this year, it's new.

STUDENT: They're... the problems are usually very simple, so it's... a good way to keep track of participation in a large group, I guess.

RESEARCHER: Okay.



STUDENT: But as far as actually demonstrating understanding of material. Well, I guess, based on the responses that she gets, that's (*unintelligible*). I don't know, I never really had much trouble with the I-clicker questions. But...

RESEARCHER: Okay. Um, what have you found the least helpful? What aspect of the course did you... do you not really care for, or don't think is helpful?

STUDENT: (Pause) The online... like, the online homework, the... limited quantity of questions. It seems, it doesn't take very long to do, so it almost seems, kind of like, busy work.

RESEARCHER: Okay.

STUDENT: Um, the online format, I like, but the fact that there's only, like, 4 questions at a time, you just, like, click and you're done. Um... it's like, basically the format is good, but I don't like the quantity.

RESEARCHER: There should be more?

STUDENT: Yeah.

RESEARCHER: Okay.

STUDENT: Higher quantity. Make it more worthwhile.

RESEARCHER: Okay. Um, do you have any suggestions for improving the class in general?

STUDENT: Hmm... no, not other than that. Studio's actually really good. Um, availability of the instructors is good. Lecture... I like.

RESEARCHER: Okay. With these questions, obviously, I've been trying to, you know, get at your opinions, what you think about the class. Is there anything that I missed, that I should have asked you and I didn't? That would help me understand you better?

STUDENT: Uh, nothing comes to mind. Talking about the class and how we learn, so...