ABSTRACT

Title of Thesis: THE NATURE OF SELF-REGULATION, SCAFFOLDING, AND FEEDBACK IN A COMPUTER-BASED DEVELOPMENTAL MATHEMATICS CLASSROOM

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This study looks at what aspects of a computer-based course are key to success and building understanding in mathematics. Three students enrolled in the Independent Study section of Developmental Mathematics at the University are interviewed, and several other students observed and surveyed throughout a semester in the course. Their responses are analyzed in terms of their perceptions of learning and understanding mathematics; confidence, motivation, and interest in mathematics; and self-regulation and one's ability to keep up with the online mathematics course. Each of the three interviewee's interviews are analyzed individually in a case-study format and discussed individually based on patterns seen. These interviews are used to address how these online courses are set up, how students proceed in such courses, and what makes students successful in such courses.

THE NATURE OF SELF-REGULATION, SCAFFOLDING, AND FEEDBACK IN A COMPUTER-BASED DEVELOPMENTAL MATHEMATICS CLASSROOM

By

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Chapter 1 – Introduction

Introduction

There has been a good deal of research (Kinney, 2001; MacDonald et al., 2002; Merisotis & Phipps, 2000; Miles, 2000) on computer-based learning and its success rate among students in developmental studies programs. This study was designed to determine if the claims of this research are demonstrated in the computer-based Developmental Mathematics classes at a major Mid-Atlantic University. The Common Core State Standards Initiative states that one of it's goals is to eliminate the need for remedial, developmental courses through initiatives at the high school level (Common Core State Standards, 2010). Three key components that research shows are the benefits of computer-based courses, and especially developmental courses, were the focus of this research: the aspect of self-regulation that comes along with a computer-based, self-paced course; the nature of scaffolding and support provided throughout the lessons in the course; and the nature and frequency of feedback provided to students throughout the course. The components of this study were an initial survey of three students enrolled in the Independent Study section of Developmental Mathematics, a background interview of the participants, observation and documentation of progress by these participants in a particular unit (or units) of the course, a follow-up interview with these participants, and a final survey of the three students. Students from a regularly-scheduled section of Developmental Mathematics were also asked to participate in only the survey and observation portion of the study, but these students were not interviewed individually. The aim is to understand how these particular students progressed through the

Developmental Mathematics program as well as how their previous experiences in mathematics might have affected their progress.

Brief Summary of Setting

Many students come to college without the correct prerequisite knowledge to be successful in college-level mathematics courses. These students score poorly on college mathematics entrance exams and tend to get placed into a developmental mathematics course. At this Mid-Atlantic University, this course is Math003, Developmental Mathematics, and is taught in two different settings. Students may register for the regular sections of Math003, or they can be recommended to request enrollment in the Independent Study section. The course is a general review of middle and high school level mathematics to prepare students for their next course at the University. The regular sections of the course take place in a large computer lab (holding about 45 computers) and have one Teaching Assistant and one Instructor present during class time. These classes meet two or three times a week at a scheduled time. The Independent Study section, on which this study focuses, can only be taken with permission from the Learning Assistance Service center on the University's campus (a part of the Counseling Center). This section is much smaller (5 computers in the lab) and offers more individualized instruction for the students enrolled because there is a Math Learning Specialist and Assistant (me) available in the lab at all times that the offices are open.

Three students from this smaller section of the course were selected to participate in the study because they had completed some course work before the start of the semester. These three students were interviewed twice, surveyed twice, and observed throughout the two-month-long study. I worked closely with these students during the

rest of the semester as well. Because of low enrollment in the Independent Study section for the spring semester, I asked for volunteers from two regular sections of Math003 to participate in the survey portion of the study. Twelve students joined the study and completed two surveys and record keeping logs during a three-week period. This total of 15 participants helped to shed light on some of the issues surrounding developmental mathematics, and particularly computer-based developmental mathematics.

The course uses an internet-based textbook for instruction as well as some other online tools, and students are expected to teach themselves. My research focused primarily on the students enrolled in the Independent Study section of the course, students who tend to struggle with mathematics more than the average Math003 student. These students are particularly interesting because they have very different background stories as well as reasons for being in the course. I hoped to learn more about the course, the effectiveness of its online format, and the impact it has on the students who participated in this research.

Research Questions

From this group of fifteen participants, I hoped to gain some insight into the following issues:

1. How does a student's history with mathematics affect the student's perceived ability to learn mathematics from an internet-based program?
2. What effects do confidence, motivation, and interest have on a student's perceived ability to navigate through an internet-based program?

3. What effect does a student's perceived ability to self-regulate her/his learning and keep up with a self-paced course have on her/his success in an internet-based mathematics class?

4. Is there a connection between a student's conception of understanding and learning mathematics and her/his approach to an internet-based mathematics course?

5. What kinds of feedback are students looking for in a mathematics class? Does the internet-based course offer the feedback necessary for these students to feel they can succeed?

I created a background interview including a few mathematics content questions, an initial survey given to all participants, record keeping logs for participants to use, a follow-up interview, and a follow-up survey. Each of these instruments was designed to help in some way to answer the questions above. This table shows which instrument was used in the analysis and discussion for each question. While the size of the student sample limited any broad generalizations from this research, the data can be used to learn more about each of the interviewed students individually as well the overall feeling all participants had about the course as a whole.

Research Question	Interview I	Survey I	Daily Logs	Interview II	Survey II
1	X			X	
2	X	X		X	X
3	X	X	X	X	X
4			X	X	
5				X	X

Chapter 2 – Literature Review

Introduction

This review is meant to give an overview of the literature of the components that are important to success in developmental mathematics courses. First there is an overview of developmental courses in general, with specific information on mathematics courses. Second, I discuss some of the common aspects shared by developmental students, why they may place into developmental classes, and characteristics that link these students together. Third is a discussion of two common threads that link developmental students together as well as create difficulties for them in these types of courses: self-efficacy in mathematics and self-regulation in the context of Math003. Finally, there is a discussion of computer- and internet-based developmental mathematics courses and their effects on student performance. Studies have been conducted surrounding developmental students as well as characteristics that set these students apart from others. Student attributes that lead to success in developmental mathematics or other developmental courses have been researched as well, but there is no conclusive data specifically related to developmental mathematics courses that are computer- and/or internet-based. The few studies that have been conducted point to the need for more research in this area to better aid in teaching for understanding in developmental mathematics courses.

Developmental Courses

The need for developmental courses arises when students arrive at college with weak academic skills and find they are poorly prepared to succeed without some kind of additional assistance (Maxwell, 1979; Casazza, 1999). According to the National

Association for Developmental Education, developmental courses are meant to help, "under prepared students prepare, prepared students advance, and advanced students excel" (Boylan, 2002, p. 3). With almost 30% of college and university students needing one or more developmental classes their first year, there is clearly a need to serve this particular student population (Boylan & Bonham, 2007; Breneman & Haarlow, 1998; Smittle, 2003). In the fall of 2000, 71% of higher education institutions offered at least one course in developmental mathematics (National Center for Educational Statistics, 2003b), targeting primarily the students who are considered "under prepared," and typically not the other groups of students in need of developmental mathematics. The National Council of Teachers of Mathematics (NCTM) has made it clear that mathematics is important and lack of fundamentals must be addressed. The NCTM's (2000) *Principles and Standards for School Mathematics*, state that,

> The need to understand and be able to use mathematics in everyday life and in the workplace has never been greater and will continue to increase. In this changing world, those who understand and can do mathematics will have significantly enhanced opportunities and options for shaping their futures. Mathematical competence opens doors to productive futures. (p. 1)

So now, more than ever, it is important to assist incoming students with their deficiencies in mathematics and other study and organizational skills that may be influencing their performance in the subject.

Prior research (Bassarear, 1986; Higbee & Thomas, 1999) indicates that students in developmental classes feel that there is a stigma associated with being labeled as a member of a remedial class, proving the need for support for this specific population of

students. It is imperative for educators to develop an understanding of how these students are academically affected by such stigmas, and how this might affect their future career choices that are based on their perception of their ability to excel in a particular field (Betz & Hackett, 1983). A 2007 report showed that 72% of students still enrolled in developmental math at the end of the semester earn a C or better in the course (Gerlaugh, Thompson, Boylan, & Davis, 2007). The University that is the focus of this study has an 89.9% first year retention rate for all students enrolled in the five types of developmental level classes offered at the University (Task Force on Student Retention and Graduation, 2010, p. 21). In order to achieve success rates like this for all developmental courses, the students enrolled in these classes must be better understood and courses must cater to their specific needs. According to the National Study of Developmental Education (2002), developmental students are the most successful when enrolled in a program that offers tutoring, centralized organization, mandatory assessment, advising, mandatory placement, and program evaluation (Boylan). These structured aspects and tutoring opportunities lend the support necessary for students to succeed in the courses. Research (Hagedorn et al., 1999; Moreno & Muller, 1999) has also shown that, while there are many courses required for completion of a college degree, the subject that is crucial for students' choices in determining their majors and their ultimate success in obtaining a degree is mathematics.

The typical content in a developmental mathematics course at this University varies based on the mathematics course for which each student's major requires her/him to take. These courses are the fundamental college-level mathematics courses such as: introductory college math, college algebra (with and without trigonometry), introductory

statistics, and pre-calculus. Developmental mathematics has various tracks that attempt to prepare the students for whichever of the above courses is required. In all tracks, students can start as early as "number concepts" which review signed numbers, fractions, addition, subtraction, multiplication, and division. These lower-level concepts may not be included in review for students who require the higher-level college math classes later on. Students progress through two introductory algebra units (reviewing expressions, equations, inequalities, and applications). Then students are guided through solving and graphing linear equations. The course then introduces polynomials, operations on polynomials, and factoring. Students then are taken through rational expressions and equations, systems of equations in two variables, systems of inequalities in two variables, composition of functions, and inverse functions. If students require more prerequisite knowledge for their next course, they are introduced to logarithms and exponential functions. There are fewer developmental mathematics students who will require placement into pre-calculus than any other course, so these are the only pre-calculus topics that are addressed. It is clear that the students in these courses have a large amount of material to cover in one semester, but the expectation is for the course to be a review of prior knowledge as opposed to a place to teach new material. The content in these courses ranges from pre-algebraic concepts to pre-calculus concepts, a lot of ground to cover in a short period of time.

Developmental Mathematics Students

Prior Mathematics Background

There are several reasons why students might find themselves in a developmental college mathematics class. Many students receive instruction in elementary school that

focuses on rules and not on understanding of concepts because many teachers in these positions do not understand the mathematics behind these concepts themselves (Hammerman & Goldberg, 2003). Reading levels of college students affect their mathematics performance and placement due to the difference between a student's reading level and the reading level of many mathematics textbooks (Maxwell, 1979). Returning students, those who have taken some time off from mathematics between high school and college, have a difficult time in college mathematics as well (Merisotis & Phipps, 2000). The highest level of mathematics completed by a student in high school as well as the courses offered in high school also contribute to students' level of understanding and their mathematics placement in college (Hall & Ponton, 2005). Many high schools allow students to put off choosing mathematics courses until their senior year, and students who only take the minimum requirements in high school are less prepared for college-level material (Johnson & Kuennen, 2004). Students who complete more rigorous mathematics courses in high school have a greater likelihood of completing a bachelor's degree than those who have not taken such courses (Trusty & Niles, 2003). It has also been shown that there is little connection between what is taught in high school and what colleges anticipate their incoming students to understand (Boylan, Bonham, & White, 1999). These factors add up to create a population of students requiring developmental courses in order to succeed in completion of their college-level mathematics courses, understand mathematics, and build confidence in their mathematics abilities.

Student Motivation and Confidence

Further, among students in developmental courses, there are common threads that are not necessarily directly related to their mathematics backgrounds. They lack study skills and organizational skills that are necessary for college success (Armington, 2003). They also tend to lack motivation, confidence, the ability to self-regulate their learning, and self-efficacy in mathematics (Higbee & Thomas, 1999; Hall & Ponton, 2005; Armington, 2003). Other attributes often found among students in this population are a tendency to credit their successes and failures to external factors and being humiliated in the past by a parent or teacher (Wheland et al., 2003; Hammerman & Goldberg, 2003; Armington, 2003). Developmental mathematics students' goals, performance, and attainment in mathematics courses are influenced by attitudes towards success in mathematics, self-efficacy, math anxiety, and confidence in their ability to learn mathematics (Stanley & Murphy, 1997; Breneman & Haarlow, 1998; Higbee & Thomas, 1999; Wheland et al., 2003).

Student Self-Efficacy and Self-Regulation

Bandura (1997) defines self-efficacy as an individual's perception of her/his ability to perform tasks and accomplish goals. He continues to say that this belief has an influence on one's effort, action, resilience in the face of adversity, and realization of goals. Bandura defines the four principal sources of self-efficacy information as performance accomplishments, verbal persuasion, emotional arousal, and vicarious experiences. These four factors all influence how people perceive themselves, what they do with these perceptions, and how these perceptions influence their daily lives. These factors are particularly important when it comes to learning and developing

understanding in mathematics because Bandura also suggests that an individual attributes her/his self-efficacy to previous experiences and how those experiences relate to them on a personal level. If an individual does not have the knowledge necessary to accurately assess her/his own ability, then the assessment will be flawed (Bandura, 1997). This is linked directly to a student's performance in a mathematics class. Studies (Hackett et al., 1990; Campbell & Hackett, 1986) have shown that perceived ability and performance in previous mathematics encounters are major components for success in mathematics courses. If students have had positive experiences in mathematics in the past, they will experience an increase in self-efficacy, assuming they can link their positive outcomes in mathematics to an increase in their personal capabilities.

There are also correlations among confidence in one's ability to complete a mathematical task, test anxiety, and math anxiety (Higbee & Thomas, 1999). One's self-efficacy has an influence on performance and motivation, and it remains a key factor in academic outcomes and cognitive engagement (Patrick & Hicks, 1997; Bandura, 1997; Ponton, et al., 2001). The primary source of mathematics self-efficacy is self-reflection on past exposure to, or lack of exposure to, mathematics courses. Students, who lack the skills of self-reflection and the motivation to succeed in mathematics, attribute any deficiencies in current performance and/or negative attitude towards mathematics to their past experiences, making their past their primary reason for failure in the present. We must recognize and understand students who lack self-efficacy and provide reinforcement in their classroom environment to help them learn to build confidence and understanding.

Experience with Online Courses and Internet-Based Resources

Because many developmental mathematics courses are now taught online or through a computer-based program, student self-regulation is a key factor in learning for understanding in these courses. Self-regulation refers to "learning that occurs largely from the influence of students' self-generated thoughts, feelings, strategies, and behaviors, which are oriented toward the attainment of goals" (Schunk & Zimmerman, 1998, p. viii). This is directly linked to a student's self-efficacy, and research has shown that students who use self-regulated and self-determined approaches to learning will gain more and be more satisfied with their work (Pintrich, 2000; Ryan & Deci, 2000). These are necessary traits for students in technology-oriented developmental mathematics classes, because many of these classes have students work individually and require students to be on top of their work, organized, and motivated to complete tasks on time. At the high school level of mathematics, teachers typically teach in a traditional lecture-style manner, emphasizing modeling of concepts as well as practice in class. This is dramatically different from a developmental mathematics course in college in which students must navigate an internet- or computer-based program in order to learn material and complete their assignments on their own. This change, and the need for self-regulation in developmental mathematics classes, affects students' self-efficacy in mathematics as well as their ability to perform. These links between factors in student success show the difficulty that developmental mathematics instructors face when collaborating with a diverse group of students who may not have the study skills and confidence necessary to be successful in college courses.

Computer- and Internet-Based Approaches to Learning

The way a course is taught can influence a student's success in that class in many different ways. Since the population of developmental mathematics students at any college or university is very diverse, there is no one instructional method that will meet the needs of all students (Boylan, 2002; Boylan et al., 1999; Higbee & Thomas, 1999; Kinney & Robertson, 2003; Miles, 2000; Perez, 1998; Roueche & Kirk, 1974; Waycaster, 2001). Roeche and Kirk (1974) maintain that, "individualized instruction is critical to the effectiveness of developmental programs" (p. 88). Courses in which computer-assisted instruction is used can provide students with an individualized study plan that is based on each individual's scores on homework, quizzes, and tests (Hannafin & Foshay, 2008; Cotton, 1991).

Because such courses are taught in various forms it is difficult to analyze their success, but here we will focus on the courses that are typically considered to be a hybrid form of course instruction. In a hybrid course, students have mostly online components to the class, but they may have human interaction from an instructor or teaching assistant if needed. This format for a course can be difficult because research has shown that students who have previously used effective study strategies in their other courses may not be able to translate these strategies to an online course (Wadsworth et al., 2007). Success in an online developmental mathematics class is dependent on concentration, self-efficacy, motivation, self-assessment skills, and information processing (Wadsworth et al.). However, it has also been shown that computer-based instruction can have positive effects on students who have mild to moderate cognitive learning disabilities and

this can help us to reach the diverse population in developmental courses (Fitzgerald & Koury, 1996).

Online courses have many components to keep up with, and Heubeck (2008) suggests that discipline is required for students to keep up with the rigor of submitting online assignments and completing tests on time. Some students don't possess the maturity or self-motivation required to succeed in that kind of classroom environment. Developmental mathematics students also need to see an instructor work problems out for them (Maxwell, 1979); this can be incorporated into some courses through online access to video tutorials. While these tutorials can be helpful, there is no substitute for the presence of a teacher of whom you can ask questions and receive immediate coaching. In a computer-based environment, students also tend to feel as if they don't have a real "teacher" and are not attending or enrolled in a real "class" (Kinney, 2001). One key factor leading to frustration among students as well as teachers is the difficult nature of communicating mathematically with symbols and other terms over the Internet (Testone, 1999; Smith & Ferguson, 2004). Paired with these findings, Boylan (2002) states that,

> Computer-based distance learning has yet to be proven effective with developmental students. Distance learning often requires independent learning skills, study discipline, time management skills, and a high degree of motivation. These characteristics are not plentiful among developmental students. (p. 82)

These drawbacks might lead one to think that the online format for developmental classes is not ideal, but traditional lecture-based instruction in developmental mathematics classes has produced low pass rates and high drop out rates in the past (Wright et al., 2002). Teaching strategies that encourage persistence, teach study skills,

decrease anxiety, and build confidence have shown higher success rates (Perez, 1998; Hall & Ponton, 2005; Higbee & Thomas, 1999; Roueche & Kirk, 1974). It is also important for students to integrate technology into their mathematics learning because, as NCTM's (2000) Technology Principle states, "technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances students' learning" (p. 3). And it helps to prepare students for the technology they will continue to meet throughout their lives. While challenging, computer-based courses can be beneficial in mathematics and beyond for students who work hard and have the motivation to keep on track.

Computer-based instruction allows students to work at their own pace, receive immediate feedback, be guided through practice problems and examples, and have 24-hour access to their mathematics materials. Research has shown that this type of instruction has great potential for developmental mathematics students (Kinney, 2001; MacDonald et al., 2002; Merisotis & Phipps, 2000; Miles, 2000). It has also been shown that students appreciate the non-judgmental feedback and infinite patience that a computer can provide and some instructors do not (Cotton, 1991; Hannafin & Foshay, 2008; Kulik & Kulik, 1991; Mahmood, 2006; Merisotis & Phipps). Cotton (1991) and Mahmood (2006) also emphasize that computers and online programs can be programmed to cater to students' needs for less or more feedback and for less or more time on task. Students have reported that they like working with computers because they can learn in small increments, instruction is individualized, computer skills are developed, and teachers are left available for more meaningful interactions involving the mathematics in the course (Cotton, 1991).

Computer- or internet-based instruction is a student-centered type of instruction, in which the students have control over the amount of time spent "in class" at one time and responsibility for their own learning. In this type of instruction, teachers become facilitators, tutors, and coaches for the students (Brown, 2003; Kinney & Robertson, 2003; Brothen & Wambach, 2000). Student-centered approaches to teaching have been associated with motivation to learn, deeper level of understanding, appreciation of content, increased mastery of concepts, and satisfaction with the class (Grasha, 1994; Felder & Brent, 1996). Factors found to be critical to the success of computer- and internet-based courses are student comfort with technology, trained faculty, engaging instructors, frequent faculty feedback, and students who are self-motivated and self-disciplined (Testone, 1999; National Center for Academic Transformation, 2005). While all this may be true, researchers reflect on the lack of a meta-analysis or any conclusive research on computer- and internet-based instruction for developmental mathematics (Trenholm, 2006). Engelbrecht and Harding (2005) agree and believe this lack of research reflects the fact that e-learning and computer-based instruction are relatively new to the field of developmental mathematics, and that "research on this new mode of instruction is sparse and open research questions are temptingly plentiful" (p. 235). With both the opportunities and pitfalls in mind, it is clear that there is a need for more research on best practices for the use of computer- and internet-based courses for teaching developmental mathematics.

Chapter 3 – Methodology

Expanded Contextual Description

Developmental Mathematics is a course offered by many colleges and universities in order to help students prepare for their later mathematics courses (National Center for Educational Statistics, 2003b). At this major University, placement into this course is based on Mathematics Placement Test scores. Students who come to the University are required to take a Mathematics Placement Test prior to their orientation to the campus, and are placed into mathematics classes based on the score from this test. Students with special circumstances (excellent AP scores or SAT scores) can receive course credits towards their college math requirement. Students who perform poorly on this Placement Test are sent to one of the many developmental mathematics tracks that the University offers. Some students begin in a course that reviews for five weeks and continues into a credited course after that time. Others are placed into Math003, where they review for an entire semester in order to move on to their next course.

These courses are taught in many different ways at different schools, but this study focuses on a student-centered approach to teaching that involves internet-based resources as well as open-lab time for students to use computers in the presence of an instructor and/or teaching assistant. This East Coast University has been implementing this program for just over two years, but has offered Developmental Mathematics in some computer-based form for the last 10 years (Department of Mathematics, 2009). Math003 is an internet-based, non-credit, developmental-level mathematics course. The course is required of students who have very low placement scores in order for them to have a chance to review for their next college-level mathematics course.

Description of Math003

Math003 is organized as a one-semester course with both in-class and out-of-class components. Students enrolled in a regularly scheduled section of Math003 attend the computer lab at a specific time of day (either 2 or 3 days a week) for 6 hours total in the lab each week. Students are expected to put another 6 hours of their time in at home in order to finish the course in one semester. This course is self-paced, but students are given checkpoints at the beginning of the semester in order to stay on track. Instructors will offer students a list of dates when they are expected to take written tests (3 total throughout the semester), and also give a regularly scheduled final exam at the end of the semester. The course load is approximately equal to that of a 3-credit course at the University, so for financial aid and insurance purposes, students' schedules during the semester display the course at three credits, but they receive no credit toward their degree at the end of the course.

There are two settings in which students can take Math003. First, there are multiple sections of the course that accommodate between 20 and 40 students in one lab. These courses meet regularly throughout the semester, students have an undergraduate teaching assistant in the lab at all times, and the instructor is in the lab for half of each class period. The course is pass-fail and students must score above a 70% overall in order to pass. The students may come into the lab for extra hours at any time there is a teaching assistant and/or instructor present, but the rest of their work must be completed outside of the computer lab. Students go through an online textbook in order to complete the course. The text is part of Pearson's MyMathLab software and is tailored to the next course that the student will be taking. There are four different textbooks used here at the University,

but each student is expected to proceed through the material in the same way. Each book contains approximately 12 chapters of mathematics material that are broken down by section, designed to prepare students for the next mathematics course necessary for their degree.

Description of MyMathLab Software

The MyMathLab program includes many different components, not only an online text. The online text is a multimedia textbook, equipped with links to applets that help visualize mathematics situations as well as videos and tutorials that give the students a different perspective on the mathematics content. There are five important aspects to the course: chapter content, pre-tests, study-plan questions, worksheets, and post-tests. Each student is expected to study the content of each chapter, either through the multimedia textbook, PowerPoint presentations, and/or video tutorials.

Once the student feels comfortable with the content and has taken notes, s/he goes on to take the chapter pre-test. Students are allowed to use their notes here, and pre-tests range from 10-60 questions depending on the amount of content and number of sections in the particular chapter. Each pre-test has a number of questions that pertain to each section that will be covered in the text. Students have only one opportunity to take each chapter pre-test, but it is not necessary that they take the entire test at one sitting. MyMathLab will allow students to come back to a pre-test at a different time before submitting their answers to be scored. The online program scores the pre-test, once it is complete, and indicates, within the study plan, any problems that students struggled with or got incorrect answers for. Each section in the chapter is marked with a symbol indicating whether or not the student correctly answered the pre-test questions that

correspond to that section. If a student answers questions correctly for a given section, a small graduation cap icon will be displayed next to that section. If a student has a chapter in which all sections are marked with a small graduation cap, then s/he can move on to the next chapter of material without taking a post-test.

If a student does not answer the questions for a section correctly, a small pencil icon will appear next to that section in the study plan. These questions are individually marked with a pencil inside the study plan. If a student has questions marked by pencils in the study plan, s/he must go through these questions, get the correct answers, and then complete a chapter post-test. Within a section, the program selects questions for students to answer that directly relate to those that were answered incorrectly on the pre-test. Once a student answers all of the pencil questions in one section, the pencil icon for that section will be replaced by a checkmark.

MyMathLab software gives students some extra help for the study plan questions, as needed. Students have the options of: "view an example," "help me solve this," "watch the video," "textbook," and/or "ask my instructor" (See Appendix B, p. 1). Each of these tools can help the student complete the task at hand, if they have questions. "View an example" takes the student to another problem that is similar and walks them through the solution step-by-step. "Help me solve this" walks the student through the same problem as the study plan, but then changes the numbers once a student is required to enter an answer, so the program does not give away answers. "Watch the video" is not available for every problem in the study plan, but when it is, students are directed to a short video of an instructor modeling the solution to a very similar problem as the one in the study plan. "Textbook" allows students to link directly to the page in the textbook that

discusses the content related to the study-plan question at hand. “Ask my instructor” allows a student to send an e-mail, with a personalized message, to her/his instructor along with an attachment of the image pertaining to the question in the study plan that the student struggled with. These tools are meant to aid students in completing work outside of the lab or without the presence of a teaching assistant or instructor.

Once students answer all of the questions in their study plan, the program will indicate that a section has been mastered by displaying a small icon of a check mark, meaning that a student can successfully move on to the next section or chapter of material. When students complete a chapter in the study plan, they must take the chapter post-test and score a 70% or above in order to move on to the next chapter. This test can be repeated (with different problems) as many times as needed in order to move on.

Throughout the semester, students are given worksheets to either complete in class or to take home and complete as a homework assignment. These worksheets are graded by the teaching assistant and used to help target struggling students. Students are expected to complete three written tests during the semester as well, and tentative completion dates for these are indicated on the syllabus for the course, which differ depending on the course a student is required to take after developmental mathematics and on their instructor. Students take a final exam at the end of the semester, and, with an overall grade of 70% or above, can move on to their credited-course in their next semester at the University.

Description of Math003 Independent Study

The other option for taking Math003 at the University is the Independent Study section of the course. The course load and procedures for completion of the course are

identical to those discussed above with the exception of chapter post-tests. This section meets in a small computer lab in the University's Learning Assistance Service (LAS, a division of the Counseling Center). It is designed for students who do not perform well in the regular sections of Math003, are repeating the course, have a learning disability that affects their mathematical processing, are returning students, and/or have no room in their schedule to meet in the regularly scheduled sections. Students must be referred to this section by either an advisor or their instructor from a regular section of Math003. Students who meet the criteria for being enrolled in this section then create a class schedule with the Math Learning Specialist in LAS. This schedule includes 6 hours in the LAS lab, as well as an individual bi-weekly appointment with the Math Learning Assistant in LAS. These students are scheduled into the lab during times when either the Math Learning Specialist or Assistant is available, so there is help when needed. This section offers students more one-on-one attention with the teaching assistant and/or instructor, and caters more to the students' needs than the regular section of the course.

Students placed into the Independent Study section of Math003 typically learn mathematics at a slower pace than those in a regular section, and most students enrolled will require a minimum of two semesters to complete the course. The only difference in course procedures is that students in the Independent Study section are not required to take a post-test. After completing their study-plan questions, they may move on, and written tests are used to maintain accountability for student understanding. The Independent Study section of Math003 focuses on any specific disabilities, anxiety issues, or gaps in previous mathematical knowledge. This section's aim is to help students who truly struggle in mathematics to pass their fundamental mathematics

requirements and build an understanding of mathematics in order to be successful in the future.

Description of Research Questions

This setting is a particularly good site to explore the following questions:

1. How does a student's history with mathematics affect the student's perceived ability to learn mathematics from an internet-based program?
2. What effects do confidence, motivation, and interest have on a student's perceived ability to navigate through an internet-based program?
3. What effect does a student's perceived ability to self-regulate her/his learning and keep up with a self-paced course have on her/his success in an internet-based mathematics class?
4. Is there a connection between a student's conception of understanding and learning mathematics and her/his approach to an internet-based mathematics course?
5. What kinds of feedback are students looking for in a mathematics class? Does the internet-based course offer the feedback necessary for these students to feel they can succeed?

These questions are difficult to answer with only a survey and observations, so this setting allows for the interview process to be built into each student's class time. Questions 2, 3, and 5 can be answered generally for each student based on some of the answers from the surveys and daily logs. This particular setting gave me the opportunity to interact with my students and get to know them on a personal level before conducting the interviews. While data collected from students who were not interviewed was

valuable to the research, the relationship that I developed with the students in the Independent Study section of the course is far different from any relationship I built with the other students. This comfort level, as well as proximity to my participants, is what allowed for a deeper interpretation of interview data, combined with the surveys and daily logs, to explore the questions above. Questions 1 and 4 appeared more difficult to answer and required some exploration into how each student viewed learning and how they felt they could progress and learn in the Math003 classroom, which is why this setting was ideal. I was able to work with the three selected students and learn how they perceived math learning to operate, and I believe this helped greatly during the study and added information that could not have been obtained otherwise.

Participant Selection

This study focuses on students enrolled in Developmental Mathematics courses at a major Mid-Atlantic University. Students chosen to participate were selected from each of the two types of Math003 sections offered: a regularly scheduled section of the course and the Independent Study section of students who have scheduled the course around their other scheduled activities for a number or reasons.

Selection of Participants

The developmental classes in the spring semesters at the University typically have lower enrollment than the fall semester because many freshman take it in their first semester. In the 2011 spring semester, enrollment in Math003 Independent Study was quite low. Originally, this study focused solely on students enrolled in this specific section of the course because of the access I, as the Math Learning Assistant at LAS, have to these students. These students are an interesting population given the various

reasons for their being enrolled in this section, and I am able to work closely with each of them. At the start of this study, only four students were enrolled in Math003 Independent Study, and only three of these students had completed course work the previous semester. One criterion for involvement in the study was that students had to have completed at least three units of course work before their involvement in this research, so I selected the three students who had completed a few sections of material before the start of the semester. After consideration, I amended my research proposal to include sampling students enrolled in a regularly scheduled section of Math003.

I visited two sections of Math003 and was able to recruit ten more students to fill out the initial and post-surveys as well as keep daily logs of their progress. The students were informed of the different components of the study that they would have to complete, and they volunteered to assist me with the research. With the three students from the Independent Study section and 10 from the regular sections of Math003, there were a total of 13 students enrolled in this study. Broadening the selection provided a larger sample size for the survey and daily log portion of the study (discussed below). The addition also allowed me to obtain data from students not enrolled in the Independent Study section, which is quite different from a regularly scheduled section of Math003. This change in sample size can increase the impact on the scientific integrity of the study by pooling a larger sample of students and collecting data from a more diverse population than originally planned.

Description of Subjects from Math003 Independent Study

There are various reasons for the subjects from Math003 Independent Study to have been placed in the course, and all subjects have been given a pseudonym. First is

Trent, a freshman on the basketball team who completed a summer mathematics prep course and was placed into Math003 at the end of that class. Trent is registered with Disability Support Services (DSS) and has been shown in previous psychological studies to have some mathematics learning difficulties. Trent's accommodations include extended testing time, note-takers, and access to computers for written exams. Trent was enrolled in this section for both the fall and spring semesters of the 2010-2011 school year. His attendance during the first semester was better than his second semester (as the basketball season had started by then). Trent did not pass the course at the end of the spring semester.

The next student, Kenny, attempted both non-credit and credit-bearing mathematics courses at a community college and this University, but was unable to attain a passing grade in any of these courses. Kenny passed a developmental mathematics course at his community college after several attempts, and felt it was necessary to start at the beginning again. Kenny voluntarily joined the Independent Study section of Math003 in order to prepare for his next course as well as build confidence and understanding in early mathematics concepts. Kenny is involved in extracurricular activities on campus, but is not involved with athletics. Kenny is motivated and determined to do well in his next course, and he has been enrolled in Math003 since the start of the 2011 spring semester. Kenny received a passing grade in Math003 for the spring semester, and will continue to review over the summer before he begins his credited course at the University in the fall.

The final Independent Study section student selected for the study is Rick, who is also an athlete. Rick is a 4^{th} year student at the University and he has attempted

mathematics here in the past. Rick has another year of eligibility on the football team, so he has a total of five years here at the University. Rick is a special case because he has been enrolled in Math003 (various different sections) for the last 3 years. He began his career at the University in Math003, after completing the summer math preparation program (the same program Trent went through). He was unable to pass Math003 his first year here, and was also unable to pass an attempt at a credit-bearing course. Rick has been registered with DSS his entire time here at the University, and has been registered each semester for Math003. This year was the first time Rick enrolled in the Independent Study section of Math003 and was able to attend class and complete some of the course work. Unfortunately, Rick was unable to complete the semester and had to withdraw from the course due to a family emergency that took place in the spring semester of 2011. While he did not complete the course, the effort Rick expended this semester and last fall was more than I have seen from him in his four years here. He was chosen for this study because he had completed material in Math003 in the past, and because of the interesting circumstances for his still being enrolled in the course at this point in his college career.

Description of Non-Interviewed Subjects

I cannot be as specific with descriptions of the other students involved in the study because they were registered for a regular section of Math003 and I did not have as much access to these students as I did to the three mentioned above. The other ten students who volunteered from the regular sections of Math003 (Chris, Harry, Martin, Reuben, Alex, Kelly, Karl, Melissa, Olive, and Taylor) were not interviewed individually in this research study, but their responses to surveys and their daily logs are considered, and the effect of the course on their success in developmental math will be analyzed.

These students were included in the study with the expectation that there would be more information to gain from learning about similarities and differences among students enrolled in the two types of developmental mathematics offered at the University.

Risks, Benefits, and Conflicts of Interest

Risks to participants in this study include anxiety, concerns about grades, and concerns about revealing too much personal information. In order to address these risks, all participants were encouraged to ask the researcher questions throughout the study and were informed that they could withdraw from the study at any time without penalty. All participants were given the opportunity to review their interview transcripts to insure that the transcriptions reflected their answers to the interview questions. All students were also informed that their decision to participate would not affect their grade in Math003.

Benefits for students enrolled in Math003 Independent Study could include increased individual time with the Graduate Assistant, self-reflection on past mathematics experiences, an opportunity to reflect on the instructional methods used in this course and their effectiveness in comprising the key components of a computer-based course. Benefits of this research include the potential to improve practices based on the impact of the developmental mathematics process at the University on the students enrolled in the course. New knowledge may also be obtained regarding implications of students' opinions on the effectiveness of the three major components of a successful, computer-based course (self-regulation, scaffolding, and feedback).

Though this study has no affect on student grades, a conflict of interest could arise due to the fact that the Student Investigator (myself) is also the Graduate Assistant (Math Learning Assistant) for the course. Concerns include: the three students chosen for this

study will have increased individual time with the GA for the course, which could in turn affect their performance in the course. There is no known conflict of interest for students participating in only the survey and daily log process.

Instruments

All participants granted consent to be interviewed, surveyed, and to complete daily logs. Three students were selected from the Independent Study section of Math003 based on their current progress in the course (a minimum of three units of material completed at the start of the study). These participants were informed of their duties in the study and signed and received a copy of a consent form. Subjects were asked to participate in an interview lasting one hour (See Appendix A, p. 7). This interview asked questions related to the students' background in mathematics, attitude towards mathematics, the three key components of the computer-based instructional resource, and specific content knowledge associated with their current progress in the course. This interview was videotaped for record keeping purposes. All video recordings are stored on a password-protected computer to which only the Principal and Student Investigators have access.

The subjects were observed as they progressed through the next unit in the course material via a daily log (See Appendix A, p. 9) as well as the number of times they accessed different instructional tools on the course webpage. The daily log consists of the amount of time the student spent on the unit that day, which methods they used for instruction, how many practice problems they completed, and if they explored anything new on the website that day. This portion of the study took differing amounts of time depending on the student and their unit of choice, because MATH003 is a self-paced

course. For students enrolled in the regular section there are three weeks worth of daily logs.

Once the unit was completed, subjects chosen from Math003 Independent Study were asked to participate in a follow-up interview that probed them on their choice of instructional materials throughout the unit, how they felt they performed in this unit, their overall feelings about the subject and materials available, their opinions of the three key components linked to the success of computer-based courses, and their perceptions of themselves as mathematics learners in this particular course (See Appendix A, p. 10). All participants in the study answered questions on a follow-up survey, which reflected on the unit they completed and their perception of their math learning (See Appendix A, p. 12).

Data Collection

Math003 Independent Study

Data collection for this population of students began during the first week of classes of the spring semester. All three students signed their consent form as well as answered the first survey within the first week of classes. The first survey consists of questions about each student's experience with Math003, computer-based learning, self-confidence in mathematics, and perception of tools necessary to succeed in a mathematics class. Students were given fifteen minutes to complete the survey. All written responses from students (throughout the study) were scanned into a password-protected computer and then all paper copies were destroyed.

Once the survey was administered, the students selected a time in their schedule, within one and a half weeks of their consent (during Math003 class time) that would

work best for the first interview. Each student was given one hour for the first interview, and some of the interviews lasted longer than others. The first interview consists of questions related to the students' math background, perception of necessary materials for success in mathematics, and math content knowledge in a specific area (See Appendix A, p. 6). For each of the three students, the math content portion of the interview focused on solving systems of linear equations (Chapter 7 of their online text), which is a concept that none of them had gotten to in the course, but used some of the material from Chapter 3, material all students had been introduced to by this point in their Math003 curriculum. The interviews were recorded using a camera on my computer, but only audio was recorded with little attention to visuals. During the mathematics content portion of the interview, the camera was faced downward to capture anything the student might have written down. The recordings are saved on a password-protected hard drive to which only the Principal and Student Investigators have access.

These students were then given copies of daily logs every time they came to class. The students were expected to fill out a log each time they attended the class, but were not required to fill out the logs when they worked outside of the classroom. This process continued for several weeks, allowing the three students the opportunity to complete a chapter before being interviewed again. At the end of this time, students then scheduled their second interview with me. This interview, followed by a final written survey, is meant to bring together all that the student may have learned during the course of the study. The second interview consists of questions related to the students' opinion on the program used for the course, feedback offered throughout the course, ability to self-regulate their learning, and perceptions of how well they understand the material that they

studied during the research process (See Appendix D). Students were again given one hour for these interviews, and times did differ for each of the interviews. After the interview, students filled out a second written survey that probed them on their feelings towards the course, confidence in their understanding of the material, and any ideas they may have for the course itself or for students taking the course in the future. Once this second survey was complete, students were considered to be finished with their role in the study. If they chose to, they were allowed to review their transcriptions prior to my analysis. None of the students chose to do this.

After the students completed all of the portions of the study, I observed their online interactions through the instructor control panel on the MyMathLab webpage. The data collected are minimal, but show when students logged in and for how long as well as which components of the internet-based textbook the students chose to use to help them complete their assignments (See Appendix B).

Math003 Regular Sections

Data collection for this population began two weeks prior to spring break during the spring semester of 2011. Two Math003 classrooms were visited on the same day and students were asked to participate in the study. Four students from the first section volunteered as well as six students from the second section. These students were asked to read and sign a consent form as well as fill out the first survey for the study (See Appendix A, pp. 1-5). The students were given twenty minutes to complete these two tasks. Once completed, I informed the students that they would receive an e-mail containing an attachment in order to fill out their daily logs. Each student provided me with an e-mail address and these were sent out within 24 hours of the classroom visits.

Students were asked to complete the logs every time they logged onto the course webpage. They were given the opportunity to print them out or send them back to me electronically at the end of the three-week time frame. Students received three e-mails throughout the process (one per week, excluding spring break) as a reminder to complete the logs as well as expectation to see me in class a few weeks later. Exactly three weeks after the first survey was administered (not including the week of spring break), I revisited the classrooms of these students and administered the second survey to them as well as collected any daily logs that might have been hand-written. Students who preferred to submit their daily logs electronically were asked to do so within 24 hours of this second class visit. Once the students completed the second survey, they were told that their participation in the study was done. These students received surveys and daily logs identical to those received by students in the Independent Study section of the course. Because these students were not enrolled in the course to which I had access, statistics based on their online participation were not analyzed.

Complications with Data Collection

Several complications arose with the data collection process, both within Math003 Independent Study as well as the regular sections of the course. These complications may have an effect on the results of this study, and therefore must be addressed. First, there was a malfunction with the software used to record Kenny's first interview, so the final product only contains the interview questions related to Kenny's confidence in mathematics and his perceived ability to complete Math003 at this University. Kenny's answers to the mathematical content questions were not recorded due to the technical difficulty experienced. Second, Rick had a family emergency and

was unable to continue through to the end of the study. From Rick, I was only able to collect an initial survey as well as a first interview. One week after the interview Rick was out due to illness, and the next week he withdrew from the course due to a family emergency, but I am still interested in his case and will analyze his first interview in the next chapter. Third, many of the students who chose to participate in the study who were enrolled in a regular section of Math003 were not able to complete all of the components of the study. Of ten students who volunteered, only six students completed every component they were asked to complete. Due to this low number, I analyzed information from all initial surveys, but only make comparisons for students who have both an initial and a final survey completed. Also to increase the data base, I decided to include two students who had a late registration for Math003 Independent Study (Mark and Walter) in the survey and daily log portion of the study, and their answers were analyzed as well.

Tables of Data

Components	Consent	Survey 1	Interview 1	Daily Logs	Survey 2	Interview 2	Race/ Ethnicity
Students							
Trent	Complete	Complete	Complete	6	Complete	Complete	African Amer.
Kenny	Complete	Complete	Partial	8	Partial	Complete	African Amer.
Rick	Complete	Complete	Complete	0	Incomplete	Incomplete	African Amer.
Mark	Complete	Complete	N/A	3	Incomplete	N/A	African Amer.
Walter	Complete	Complete	N/A	6	Complete	N/A	Hisp./Latino
Chris	Complete	Complete	N/A	13	Partial	N/A	African Amer.
Harry	Complete	Complete	N/A	5	Complete	N/A	Hisp./Latino
Martin	Complete	Complete	N/A	0	Complete	N/A	African Amer.
Reuben	Complete	Complete	N/A	7	Complete	N/A	White
Alex	Complete	Complete	N/A	4	Complete	N/A	Asian
Kelly	Complete	Complete	N/A	0	Incomplete	N/A	White
Karl	Complete	Complete	N/A	0	Incomplete	N/A	White
Melissa	Complete	Complete	N/A	12	Complete	N/A	White
Olive	Complete	Complete	N/A	0	Complete	N/A	African Amer.
Taylor	Complete	Complete	N/A	3	Complete	N/A	African Amer.

Survey I

Number of Responses →	**Yes**	**No**	**Omitted**
Survey Question ↓			
1. Is this your first time taking this course?	10	5	0
2. Do you feel you were accurately placed into this course?	10	5	0
3. Have you had experience with computer-based or internet-based instruction in the past?	9	6	0
4. If the U offered this course taught by an instructor in a small lecture, would you have registered for it?	9	6	0
5. Is feedback in math class important to you?	12	3	0
6/7. Explain why or why not.	N/A	N/A	0
8. This course is self-paced. Rate yourself (0-5) on your confidence to self-regulate your work and keep up with the course.	N/A	N/A	0
9. Do you believe students should receive credit for completing this course?	11	3	1
10. What kind of in class support do you feel is necessary for you to succeed in a math class?	N/A	N/A	2
11. What kind of out-of-class support do you feel is necessary for you to succeed in a math class?	N/A	N/A	2
12. What does "developmental math" mean to you?	N/A	N/A	2

Answered "Yes" to Question 5	***Is feedback in math class important to you? Explain***
Trent	Gives me something to go on, helps me stay motivated to do work.
Kenny	I don't feel that I would be able to grasp the material without feedback.
Rick	It helps me learn from my mistakes.
Mark	It is important because you would know what to work on or correct.
Walter	Because a lack of feedback is how I ended up here. It's crucial for learning and especially for advancing.
Chris	Because it lets me know what I am doing right and what I need to improve
Reuben	I like to know that I'm understanding what I'm learning.
Alex	Helps with progress.
Kelly	Because it helps me figure out what I should continue doing.
Melissa	Because there are so many ways to solve math problems and one way (by a computer) may not be the most easily understood to the student.
Olive	Yes, because I like to know where I've made mistakes and get advice on how to improve my skills.
Taylor	Obviously, I wont get any better without it.
Answered "No" to Question 5	
Harry	As long as all the material is available online to use none will be needed. Math is very linear.
Martin	I know that the work I'm doing is correct. The course basically guides you enough that there is no need for feedback.
Karl	The online program is enough help.

Students	8. *Rate yourself (0-5) on your confidence to self-regulate your work and keep up with the course. (5 = confident)*	9. *Do you believe students should receive credit for completing this course? Explain.*
Trent	5	**Yes:** It takes up time just like every other class you receive credit for.
Kenny	4	**Yes:** This course takes a lot of hard work and effort on the part of the student in a subject that they have probably struggled with for a good part of their lives.
Rick	4	**Yes:** It is harder to work at your own pace.
Mark	5	**Yes:** Because it is a course to move on to higher math.
Walter	5	**No:** It's all things covered in high school and should be mastered by now. Fml.
Chris	4	**Yes:** I believe students should receive credit for this course because it takes time and effort to go through this like any other course.
Harry	5	**No:** Attending a University, a minimum requirement is expected by the student to know about basic subjects, math is one.
Martin	5	**Yes:** You're taking the time and money to do it, it should at least be one credit.
Reuben	5	**Yes:** Even though it is self-paced it should be for credit.
Alex	5	**Yes:** Because we still pay and engage in all aspects of education, hw/quiz/test/etc.
Kelly	3	**Yes:** Because it takes up just as much time as other courses and we do work.
Karl	4	**No:** It should be review for an honors University.
Melissa	5	**Yes:** Because it's still work, time consuming, requires tuition, and has all the same elements involved as in a regular course (tests, quizzes, hw, etc)
Olive	5	**omitted**
Taylor	2	**Yes:** The course is still difficult and time-consuming. If a student has to take large amounts of time away from working on other classes, they should get credit.

Students	12. *What does "developmental math" mean to you?*
Trent	Learning how to understand math if you haven't before.
Kenny	"Developmental Math" means math that covers the fundamentals that may have been missed during the formative years.
Rick	omitted
Mark	Learning steps.
Walter	Developing skills so I can succeed in college level math.
Chris	It means everything to me because it serves as a foundation to other higher math courses.
Harry	omitted
Martin	You've been away from math so long or a different kind of math (maybe a more specific class like Stats) that you forgot how to do the other basic math.
Reuben	It means developing skills that may have been lost to years of not using them.
Alex	Math used in the development of more complex problems.
Kelly	It means my math is not where it should be for college.
Karl	Review of what I've previously learned.
Melissa	The "basics" of math.
Olive	Math skills that you have to develop in order to succeed in a higher math.
Taylor	I suppose it means "below average." The name really should be changed as it makes the students in the class seem mentally deficient to those outside it.

Daily Logs

Key

ppt	PowerPoint
sp	Study Plan
vid	Videos
hmst	"Help Me Solve This"
vae	"View An Example"
me	Allison's Help
anim	Animations
tb	Textbook
self	Student's Self-no extra help
rs	Review Sheet

Participants

	1/6/11	1/10/11	1/13/11	1/20/11	4/5/11	4/7/11
time spent	1 hr	55 min	1 hr	30 min	1 hr	30 min
sections	3.3	3.3	3.3, 3.2	3.3	5	5.1-5.5
methods	ppt	sp	sp	none	vid	vid
problems completed	7	5	15	6	0	0
anything new?	no	no	no	fcm	vid	vid

Kenny	2/25/11	3/2/11	3/4/11	3/7/11	3/17/11	3/28/11	3/30/11	4/11/11
time spent	1.5 hrs	3 hrs+	3 hrs +	3 hrs +	3 hrs	3 hrs	3 hrs +	1 hr
sections	2.7, 2.8	2.8, 3.1, 3.2	3.2-3.4	3	4.5-4.8	4.1-4.8	4	4.5, 4.6
methods	hmst, vae	ppt, hmst	ppt	ppt	ppt	ppt	none	ppt
problems completed	11	8	0	20+	none	none	none	4
anything new?	no	ppt	no	no	no	no	no	no

Mark	4/6/11	4/11/11	4/15/11
time spent	1 hr	40 min	30 min
sections	4.3, 4.4	4.5-4.6	4.6
methods	me	none	sp
problems completed	2 sections	2 sections	11
anything new?	no	no	no

Walter	3/28/11	4/11/11	4/14/11	4/18/11	4/22/11	4/26/11
time spent	1.5 hrs	1 hr	1 hr	1 hr	3 hrs	1.75 hrs
sections	5.3	6.1-6.8	6.3	6.3	4.6-4.7	ch 5 pretest
methods	anim	tb	me	me	self, tb	none
problems completed	30	6	15	15	30	21
anything new?	no	vid	no	no	yes: self	yes:music

Chris	3/9/11	3/10/11	3/13/11	3/15/11	3/16/11	3/17/11	3/23/11	3/26/11	3/29/11	3/31/11	4/2/11	4/5/11	4/5/11
time spent	2 hrs	2.5 hrs	1.5 hrs	3 hrs	1.5 hrs	2.5 hrs	2.5 hrs	3 hrs	1 hr	1.75 hrs	3 hrs	1 hr	1 hr
sections	ch 8 pretest	8.1, 8.2	8.3	ch 9 pretest	9.2	9.3, 9.4	9.5, 9.6	9.7	10.1	10.2, 10.3	ch 10 review	review 8, 8, 10	11
methods	pretest	sp	sp	pretest	sp	sp	sp	sp	sp	sp	ppt	ppt, tb	ppt
problems completed	9	29	24	25	25	33	37	27	23	33	25	15	none
anything new?	no	no	no	no	no	no	no	no	no	no	no	no	no

Harry	3/9/11	3/13/11	3/27/11	3/28/11	4/6/11
time spent	1 hr	1 hr	5 hr	5 hr	3 hr
sections	8.2, 8.3	9.1-9.3	10.1-10.3	10.3-10.4, 10.8	11.1, 11.2
methods	hmst, vae, sp	ppt	hmst, vae, sp	hmst, vae, sp	hmst, vae, sp
problems completed	19	none	70	93	20
anything new?	no	no	no	no	no

Reuben	3/14/11	3/16/11	3/19/11	3/18/11	3/30/11	4/4/11	4/6/11
time spent	1 hr	2 hrs	45 min	1.5 hrs	1 hr	1 hr	1 hr
sections	test 2 review	11	ch 11 pretest	11	ch 12 prep	test 3 review	exam review
methods	tb, vid	tb	none	tb	tb	tb, rs	tb, rs
problems completed	whole rs	50	whole pretest	sp-pencils	0	whole rs	whole rs
anything new?	no	no	no	no	no	no	no

Alex	3/22/11	3/24/11	3/29/11	4/6/11
time spent	1.5 hr	8 hrs	2 hr	45 min
sections	4	5	6	7
methods	ppt	ppt	ppt	ppt
problems completed	45	206	59	59
anything new?	no	vae	no	no

Melissa	3/9/11	3/10/11	3/14/11	3/15/11	3/16/11	3/17/11	3/28/11	3/29/11	3/30/11	3/31/11	4/4/11	4/5/11
time spent	1.5 hr	2.75 hr	2 hr	2.25 hr	2 hr	2.75 hrs	1.5 hrs	2.75 hr	1.5 hr	2.75 hr	1.5 hr	2.75 hrs
sections	7	ch 8 pretest	8 and 9 pretest	9	9, 10	10 prep	10 pretest	10 pretest	10.1, 10.2	10.2, 10.3	10.3	test 2 review
methods	vae	ppt	ppt	hmst	vae, ppt	ppt	ppt	ppt, vae	hmst, ppt	vae, ppt	vae, ppt, hmst	sp, rs
problems completed	50	9	26	38	26	none	15	21	29	37	25	whole rs
anything new?	no	no	no	no	no	no	no	no	no	no	no	review sp

Taylor	4/18/11	4/25/11	4/27/11
time spent	1 hr	1.5 hr	45 min
sections	7.3	7.5	ch 9 pretest
methods	tb, me	tb, me	none
problems completed	15	20	7
anything new?	no	no	no

Survey II

Number of Responses →	**Yes**	**No**	**Omitted/Not Completed**
Survey Question ↓			
1. Do you feel that the unit(s) you just completed was well taught in this course?	9	2	4
2. Do you believe that the feedback offered throughout the unit(s) was helpful?	8	2	5
3. Do you feel you obtained the support you needed (from the instructional methods offered online) in order to successfully complete the unit(s)?	9	1	5
4. Did you feel confident in your ability to self-regulate your learning throughout the units?	10	1	4
5. Do you feel that you have mastered the material in the unit(s) just completed?	7	4	4
6. Do you feel confident that you will be able to apply this material in your next math class?	9	1	5
7. Do you have any suggestions or comments for the Developmental Mathematics program at the U? What improvements could be made?	N/A	N/A	5
8. What advice would you give to students who will be taking this course in the future?	N/A	N/A	5

Answered "Yes" to Question 2	***Do you believe that the feedback offered throughout the unit(s) was useful? Explain***
Trent	Allowed me to go back and re-check my work.
Kenny	omitted
Walter	Because Allison is a great tutor who will make a great teacher, and make a lucky man very happy someday.
Chris	I believe the feedback was useful because it enables students to see what they are doing wrong and what needs to be improved in order to be successful in the course and further math courses.
Harry	Yes, I like that there are a variety of methods that you can learn: audio, PPT, or textbook. I utilized PPT and if things were still not clear I utilized the audio.
Reuben	I improved my math ability very well.
Alex	The feedback from pretest and study plans were efficient in helping me learn.
Melissa	If I didn't have the instructor and TA's to ask <u>many</u> questions then I would have answered no. Course compass doesn't explain well enough in the prep work, so of course you don't do well on the pretest and have tons of problems that are not hard just the steps to solve were not explained prior.
Olive	It let me know where I stood and what I needed to work on and study more on. Also, I've noticed that the feedback improves my understanding of the material.
Answered "No" to Question 2	
Taylor	There is basically no feedback.

Answered "Yes" to Question 4	***Did you feel confident in your ability to self-regulate your learning throughout the unit(s)? Explain.***
Trent	I feel I can get through the course, just need to put time in.
Kenny	omitted
Walter	Because I am awesome, and I already know most of it.
Chris	Because the entire material(s) is self-explanatory and easy to understand.
Harry	There provide two forms to aid a student. The first helps the student by providing reminders of the approach method to solve the problem. The second, after following the steps and you are wrong, it provides the details to the process. It allows for quick determination where the mistake is made.
Martin	Yes because I've been teaching myself the material since chapter 1, self-regulation is becoming easier by the unit
Reuben	I'm finishing a month early.
Alex	I work better at a self-paced level.
Melissa	I want to finish the course online, and finish math classes.
Olive	Since I can set my own pace I can work more on one unit if I want to and work quickly through some too. I feel comfortable with the pace I'm at and how I self-regulate my courses.
Answered "No" to Question 4	
Taylor	To be completely honest, no. The "learning" I got was just me reading an online book. I doubt I'll remember much.

Answered "Yes" to Question 6	***Do you feel confident that you will be able to apply this material in your next math class?***
Trent	Been in the class for a year!
Kenny	omitted
Walter	Because I have mastered it.
Harry	Yes, but at the same time no. If I don't constantly apply it, I will end up forgetting. Things learned are perishable, it takes constant practice.
Martin	What I'm learning is basic math and is essential for all other maths in the future to an extent.
Reuben	It is a good stepping stone.
Alex	My last teacher went too fast. This course helped me understand at a comfortable pace.
Melissa	Because I asked the instructor and TA's many questions throughout.
Olive	Yes because the instructional videos helped explain the material better and take better notes to where the material I learned is locked in and I'll be able to use it in my next class.
Answered "No" to Question 6	
Taylor	I've been in 003 for 2 semesters now. It just doesn't work, it's a waste.

Students	7. *Do you have any suggestions or comments for the Developmental Mathematics program at the University? What improvements could be made?*	8. *What advice would you give to students who will be taking this course in the future?*
Trent	No.	Get it Done!!!!
Kenny	In the wrong answer boxes, more attention to the answer could be given.	Remember that you are here for a reason.
Walter	Keep Allison forever.	Don't come on Fridays. Allison's not here and it blows.
Harry	None at this time.	It takes dedication and focus. To succeed you really need to pace yourself in an area that is away from everyone. Some people find it difficult to learn online. Personally, I think it is great and convenient. Then again, I live on my own so I don't worry about people bothering me.
Martin	No suggestions, program is run well.	Stay ahead of the material, be consistent, make yourself a schedule for when you specifically spend time doing math.
Reuben	Better accountability?	Stick to the plans and study hard.
Alex	No.	Prepare before each pretest.
Melissa	More TA's to work with only 4 students at a time (4 students for every 1 TA).	Follow prep well and take better notes, it helps when trying to pass pretest.
Olive	I don't have any suggestions or comments and don't see any areas that need improvement.	That they shouldn't take too much advantage of the self-regulating and that they should do both the videos and PowerPoints because each gives different examples of the material.
Taylor	I'm not sure what should be improved, but I know one thing. If students are in 003 then they need actual teachers, not crappy computer programs and online books. This is my second semester taking this class and I still don't know enough to pass/complete the course. It's upsetting.	Don't expect much help from those there. Go to LAS from the start.

Chapter 4: Analysis

Introduction

The analysis is presented in the order in which the data were collected. The analysis began when students signed consent and were given the initial survey, Survey I. The results of this survey have been summarized, then some attention is paid to students' comments about feedback, their self-perceived confidence, their opinion on the non-credit-bearing nature of the course, and their opinions on the meaning of "developmental mathematics." Three of the students from the Independent Study section of the course then participated in an initial interview. The results of the interview are broken down by the following categories: history with math; confidence, motivation, and interest; online courses and self-regulation; perceived understanding of math; and preferred methods of instruction. The sections for each category include responses from each interviewee in the order in which the interviews took place (Trent, Kenny, and then Rick). Students were then observed and given daily logs to complete, some students had three weeks (those in the regular section) and some students had 8-10 weeks (those being interviewed) for this process (but all students were asked to participate in this portion of the study). The daily logs are organized by the following categories: number of logs per participant, most popular methods chosen, average time spent each session, and attempts at new instructional materials.

One of the students that participated in the initial interview unfortunately had to withdraw from the course for the remainder of the semester, so the other two participants were interviewed again after the collection of the Daily Logs (Interview

II). These two interviews are discussed using the following categories: confidence, motivation, and interest; online courses and self-regulation; learning and understanding math; and course options and advice. The sections for each category include responses from each interviewee in the order in which the interviews took place (Trent and then Kenny). All students who were present on the day I collected they Daily Logs completed a final survey (Survey II). The results of this survey are discussed based on the questions asked, and they reflect the following categories: opinions on feedback, confidence in learning and in preparation for future courses, suggestions for the course, and advice for future students. The analysis is rich, and reflections on the information presented are discussed in the following chapter.

Survey I

The initial surveys were given to fifteen students. Every student who participated in some part of the study completed an initial survey. There were several yes or no questions asked as well as a few open-ended questions. Because the sample of students was so small, only generalizations about these fifteen students can be made, and attention given to some of the more interesting open-ended questions. The results are as follows:

Ten out of fifteen (67%) students think they were accurately placed into Math003. That is, a large percentage of the students surveyed think that they belong in developmental mathematics, which I believe means they either have low self-confidence in mathematics (their ability to do mathematics) or are aware that they are missing crucial building blocks for mathematics concepts. Nine out of fifteen (60%) students have had previous experience with online classes. This is a large percentage

as well, and can be attributed to the fact that these students are young and many have been given online instruction at the high school level before. Nine out of fifteen (60%) students would have registered for a section of this course that was taught by an instructor in a classroom if it had been an option. This is not surprising because developmental students learn in many different ways, and many of these students are used to the traditional high school classroom setting for mathematics and may prefer to learn that way. Eleven out of fifteen (73%) students believe that credit should be earned for their work in this course. This is also not surprising, and we will see that most of these students feel this way because the course takes just as much time as other courses and comes with the same tuition costs as credit-bearing courses.

Is feedback in mathematics class important to you?

Trent – Yes. Gives me something to go on, helps me stay motivated to do work.

Kenny – Yes. I don't feel that I would be able to grasp the material without feedback.

Rick – Yes. It helps me learn from my mistakes.

Walter – Yes. Because a lack of feedback is how I ended up here. It's crucial for learning and especially for advancing.

Melissa – Yes. Because there are so many ways to solve math problems and one way (by a computer) may not be the most easily understood to the student.

Harry – No. As long as all the material is available online to use none will be needed. Math is very linear.

Martin – No. I know that the work I'm doing is correct. The course basically guides you enough that there is no need for feedback.

Karl – No. The online program is enough help.

All three students who were later interviewed (Trent, Kenny, and Rick) agree that feedback is important to know how you are doing in a class, keep motivation up, and monitor your understanding. Walter came to the LAS lab late in the spring semester after failing a second attempt at the Math Placement Exam, and he believes that if he had been given better feedback in his other review course, he might not have been in the same situation. Melissa's answer was interesting because she understands the complexity of mathematics and the need for feedback to understand if she is on the right track with her work. Harry, Martin, and Karl all said that feedback was not important because the internet-based textbook and other resources were a good guide through the material. What they meant was that they didn't feel the need for any feedback outside that provided by the computer program (only Martin believed he was inaccurately placed into this course). There is a clear distinction among the participants between feedback from the computer and feedback from a person.

Rate yourself on your confidence to self-regulate your work and keep up with the course (on a scale from one to five where five implies you are confident).

Trent: 5

Kenny: 4

Rick: 4

Total number of students who rated themselves at a five: 9

Total number of students who rated themselves at a four: 4

Total number of students who rated themselves at a three: 1

Total number of students who rated themselves at a two: 1

No student rated him/herself any lower than a two on this scale.

Clearly, two students (Kelly - 3 and Taylor - 2) have low self-confidence in their ability to learn on their own and self-regulate their work throughout the course. Both of these students took the regularly scheduled section of Math003, with Taylor coming to LAS for help later on in the spring semester. The three students interviewed later in the study all rated themselves quite high, and overall, the ratings on students' self-confidence in their abilities to use an online course are very high. This could again be due to the fact that these students are typically young and may have been exposed to online classes in the past.

Do you believe students should receive credit for completing this course?

Trent: Yes - It takes up time just like every other class you receive credit for.

Kenny: Yes - This course takes a lot of hard work and effort on the part of the student in a subject that they have probably struggled with for a good part of their lives.

Rick: Yes - It is harder to work at your own pace.

Walter: No - It's all things covered in high school and should be mastered by now.

Harry: No -Attending a University, a minimum requirement is expected by the student to know about basic subjects, math is one.

Karl: No - It should be review for an honors University.

Taylor: Yes - The course is still difficult and time-consuming. If a student has to take large amounts of time away from working on other classes, they should get credit.

Participants who said they wished to receive credit gave the typical reasons students choose: time commitment, cost, and amount of effort expended. The students who answered no all cite the reason the University does not give students credit for the course: it does not cover college-level mathematics and is a review of mathematics that should be mastered by students prior to their entrance into the University. Taylor's answer was interesting because he said this course takes time away from other courses, but students should be using the time in this class to learn the material just like any other class they attend. Mathematics is clearly less important than other courses to this student.

What does "developmental math" mean to you?

Trent: Learning how to understand math if you haven't before.

Kenny: "Developmental Math" means math that covers the fundamentals that may have been missed during the formative years.

Rick: omitted

Reuben: It means developing skills that may have been lost to years of not using them.

Taylor: I suppose it means "below average." The name really should be changed as it makes the students in the class seem mentally deficient to those outside it.

With the exception of Taylor, these students all agreed that developmental mathematics is meant to help you cover the material you may have misunderstood or learned incorrectly previously. These answers were insightful, and it is clear that these students know why they are in this course (all three said they were accurately placed into this class). Unfortunately, Rick omitted this question, but it was repeated in the interview, which he participated in later in the study. Rick described the course as one for "beginners," implying that he believes he is a beginner when it comes to learning mathematics. Taylor has a negative attitude towards this course because he is repeating it and truly struggles with understanding mathematics. He said that the course name makes students feel deficient, a link that has been seen in previous research in which students feel there is a stigma attached to this course and other "developmental" courses (Bassarear, 1986; Higbee & Thomas, 1999). This is an unfortunate reality for many students placed in these courses, and something that Universities might consider when developing programs such as this one.

Interview I

Introduction

Trent

The interviews began with a bang. First interviewed was Trent, the freshman basketball player who took this course in a summer program as well as the fall 2010 semester. We took our seats in the Learning Assistance Service conference room; I opened my laptop and angled the screen so the only thing on film was the table in front of the computer. As soon as I began to record the interview (see Appendix D), Trent put his hands on the table where the camera was focused and stuck both of his

middle fingers up at the camera. This shows his level of maturity, interest, and respect for the interview. Next, Trent took out his phone and began text messaging during the first line of my introductory speech, after which you can see me ask him about it:

AB: All right. First, I'd like to thank you for your willingness to take the time to participate in the interview. Are you texting?

TS: No, I'm listening. (p. 1, lines 16-19)

Trent was clearly preoccupied and distracted from the beginning of the interview session. His ADHD makes it difficult for him to concentrate for long periods of time, a concern of mine when I chose him for the interviews. While Trent may have a short attention span, he also has an interesting outlook on learning mathematics and how to be successful at it. He is quite confident in general, but in mathematics class his confidence is easily shaken. In his opinion, he has had a hard time understanding mathematics since high school and possibly even earlier. His struggle with mathematics and attitude towards the subject are interesting, and a lot can be learned from talking to him about his history with mathematics, confidence in mathematics, success with the internet-based program, self-regulation in the context of the Math003 lab, perceived mathematical understanding, and preferred instructional methods and forms of feedback.

Kenny

Kenny was the second student to be interviewed. He is a junior at the University and has attempted three credited mathematics classes since he transferred two years ago. Kenny was unsuccessful in all of these classes, and in an attempt to prepare for taking his statistics class for the third time, Kenny decided to register for

Math003 Independent Study for review. In the interview, Kenny claims never to have taken the Math Placement Test, which is most likely untrue because this rarely happens to students, especially transfer students, at the University. If this is the case, then Kenny placed into statistics based on his previous credits earned at community college. When asked to describe developmental mathematics, Kenny answered:

> Um, I think it means that the class – the course would be meant for those people who have a deficiency in many areas of college-level of math, mathematics and um, basically they are taking the course to kind of fill in for those years probably that they weren't able to um, achieve the level of math that they need for college – college level math. (p. 25, lines 84-87)

He describes the course as a course for students with deficiencies in mathematics, which suggests that Kenny views himself in this category. He sees himself as having a deficiency in mathematics due to poor preparation in high school, and describes the development of his mathematics knowledge in this course as, "You're basically kind of coaxing it to grow" (p. 25, line 99). Unlike many students in Math003, Kenny believes that credits should only be earned in classes for which college-level material is taught. He does not agree with Trent's feelings about the load of work relating to the number of credits received. When asked about receiving credit for the class, Kenny said:

> KW: Um, I kind of figured before I even took it that it was gonna be non-credit.
>
> AB: It was gonna be non-credit, why is that?

KW: Uh, because um, I can't really see the college offering credits for uh, taking a course that you really technically shouldn't have to take if – if you're uh – if – if you're um, education before coming to the university was sufficient. You know, they are basically giving you credit for uh, further education. (pp. 25-26, lines 109-116)

Kenny's maturity on this issue is impressive, and it may be due to his experience in college-level mathematics thus far. He sees college-level mathematics as more rigorous and rigid than this course, which is an accurate observation on his part. Kenny said that he hadn't gotten very far in the material as of this first interview, but he is beginning to think about mathematics more and attempt to relate it to his life.

Rick

Rick, much like Trent, has had the opportunities to succeed in Math003, but has not yet done so. While Trent is in his first year, Rick has been at the University for four years and never completed his mathematics requirement. He began mathematics as a freshman, but was red-shirted on the football team, so his four years of playing did not begin until his sophomore year. Thus, Rick has been here for four years and not finished mathematics, but he also has one year left to take classes and get his degree. Rick placed into Math003 his freshman year after taking the Math Placement Test, and claims he "got pretty far" in the course at that time. Rick also participated in the summer STEP program that Trent participated in last summer. Early in the interview, Rick admits to not doing any work once finding out he needed to repeat Math003 again his spring semester of freshman year, "and then I just – I just – I had to, uh, retake it that next semester and then just started slacking" (p. 37, line

66). Rick's attitude towards mathematics for the last three years has been simply to avoid it, and this has been working well for him. This year, Rick decided he wanted to complete his degree, so he began Math003 again.

When asked to define developmental mathematics, Rick said, "Developmental, uh, maybe it's just – I guess, like the beginning stage, the learning stage, the – the necessary things you need to – to continue, like to be able to take math" (p. 38, lines 116-117). Rick believes that this is a class for beginners, so he must see himself as a beginner as well. Not only does he believe this course is for novices, but he also showed a lack of motivation because it is non-credit:

> AB: When you first got here and they told you, "you have to do all this work, three credits worth of work, but we're not going to give you any credits." How does that make you feel?
>
> RT: I mean at that point you – I mean you sit this – sit this out to the side and then you say, well, I got 12 other credits I need to worry about, and then it doesn't help that it's self-paced, that you do wherever you want and, you know? So… (p. 38, lines 126-131)

Rick associates non-credit classes with those that require less work and with a lack of motivation to get the work done. This class clearly was not Rick's priority, but he claimed that this semester would be different for him.

History with Mathematics

Trent

After my introduction was complete, the interview began and Trent was already showing body language that told me he was bored (poor posture, looking

about the room, fidgeting with his hands). I was intrigued already by his answer to my first question:

AB: Can you explain how you became a student in math 003?

TS: Um, they gave me a placement test to see what kind of math I can do.

AB: Okay.

TS: And they decided I was in 003. (p. 1, lines 41-48)

Trent's use of the word "they" implies that Trent is not taking any of the responsibility for his placement into a developmental level class. "They" were the people who told him which mathematics class to go to, not his mathematical ability or test-taking skills. This blame placement is interesting because it shows that Trent takes no responsibility for his struggles with mathematics. Trent places blame later in the interview as well when discussing his high school mathematics experience. When asked about his grades in high school mathematics, he said that everyone did poorly and fell behind in his mathematics class, not just himself (p. 5, line 253). Assuming this statement is the truth, Trent again places blame on someone other than himself for his issues with mathematics in the past and present. Trent said he received good grades in high school, but that he never really understood the material (p. 4, lines 177-181), so this lack of understanding must have an effect on his motivation, confidence, and ability to self-regulate his learning when it comes to mathematics.

In the mathematical content portion of the interview, Trent indicates some prior knowledge of the concept of linear equations; at least knowledge of the term "linear" and what it means (p. 8, line 409). When asked to define a system of linear equations again, Trent repeated the question and claimed that he had already

answered it, but did not repeat his answer (p. 10, line 550). Trent most likely doesn't remember what he answered previously and does not want to give another answer that may be wrong or different from his previous answer. As we go through the solution to the system of linear equations problem I gave Trent, I see more prior mathematics knowledge becoming visible. Trent knows there is a connection between a point and a line, but can't see it or explain it to me (or won't), and he knows how to plot a point on a coordinate plane, but does not see a connection between the system of equations and that one point (p. 15, line 833). These small bits and pieces of prior knowledge are not much in terms of getting very far in the solution, but there is something there that Trent is remembering with a little bit of help. Overall though, Trent understands very little about linear equations, which is apparent in this interview, and leads him to become frustrated and annoyed with the problems.

Toward the end of finding a solution to the first system of linear equations, Trent became visibly bored with the interview and began text messaging again on his phone. When I said something about him not wanting to continue, he said he wanted to continue the interview as long as the questions were not mathematics content questions (p. 9, lines 495-496). After seeming to give up on the problems, I was surprised that, when recapping at the end of the interview, Trent remembered the definition of a system of linear equations and its solution. I am not sure if this can be called prior knowledge, but it shows that he can remember certain concepts and that his history with mathematics has had a huge effect on his current mathematical ability and understanding.

Kenny

Kenny completed some mathematics courses in community college and then came to UMD and was unable to pass Math111 twice and Stat100 once (both introductory statistics courses). Kenny is in LAS for review for his third attempt at Math111 (a third attempt is your last at UMD for any given course). Kenny attributes his trouble in mathematics to incidents that happened years ago. In middle school, algebraic thinking was new and different to Kenny and he claims to have never gotten back on track with his mathematics since those years; the introduction of variables was confusing and caused Kenny frustration:

> KW: Yeah, yeah. I've never been a math student, a good math student. Really, I mean, I know uh, I know like starting in sixth grade, that's when the math you know, started to turn to like Algebra. Like before I was fine with the subtraction and addition and all that.
>
> AB: Or like the basic arithmetic facts?
>
> KW: When I got to sixth grade, you know, I was like, "You know, what is this?" cause it had letters and numbers. I always thought Math only inclu – well, before that point, you know, I thought of math only involved numbers. (p. 27, lines 193-201)

This confusion led Kenny to feel like this was when he stopped understanding mathematics. It can be a confusing transition in middle school when mathematical thinking changes from arithmetic to algebraic in a year and many students fall behind.

Kenny had never taken a statistics course before those he registered for here (p. 28, line 251). Statistics is another mathematics course that is very different from

what students are used to doing in mathematics. Statistics involves understanding theory and the ability to visualize relationships among different things. These are not well-developed skills for many students, especially when it comes to mathematics. Since college-level statistics was Kenny's first experience with this kind of course, it is not surprising that he did poorly in his first attempt. What is more surprising is that he attempted the course again, as well as another similar course, and did poorly in those as well. This indicates an issue with mathematics that Kenny must work through in order to be successful. That is why he is in the Independent Study section of the course that is more individualized to what he needs to understand for his future classes. In the past, Kenny has contemplated a private tutor but cannot afford it (p. 30, line 336), and he does not have any registered learning disabilities.

Rick

Rick had little to say in the interview about high school mathematics, and did not elaborate on his experiences in these courses. When asked about his grades in high school mathematics, Rick said, "it was – it was, uh – I wasn't bad. I was average" (p. 40, line 237). Rick stressed to me here that he did not have bad grades, but average grades. Average is not a bad thing, but his answer here does not convince me that he thought he really was average. Rick said that knowing what SAT score he needed to score in mathematics in high school motivated him to study for the test:

RT: Well, when – well, I was preparing for the SAT.

AB: Okay.

RT: I needed – I know the type of score I needed for my math, so that kind of made me focus in more my senior year of high school.

AB: So you, like, motivated yourself to do it?

RT: Yeah. (p. 41, lines 281-290)

When asked about his performance in the SAT prep course, Rick stated that the course was all online and none of the students really took it seriously. Here, Rick claims motivation to do better based on a benchmark he wanted to achieve, but when given the opportunity to improve his skills for the test, he did not take responsibility for his mathematics learning.

Rick uses the fact that this course is non-credit as a catalyst for the many reasons he has not attended the course in the last four years:

AB: Was there a reason or just football, friends, partying, whatever?

RT: It was, uh, I think just the fact that I wasn't going to get a credit for it. (p. 41, lines 322-324)

As opposed to citing his lack of confidence, lack of understanding, or fear of mathematics, Rick places blame (like Trent) on an outside source for his failures to complete the class in a timely manner. Rick admitted that his earlier years in college might have been fun, but he had regrets and said it wasn't worth it:

RT: Just – I mean just school in general wasn't important to me.

AB: It wasn't your priority?

RT: No it wasn't.

AB: Okay, so what was your priority? Just, anything but school?

RT: Football and having fun.

AB: Okay. Um, it sounds fun, but…

RT: Yeah, I know.

AB: Was it fun? Was it worth?

RT: Yeah, it was. No it wasn't. If I could do it all over again, I'd definitely change. (p. 45, lines 520-536)

Rick clearly is not happy with his current mathematics situation, and regrets some of the choices he made in his early years at the University. Rick never cites his lack of understanding or poor history with mathematics as reasons for not attending class, but these are typical underlying reasons why students avoid classes such as this for such a long time.

In the mathematics content portion of the interview, when asked to find a solution to a system of linear equations Rick was first confused, but then began to remember some of the mathematics content needed to solve the problem. His level of understanding is quite basic, but does show that he has some prior mathematics knowledge. When I gave him the first systems of linear equations problem (see Appendix A, p. 7), Rick knew that he must find an answer for both x and y. This showed me that Rick either understood that there were more steps involved in this problem or that he expected there to be more steps because, "there's just always more in math problems." (p. 50, line 808). Rick believed that mathematics problems are complex (which can be true), but he also showed some level of prior understanding of the concepts of algebraic manipulation. Rick saw two equations with both x and y in them, and knew to find a solution for both variables, which showed me that he is remembering something about algebra here. Once we were done finding a solution to one of the variables, Rick was surprised at how simple it was and made a comment indicating that he thought it was too easy to be the solution path to this problem (p.

50, line 828). This showed that Rick had little understanding of the solution path for this problem as well as his expectation that a solution had to be complicated. Rick lacks a significant level of conceptual understanding in mathematics, and this is the reason he belongs in Math003 Independent Study.

Confidence, Motivation, and Interest

Trent

Trent claims he does not enjoy mathematics because he has to "think too hard" (p. 7, line 377). This is an interesting choice of words because many people say that they don't like mathematics because it "takes too long" to do certain problems, but Trent really does not enjoy thinking mathematically at all. This attitude has a direct affect on Trent's success in mathematics and his actions in mathematics classrooms. Trent lacks confidence, motivation, and interest in mathematics, and this is apparent several times in the first interview. One instance is:

AB: Okay. So is there any experience or set of experiences that you have had in math class that affected your attitude towards the subject?

TS: Um, yes.

AB: Can you describe the incidents and how you feel that it affected you?

TS: Um, no. Not really. Um…No, it's because, um, I don't know. I just don't like people.

AB: Was there, like, one specific teacher or one specific class that made you hate it, or you just have never felt…

TS: I just never felt comfortable with it.

AB: Okay.

TS: I just don't like it. (p. 7, lines 183-203)

Trent has never liked mathematics in the past, and he is unable to pinpoint a specific incident that made him feel this way, but it is apparent from this answer that his discomfort with mathematics leads to his lack of confidence in the subject. Trent is adamant that he does not like mathematics, and the above shows his lack of interest in the subject as well. Lack of interest and lack of confidence in mathematics lead to a lack of motivation as well. Trent's lack of motivation is the reason why he has such a hard time in Math003: it is self-paced and requires students to show up to a scheduled lab time even though it doesn't appear as a "real class" on their schedule. These factors lead students to believe that the course is less important to their future than their other courses.

As the interview continued, Trent said that he thought that developmental mathematics could be described as "trying to get the transition from high school math to college math…even though it's like a transition class, I still want credit for it" (p. 2, lines 72-81). Trent is aware that the material he is learning is not college-level mathematics material, but he still wishes to receive college credits for it because it is time-consuming. Other students share Trent's opinion on the subject; eleven out of the fifteen students surveyed said they think students should receive credit for developmental mathematics (See "Tables of Data," Ch. 3). This attitude towards developmental mathematics adds to the stigma associated with developmental courses (Bassarear, 1986; Higbee & Thomas, 1999), decreasing the confidence level of students in these courses because they feel it's not worth it for no credit or are embarrassed to be in the course.

During the mathematical content portion of the interview, Trent's confidence was shaken several times. When he was unsure of how to answer a problem, he became frustrated by his lack of understanding and wanted the interview to be over. Not knowing how to answer or even begin the problem, resulted in more frustration, his feeling he had made the interview bad because he was not sure how to solve the problem, and spending quite a bit of time avoiding the mathematics involved (p. 9, line 491). It is clear that he was made uncomfortable by being put on the spot, on camera, while doing mathematics. Following his display of a lack of understanding of the concept of a system of linear equations, Trent demonstrated lack of motivation to do the work, which in turn affected his confidence:

AB: So to solve a system of linear equations is to just look at it and analyze which direction each line goes in?

TS: No. Um, you ask too many questions.

AB: I ask too many questions?

TS: Yeah.

AB: So I'm going to say it again, exact same question. See if you change your answer. What do you think it means to solve a system of linear equations?

TS: To – okay. Why are you doing this? All right.

AB: I don't mean to be mean. I'm not trying to – I don't care what the answer is.

TS: No, no, no. I know you're not trying to be mean. I mean – it's a terrible interview now. Um…

AB: Why?

TS: Because you put math in it. I'm trying – I'm telling you how I don't like math and you put math in the interview. (p. 9, lines 475-496)

Trent did not want to continue with the mathematics because he "doesn't like it" (p. 10, line 522), and then later admitted to disliking mathematics because he "isn't good at it" (p. 10, line 534), showing a clear lack of confidence in his own mathematical ability. Trent then compared mathematics to two things he is good at and likes: basketball and English. He went on to say that he might feel the same way about mathematics if he put in more effort (p. 10, line 546), showing that he knows what needs to be done to raise his confidence, but clearly, from statements like "I'm not scared, but I just don't want to do it" (p. 10, line 502), he is not motivated to do what needs to be done.

Kenny

Throughout the interview, Kenny displayed confidence in his ability to self-regulate his learning for this course, "A self-paced course?…Um, I'm pretty confident" (p. 32, lines 469-473), but very little confidence in his mathematics ability. Kenny's history with mathematics has caused him to be apprehensive towards mathematics, and this in turn has had an affect on his level of confidence in the subject, but Kenny remains motivated throughout it all. The first time Kenny was told to repeat a course was shocking and upsetting, as seen in his statement referring to his experiences at community college:

I'd say college – I'd say with college math, um, I had this – I had one professor um, in my first year of college…um, I was taking um college

> Algebra and I would you know, see her a lot of times after class…trying to get clarification. You know, and she'd explain things to me, the concepts, you know, and I would, you know, keep trying to you know, figure this out on my own. And I – she still ended up failing me, you know, even though you know, I kept giving her all this you know, attempt – trying to – all this effort. You know, and I wasn't really used to that because in high school, you know, I tended to talk to my teachers a lot…So, you know, that kind of – that was kind of a negative. (p. 28, lines 262-279)

This experience and his failed attempts at mathematics here, significantly lower Kenny's confidence in mathematics. He has lacked confidence in the subject since middle school, but his motivation to learn and truly understand this material is obvious in my observations as well as in this interview.

Kenny said that he likes to try to apply what he has learned in class to the real world, which is an insightful way for him to understand the material and learn how he might use it in his future (p. 30, line 375). This attitude directly affects his motivation for completing the course. Kenny has struggled with mathematics in the past because he did not see how it might relate to his personal life, but he has started making these connections in the last year at the University. Ironically, word problems and real-world applications of mathematics concepts are what Kenny said gave him trouble in the credited courses he has attempted in the past (p. 33, line 532). It is good for Kenny to visualize mathematics in his everyday life, as long as he is accurately applying mathematics concepts to his daily activities. Because of this new view on mathematics and it's prevalence in the real-world, Kenny said in the interview that he

feels he is beginning to enjoy mathematics because he is beginning to understand it (p. 33, line 538).

Rick

Rick lacks motivation to learn, perform, and understand mathematics. He did not intend to be in this position his senior year, and he knows why he is here:

AB: So what does it mean to you to be in developmental math?

RT: Um, I mean at this point it's – it's not what I planned.

AB: Okay.

RT: But, uh, I mean I know I'm here for, uh, lack of effort.

AB: Okay.

RT: But, um, I mean I've got to get it done. It's – it's time, so. (p. 37, lines 98-108)

These comments show that Rick is motivated by the fact that he must complete this course and one other mathematics course to graduate. Rick is not motivated to learn the material, but just to get through the class. When asked about his level of confidence in completing the course this year, Rick said he felt more confident that he could keep up with the material, more so than when he first registered for the course four years ago. He admits to being distracted by the college lifestyle; his priorities were football and having fun (p. 43). These priorities can hurt students in the long run, but Rick doesn't see that his lack of effort has truly hurt his college career yet. He is still focused on the football team and his final year of eligibility.

When we moved into the mathematical content portion of the interview, Rick's lack of confidence in mathematics became clear. Even after I elaborated on

some of the concepts involved in systems of equations (defining lines, graphing, and the meaning of the solution), he did not seem confident that he remembered these concepts (pp. 47-48). He repeatedly talked down to himself in the interview as well, which showed a lack of confidence in his mathematics abilities (p. 50). Much like Trent, Rick asked for my approval throughout the mathematics portion of the interview. Before actually performing operations or attempting to begin a solution, Rick asked me if he was correct, if he was on the right track, and if his solutions were right. Just like Trent, this showed a lack of confidence in his problem-solving skills.

When given the second system of linear equations problem (Appendix A, p. 7), Rick immediately said he needed to make "it" smaller. This could mean that Rick wanted to take the two equations and make them one equation. I was not sure what this meant, so I asked him to elaborate, and his first thought for the solution was correct, but he still lacked confidence when he looked to me for approval before moving on and said, "I just can't add equations can I?" (p. 52, lines 907-908). Rick clearly remembered something about systems of linear equations, but he did not believe that his memory was accurate, and therefore questioned his first instinct. Later in the problem, Rick was able to see the similarities between the two examples of systems, but did not convince me when he said that he remembered what to do, because he still experienced some confusion for the remainder of the problem.

Once the problems had been completed, Rick displayed very little confidence that he got the right answer for either of the problems:

AB: How confident are you that you solved this problem correctly?

RT: Um, not really. I – I kind of had, like, maybe, like, adjusted what it is – what I had to do. But, like, if I – if I would have seen – if you had a piece of paper that was already solved, then I just could have looked at it to see, like, what I just could have like, done. (p. 51, lines 843-848)

Rick, like Trent, feels he must see a problem modeled for him in order to feel comfortable attempting to solve it on his own. He does not demonstrate the ability to begin to problem-solve on his own and develop his own unique solution to a problem. By the end of the interview, Rick began to joke and use humor in his answers, most likely because he was unsure or uncomfortable with the answers:

AB: So now what is a system of linear equations?

RT: Um, you got me.

AB: Say it again.

RT: It's a never-ending line.

AB: It's a never-ending line? Just one?

RT: Uh, two.

AB: Okay. Could it be more?

RT: It could be, yeah.

AB: Okay.

RT: As many as you want. (pp. 57-58, lines 1219-1237)

This sense of humor and lightheartedness towards my questions showed that Rick did not gain anything from this interview in terms of understanding, and that his confidence is low. He is not motivated to think of answers to the questions I asked above. At the end of the mathematics portion of the interview, Rick claimed he was

slightly more confident, which was not obvious from his answers, but could be true based on his low level of confidence in the beginning.

Online Courses and Self-Regulation

Trent

We then discussed Trent's history with online classes, some of which he took in high school. Trent's overall feelings about these courses were not clear, but he did mention that he, like many other students, enjoys the self-paced nature of online classes. This is interesting, considering Trent has a poor attendance record with the LAS lab and the amount of time he spends on the program outside the lab is nearly nonexistent. It is also interesting considering his lack of motivation, which is a key factor necessary for students to be successful in an online classroom environment (Wadsworth et al., 2007). One downside Trent felt about online learning was the inability to ask the computer a question, a common reason why students prefer interaction with a teacher as opposed to an online classroom setting (Testone, 1999; Smith & Ferguson, 2004). In the mathematics content portion of the interview, as Trent began to solve the first problem he was given, he started to second-guess himself. He can perform mental mathematics quickly, but is unable to visualize the next steps in the problem solving process, making a solution path difficult for him to see. Once he completed the problem (with some leading from me), Trent displayed confidence in his answer, which is great. As soon as I questioned him, this confidence was shaken and he became unsure of his answer (p. 16, line 859). Trent's level of confidence is directly related to the approval he receives from his instructors or the online program, and my questioning led him to believe he was incorrect. Trent is a

student who needs to be able to ask questions and get reassurance for his work before moving on, and this is difficult when utilizing an internet-based textbook because there is not a person available for assistance 24 hours a day.

Trent has a hard time with self-regulating his learning in mathematics because he lacks a significant amount of prior mathematics knowledge that is necessary to understand new concepts. Also, Trent's short attention span, because of his severe ADHD, makes him unable to self-regulate his learning on the computer. However, Trent went out of his way to find a way to get onto Facebook while in the LAS lab one day, showing his aversion to mathematics. Self-paced classes take discipline, routine, and organization in order to be successful (Wadsworth et al., 2007), and from the example above, it is clear that Trent struggles with these qualities while in the LAS lab. Trent does, however, show me he has prior mathematics knowledge for some concepts, and that he can learn quickly if he is in the mood to. Trent also possesses a clear idea of how he would ideally like to learn mathematics, and it does not involve the LAS computer lab, or a computer at all for that matter.

Kenny

Kenny has taken several online classes in the past and, when asked about the benefits of a lecture as opposed to an online course, he said:

> Um sometimes I like to just um, get to know other students and the professor just so I could build a rapport with them cause I think I do better sometimes, especially with those harder subjects – when there's actually a face you know, I can talk to about um, the material. (p. 26, lines 147-148)

So Kenny feels that interaction with an instructor and other students lend something to college courses that cannot be attained online. But Kenny has also had negative experiences with lecture classes and, for example, attributes his poor performance in Stat100 to the extensive prior knowledge of the other students in the class (p. 30, line 389). Kenny believes that he fell behind because the other students knew more going into the course, so the teacher covered the material very quickly, which did not allow Kenny much time to catch up. This could be a reason he enjoys the self-paced aspect of Math003.

While Kenny said he learned well in a lecture format in some circumstances, he also said he felt there were many benefits to a course with an online format. Online courses are less stressful in Kenny's opinion because he doesn't have to write deadlines down and have a calendar; all this information is always online for him when he needs to see it. Kenny managed to attend nearly all of his scheduled lab times in the spring semester. He felt that the routine of attending the lab at a set time helped him feel like he was in a "real class" (p. 33, line 508), something that many students do not get the chance to feel when they take an online course. Kenny also said in the interview that he liked that the course could be accessed anywhere because it is available online.

In addition to the self-pacing, Kenny said a benefit of the course offered in this setting was some face-time with instructors (p. 26, line 152). In the Independent Study section, students are rarely scheduled to attend class when there will not be someone present in the lab. Kenny also sees the flexibility in his schedule as a benefit to taking the course, he is able to reschedule if something comes up, and can always

make up the work at home on his own time. Kenny has had a good amount of experience with college-level courses and what is necessary to achieve success in them. In order for Kenny to be successful, he has attempted to stay on top of his course work on a daily basis. Kenny said that this could get away from people in an online course with little class time:

> Yeah, I mean, I think I need to actually do work on that – in that actual course – each week in order to keep it in my mind because like I tend to forget over time…I had to kind of refresh myself. So to actually – I mean, I like to try to do – when I'm taking a math class, like college level math, I try to um, do something everyday that's dealing with it so I could just keep it fresh in my mind. (p. 30, line 367-376)

Kenny understood how to learn the material in this course, even if it is not taught in a traditional format. Kenny is clearly attempting to get the most he can out of this course and his motivation and interest were high all semester. Kenny's mathematics confidence slowly increased as he became more confident with the material throughout the course.

Rick

Rick has taken online classes in the past, and found that he enjoyed the lack of "real class time" associated with an online course: "Um, I think the benefits of having online courses, like, most of the things are, like, you don't have to sit in the class" (p. 39, lines 204-205). This aspect of the online course seems to be enjoyable for most students in these classes, but there are also negatives associated with an internet-based classroom format. Rick stated that the main drawback to online classes for him

was his procrastination, which becomes worse for him if there is no face-to-face requirement for a class. Rick remembered his negative experiences with his online SAT preparation course in high school:

RT: I don't remember. I think that was all computer stuff. I can't –

AB: All online?

RT: They made all the seniors, uh, take, uh, SAT prep. Juniors, juniors. That was my junior year.

AB: Okay, so you took that class but it was – they just had you doing, like, things on online?

RT: Yeah, so we just basically did what we wanted.

AB: Okay. So was – it wasn't that helpful?

RT: Not really. (p. 41, lines 298-310)

Rick clearly did not enjoy the SAT course online because he did not get anything out of it. It is interesting to hear him talk about this experience, which seems to have been the downfall of his prep course, and still have him find the self-paced nature of an online class to be beneficial. Rick admitted that he did not take self-paced classes seriously and put assignments off until the last minute.

> Uh, I mean I think it's hard to do, uh, to be successful, or for me to be successful in the class. Not to be successful in the class, but to take the class areas that is self-paced…Because, I mean, you know, Monday you say why – I have work I need to do for this class but, I mean, it's not due until the end of the week, so – and then two hours before it's due online, you know, then that's when you're doing it. (p. 42, lines 362-369)

Rick's procrastination and lack of motivation to do work negatively affect his performance in online courses, but he still claims to enjoy doing work on his own time.

AB: Okay. Um, does the nature of this class with open lab time, being self-paced, and no real time limit besides when you want to graduate, um, does it affect the way in which you plan to proceed in this course?

RT: Um, well, like I said, I did – I guess it all depends on timing. I was young, you know. I just – just got to college. I was doing a million things and I wasn't worried about a math course. (p. 43, lines 420-425)

Rick's honesty here is a perfect example of how some students get left behind early in college. This course is typically taught to freshman, and learning to teach yourself in your first semester of college is not easy. Many other students in online developmental mathematics classes, as well as other online classes at the college level, surely share the feelings Rick expressed here.

Perceived Mathematical Understanding

Trent

Trent's idea of understanding or learning a concept is through repetition of someone else's solution (modeling–or copying in severe situations). Trent feels that feedback is necessary in the form of a student or teacher in the class that can walk around and make sure everyone's questions are taken care of, but when asked specifically what he needs to be successful, Trent stated that he wants someone to say "let me show you how to do it" (p. 6, line 307), rather than someone to walk him through steps and guide him to a solution. Trent is very interested in the answers to

problems, not the path the solution took. At the end of the content portion of the interview, Trent stressed that he learned by doing, "because I found out what it meant by doing the problems" (p. 22, line 1187). I could see that his understanding of the process we had just gone over to solve the systems-of-equations problem is superficial at best; he lacks a conceptual understanding of linear functions and their representations.

Trent lacks estimation techniques necessary to predict answers to problems. In the mathematics content portion of the interview, when asked about the solution to a system of linear equations, Trent did not know what the answer should look like, and did not have any estimation or generalization capabilities to visualize the end of the problem (p. 20). Trent was under the impression that the solution to a system of linear equations is a single number. Based on his answer, he clearly did not know that the solution would be an ordered pair indicating the intersection of the two lines, but perhaps had enough prior knowledge to indicate it as one point (but he used the term "number" here instead of point). After deliberating through the problem, avoiding it for some time, and being led through the process of completing it slowly, Trent became very frustrated and seemed to lose all interest in the problem. Once he reached a solution, he was very interested in what the correct solution was. He asked me to tell him the correct answer (p. 16, line 859), which is interesting after seeming not to have any interest at all.

Kenny

When asked about his past experience in mathematics, it is clear that Kenny struggled in middle and high school, but he received a shock in college-level

mathematics as well. Looking back on high school, Kenny did not associate his good grades in high school mathematics with understanding, but with effort:

> But um, the reason why I think that I got those good grades is I was making a lot of mistakes on – on the work and there were a lot of students in my class. Like my class, I think it had like 40-50 students, you know, so I think the teachers were just giving people who showed the most effort, the best grades, the ones they actually knew because I'd always be in teacher's face asking them questions. But they you know, really didn't have the time to actually sit down. (p. 27, lines 216-220)

This is an interesting observation on his part, and I can see why he attributed his grades to his extra effort, solely based on the amount of effort I have seen from him thus far in my course. Kenny realized that once he got to college, his effort did not directly translate to high grades, and that he was unable to do well in class based on his effort (p. 28). Kenny learned that college credit is earned through understanding, and has developed a great view of what this means for him in mathematics. Kenny is ready to learn this material and truly understand it so that he experiences success in his next class.

When asked about the necessity for a developmental mathematics course on campus, Kenny said he knows he is not the only person who needs to take this kind of course, so it is necessary to have. Knowing that other students are in the same position that he is gives Kenny some confidence in being able to succeed in Math003:

> AB: And do you think a review course like this class Math 003, is necessary to have at the University?

KW: Uh, yeah, I think so.

AB: Okay.

KW: Cause there's a lot of students who you know, are probably are like me that really didn't get the math uh, preparation that they need for college level.

AB: And what would you say to someone who says something like, "It's not necessary because you're in college so you should know this material already"?

KW: I mean, I would just tell them to look at uh, like the news reports about you know, kids in America and how they're deficiencies in math and science. (p. 34, lines 568-582)

Kenny is aware that mathematics issues do not only affect him, but many other students in the country. Math and science achievement gaps are regularly discussed on the news, and clearly Kenny has been educated on this subject. A large number of freshman (30% across the country) enroll in developmental mathematics courses in U.S. colleges and universities (Boylan & Bonham, 2007; Breneman & Haarlow, 1998; Smittle, 2003), and these students need this support and development in the subject in order to learn how to learn mathematics in the future.

Rick

Rick, like Trent, has a limited knowledge of how to understand and learn mathematics. Rick's idea of learning a concept is to repeat it several times and memorize the solution path. This is how he has learned mathematics in the past, as repetition, and his conception of understanding mathematics has not changed since

then. Rick thought that this program was helping him learn mathematics, but his consistent choice to "view an example" to "learn" the material from the online program convinced me otherwise. Like Trent, Rick copied the steps from the examples and repeated the process for a new problem:

> RT: Uh, if I get to a question that – or – yeah, a question that I'm not – not familiar with, I just look at the example…And I – I'll write the example down and then, uh, and then I write the question down too as, you know, the original question on a piece of paper and just work it out…
>
> AB: Okay. Um, do you think that you're learning the math behind it, or do you think that you're more learning, like, a procedure of how to complete something?
>
> RT: I think – yeah, I think I'm – it's just like me learning how to – it's more like me memorizing it than actually learning it. (pp. 38-39, lines 151-167)

Rick admitted to not learning the concepts, but memorizing procedures instead. Clearly he believes this is a form of understanding, which may be true on some level, but he lacks conceptual understanding in mathematics and that is why he is still in Math003.

Learning disabilities affect students differently, and Rick said he began to understand how his ADD affected him in college, and this helped him with school. He was prescribed stimulants for ADD, but did not take them because he did not like the way they made him feel (p. 44, line 465). This is fair, given the number of side

effects associated with some of these drugs, but also limits Rick's level of concentration to short periods of time. Rick altered his LAS schedule earlier in the year to address his ADD. He started coming into the lab for two hours each day but with a break in between them. He claimed that this schedule made his concentration in the course better. Rick also said he liked challenges, but some days teaching the material to himself was not as easy as other days; athletic schedules are quite hectic, demanding, and time-consuming.

When we moved into the mathematical content portion of the interview, Rick did not know what linear meant when asked–maybe because he was on the spot or maybe because he truly does not know. Rick has some level of basic understanding of solving equations in algebra. He saw the system of linear equations problem, saw two variables, and knew that he must find a solution for each one. This is a good start for someone who hasn't seen this in five years. He was able to do some simple algebraic manipulations with equations with one variable, but his comment about "crossing these two out" (p. 48, line 714) when referring to manipulating variables on both sides of an equation showed his lack of understanding of arithmetic and the order of operations. Rick also understood that $8 - 8 = 0$, but he was unable to transfer this knowledge later to variables (in the form $2Y - 2Y$). This absence of the connection between the two operations suggested that he had trouble similar to Kenny's when first being introduced to algebraic concepts.

Two instances of mathematical vocabulary reversal occurred in Rick's interview as well. First, when he was telling me what he did, Rick said, "twenty eight divided by four, four divided by…" (p. 50, line 800). Rick said this operation

correctly the first time and then began to reverse the order of the numbers in his statement, showing that he memorized division facts and was not clear on the mathematics vocabulary surrounding them, or is uncomfortable using mathematics vocabulary to explain his problem-solving process. Rick displayed a reversal of mathematics vocabulary again while solving the same problem later in the interview: "should I plug that x in to 3?" (p. 55, line 1098). This showed that Rick either had a misunderstanding of these concepts or a lack of sufficient vocabulary to begin with. By the end of the interview, Rick still could not define a system of equations correctly.

Preferred Methods of Instruction and Feedback

Trent

Starting early and continuing throughout the interview, Trent made it clear that he finds it necessary to have an instructor present in a mathematics classroom. Trent claims to work better with people than computers, and makes this apparent in many responses. With early comments such as, "Because I feel like we need an instructor to help us instead of a computer…Because for me personally, I work better with a person than a computer" (pg 2, lines 94-98), it is clear that Trent feels that the current program is not perfectly suited for him to learn mathematics to his best ability. In Trent's opinion, learning mathematics is reiterating what someone else has done before and memorizing the steps to this process, so he feels that a person can better help him do this.

AB: Okay. So what support in a class is necessary for you to succeed? So, support, like, an instructor, a TA, homework, one-on-one time, a slow pace, feedback, or anything else that you…

TS: Um, just feedback.

AB: Like what kind of feedback?

TS: Like, um, like – or if you ask questions, like, do you need help? And that gives me confidence to know that you can help me if I need help. Just stuff like that.

AB: Okay, so just somebody to be there.

TS: Yeah, just be there. (p. 6, lines 275-287)

Here, Trent directly links his confidence level in mathematics to the presence of a person in the classroom who is available to help him when needed. He does not make a connection between his prior mathematics knowledge or attitude towards the subject and his confidence in the course. We see that Trent prefers to have an instructor show him mathematics rather than attempt to learn it himself on the computer.

Throughout the mathematical content portion of the interview, Trent repeatedly asked me if he was headed in the right direction, if his next step was correct, or if his solution to the previous step in the problem was correct. This pattern, Trent asking for my approval before moving on with his solution or feeling confident with it, occurred 16 times during the interview, and is a key to analysis of Trent's mathematical understanding. Trent cannot move on with the problem at hand without

asking a question and getting verification that he is moving in the right direction. Trent asked many questions, such as:

TS: What – what's the answer though? (p. 16, line 859)

TS: So it'd be 38y, or no? (p. 14, line 738)

TS: So I'm going to get rid of negative four, right? (p. 14, line 771)

As this continued during the interview, it became more apparent that Trent has a low level of mathematics confidence and requires this reassurance from an "expert" source before feeling as though he has completed a task correctly.

After the mathematical content portion of the interview was complete, I asked Trent if he believed he could solve similar systems of linear equations problems on his own:

TS: Um, I'm confident I could do it on my own. It would just take a long time.

AB: It would just take a long time why?

TS: Because I'll have to figure it out again by myself.

AB: Okay, so you would forget –

TS: I would forget.

AB: How we solved them basically?

TS: Unless I had the notes in front of me.

AB: Okay.

TS: Then I would do it faster.

AB: Okay, so what you're saying is if you have notes in front of you, it's much easier to do the work, so…

TS: Yeah. I have examples in front of me.

AB: I would apply that to this class and take notes.

TS: I have – I have them on the computer, so…

AB: Oh, okay. So you don't need to write them down?

TS: No. (p. 22, lines 1192-1221)

Trent feels that he needs to see something performed for him so that he can do the same process for himself later on. This necessity he has for seeing a problem modeled is directly related to how he perceives his mathematics learning. Trent does very little work in class, and rarely takes notes, so his comments about the computer having the notes don't surprise me. But his lack of a connection between writing notes down and higher achievement in the class is telling. Trent prefers not to use his memory to store mathematics knowledge, which could be the reason he has been low-performing in mathematics for some time now.

Kenny

Kenny expressed in the interview that instructor availability is most important for success in any class. Kenny requires some form of human interaction in order to learn and understand mathematics; "What helps me succeed? Um, I think – I think just when the teacher – when uh, or the professor or instructor is just available like you know, maybe beyond the office hours" (p. 29, lines 311-312). In the past, Kenny noted that he was on top of his schedule in his credited mathematics classes and attended office hours regularly. While this is Kenny's preferred method of instruction, he also felt that some of his Teaching Assistants did not care about their students as much as he believes they should. Kenny said he felt that the Teaching

Assistants did not offer enough extra time for assistance outside of class. He feels he requires extra attention or help from the teacher or TA, maybe more than others, "You know and I – I – I really can't operate like that because sometimes I might need extra attent – extra attention. Not attention really but extra clarification with the class" (p. 29, lines 327-328). This need for extra attention or help in order to learn could be the reason that Kenny has not yet successfully completed his mathematics requirement. He is a student who needs social interaction with his teacher in order to learn. He does not seem to need approval, like Trent, but he is clearly in need of human interaction of some kind to feel confident.

Kenny was clear throughout the interview that feedback was necessary for him to do well in any class. When asked what kind of feedback would be best, Kenny said that he liked to see specifics that show how well he did on something and where he went wrong, or what kinds of things he might have missed. He prefers constructive feedback that helps him learn from his mistakes. Kenny said that in the past when he received feedback from a teacher, he would utilize comments from feedback in order to understand where he went wrong, and thought that simply displaying the points missed for something would not be helpful to learn from. If in a situation where he was unsure of the reasons for his points off, Kenny would take the initiative to approach the teacher or TA and ask for clarification:

> KW: So just so I could know that the reason why I got the wrong answer wasn't because I don't understand the concept but because I just need to kind of pay attention to details.

AB: So you would much prefer – like let's do an example….Say you got an 89 on your test….Okay? Would you prefer to see a bunch of x's and points marked off and a nice 89, B+ at the top of your test or would you prefer to see a test with no grade and just a bunch of comments wherever you did things wrong?

KW: I think the comments where I did things wrong might help. But I mean, again, the grade kind of helps too because it gives me an idea of you know, how well I actually did on –higher. Yeah…Like if that's a quiz and to study for the exam, I'd probably go over the homework and then use that quiz and just look at the comments just so when I'm studying I don't you know, make the same mistakes. (pp. 31-32, lines 417-450)

Kenny is able to visualize what needs to be done to be a successful mathematics student, and I truly believe that his time in Math003 Independent Study will help him develop his skills and mathematical processing in a way that will make him successful in future courses as well.

Rick

Like Trent, Rick "learns" best from observing modeling and practicing problem solving while following an algorithm. Rick has taken Math003 in the regular lab setting before, and he can see some benefits to this course as well as drawbacks. Rick liked the TA and instructor presence in the lab when he was in the regular section, "it was helpful to have somebody, uh, walk around and, you know, be able to just communicate with everybody" (p. 37, lines 57-58). Rick liked having someone

available to check up on him, but not to be teaching him the entire time. Rick also reiterated that he believes practice makes perfect and that in order to "learn," he must, "just do it over and over again, so, uh, until I remember it" (p. 39, line 177). While this is his mental image of learning, his absence from mathematics for almost four years must make this a difficult task for him. It is obvious from his answers that Rick knows that mathematics must constantly be practiced and built on to learn, but he did not do this himself in the past few years. Rick said that he realized that mathematics was something that must be kept up with:

> Well I think – I think I took another pretest, and it was just so long since I did math, and I didn't really realize that, like, math is one of those things that you have to keep doing in order to remember it because you just completely forget everything. You know? (p. 42, lines 337-339)

Rick demonstrated that he knew what he needed to succeed, but his effort to attain understanding must increase in order for him to pass the course and be successful in his next.

Rick said that in order to be successful and take a class seriously, he needs organization and deadlines, and would prefer for a teacher to be present in the classroom. I asked about the feedback he felt was necessary to succeed in this course:

> AB: Okay, and what kinds of feedback are the most helpful for you?
>
> RT: Uh, I mean it – as far as math, just showing me how to work through a problem. If I – if I can see it, I can – I can basically teach myself (p. 42, lines 380-383)

Here Rick confused feedback with instruction, which do go hand-in hand, but are two different things. He stated that he needs to see the work, but did not directly address the kinds of feedback that he might need. Rick said that he wrote down solutions when a teacher went over an old exam in the past, but he did not mention rereading them, finding mistakes in his old solutions, or attempting to understand them (p. 43). His review of his past work is superficial at best, "I mean, I look at it, and I look at, like, if there are comments, I look at the comments and I'll usually write them down…Or if the teacher's talking, going over the test or the quiz, and if it's an answer I got wrong, I – I write what I should have did right" (p. 43, lines 404-410). This shows that Rick doesn't have the motivation to attempt to understand his past mistakes and learn from them.

When asked about the need for developmental mathematics at the University, Rick thought that this class was necessary because "some people just need extra help" (p. 45, line 509). Rick lumps himself into this category of "some people" in a way that does not signify that this group has any kind of deficiency or problem, just a need for the extra support. This group of students tends to have a warped view of what learning mathematics entails. Rick showed this when he said:

RT: If I see it once…

AB: You see somebody else solve it?

RT: Then I can do it. Yeah, then I'll be able to… (p. 47, lines 622-626)

Rick believes that the way to learn is to see a solution written out by somebody else, not to create or develop his own solution to a problem. I also saw this need for assistance and modeling throughout the interview when Rick constantly asked for my

help in each step and felt the need for my approval to continue on in the problem. Rick's comments such as: "So should I solve this? You want me to…"(p. 50, line 824); "Oh, that's just it?" (p. 50, line 828); and "I mean add my – just do like this?" (p. 52, line 917) all showed that he was unsure how to proceed and required guidance to solve a problem. This mentality must have stuck with him since middle and high school when this was how instruction was given. He said he preferred to learn by example, receive feedback when he is doing poorly, and repeat processes until they were memorized. These are attributes of students in middle and high school who are learning mathematics via traditional instruction, but in college students must develop the ability to learn independently, and this is not something Rick has developed yet (in his senior year).

Daily Logs

Number of Daily Logs per Participant

Trent: 6	**Harry:** 5
Kenny: 8	**Reuben:** 7
Mark: 3	**Alex:** 4
Walter: 6	**Melissa:** 12
Chris: 13	**Taylor:** 3

Obviously some participants did not complete as many daily logs as other participants. Chris and Melissa seemed to take the logs the most seriously, while others only have a few days to take into account. Use of instructional methods will be taken into account as a percentage of the total number of days the participant reported their progress on. Also discussed below are each participant's average time

spent on the program each day and their preference for trying new methods from the online course materials.

Most Popular Instructional Methods

Trent: used both study plan and videos each 2 out of 5 days (40%)

Kenny: used PowerPoint presentations 6 out of 8 days (75%)

Mark: used myself and the study plan one 1 of 3 days (33%)

Walter: used myself and the textbook each 2 out of 6 days (33%)

Chris: used the study plan 8 out of 13 days (62%), and PowerPoint presentations 3 out of 13 days (23%)

Harry: used "help me solve this," "view and example," and the study plan 4 out of 5 days (80%)

Reuben: used the textbook 6 out of 7 days (86%)

Alex: used the PowerPoint presentations 4 out of 4 days (100%)

Melissa: used the PowerPoint presentations 9 out of 12 days (75%), and "view and example" 5 out of 12 days (42%)

Taylor: used both the textbook and myself 2 out of 3 days (67%)

No one student in developmental mathematics is the same. Comparing the strategies each used will not be helpful in determining whether or not the students used all of their options and learned from them. We can, however, discuss what appears to be successful based on the frequency of its occurrence in each daily log.

Kenny used the PowerPoint presentations 75% of the time he used the online course in the duration of the study. Kenny later said in his interview that this was his top choice of instructional method because the PowerPoint presentations are slightly

interactive and he appreciates that. Alex (100%) and Melissa (75%) also got a lot of help from the PowerPoint presentations it seems during this time. Other students chose this method as well, but with less frequency. Reuben used the textbook 86% of the time he recorded as his course time on the program. Few students use solely the textbook for review because math textbooks tend to be dry and difficult to read, especially if one struggles with mathematics. Harry used "help me solve this" and "view and example" 80% of the time he was logged into the program during the study. These are common tools for students to choose to use when going through this material because so many students feel that math must be taught and learned through modeling, memorization, and procedure. These tools above are commonly used for students who see math this way because they can copy a direct procedure and apply it to a similar problem without going over any notes or preliminary material first.

Average Time Spent Each Day

Trent: approx. 50 min

Harry: approx. 3 hr

Kenny: approx. 2.5 hr

Reuben: approx. 1 hr

Mark: approx. 45 min

Alex: approx. 3 hr

Walter: approx. 1.5 hr

Melissa: approx. 2.25 hr

Chris: approx. 2 hr

Taylor: approx 1 hr

Many students spent over an hour on the website at a time (60%). These students either had more patience or more time in a given session to devote to this class than the others. Trent's average time is quite low because of his ADHD and his very short attention span. Kenny's time is long because he spent many hours collectively in the lab on two days of the week, and I know he put in course time

outside of the lab as well (but he did not have daily logs recorded for these sessions). Mark, another athlete in the Independent Study section of the course, also has a short attention span and therefore did not spend much time on the program during each session either. It surprises me that some of the students from the regular section of Math003 spent under 2 hours on the program at any given time, considering their class time is over 2 hrs long, and only 2 days a week. The most that can be gained from this is that the students who spent more time on the program in one sitting most likely have higher motivation in this course and mathematics in general.

Attempts at New Instructional Tools/Materials

Trent: tried using the videos on 2 out of 5 days (40%)

Kenny: tried using the PowerPoint presentations on his second day, then used them for the rest of the term

Walter: tried the videos 1 out of 6 days (17%)

Alex: tried "view an example" 1 out of 4 days (25%)

Melissa: tried using the review sheet for help 1 out of 12 days (8%)

Mark, Chris, Harry, Reuben, and Taylor: did not try anything new

It is clear that many of the participants (50%) did not try any new instructional methods during the time of the study. This could be due to their familiarity and comfort with a specific instructional method. Because they are comfortable with one way of going through the program, the students don't feel they need to explore more options from the online course webpage because they don't see this exploration as helping them understand better or learn in a different way. Those who chose new methods were somewhat successful. Trent attempted to watch the online videos for

instruction, but later stated in his last interview that he did not get very much out of them because he could not ask the computer any questions. Kenny was successful in exploring the PowerPoint presentations because he then continued to use them for the remainder of the course of the study. Alex and Melissa both tried something new, but since they are in the regular section of the course I do not know if those choices led to success or not. Walter also tried the videos once, but did not seem to get much from them either.

Interview II

Confidence, Motivation, and Interest

Trent

Once the daily logs were collected, the second round of interviews began. Trent was first again and he made some very interesting observations about himself as well as his mathematics learning. This interview did not contain any mathematics content questions, but was meant to help the students reflect on their experience in this course and how they feel they progressed between the two interviews. The participants were asked to rate their confidence in mathematics on a scale from one to ten (one being low and ten being high). Trent rated in the average to low range on this scale of mathematics confidence. Trent defended his choice of a six on a scale of one to ten:

TS: Because I get lazy and the problems are, like, always too long, or it takes too long to, like, solve the formula.

AB: So how does that affect your confidence?

TS: Um, makes it go down because I like to be good at things. Sometimes I'm good at it. (p. 59, lines 34-39)

Trent said he feels confident with something when he is good at it, which is not surprising and entirely expected. This showed that Trent needs to increase his confidence in mathematics and to do this must feel like he is good at the subject.

When I asked what would make him feel more confident in mathematics, Trent responded with, "Knowing that I understand how to do it…I wouldn't be, like, hesitant to do it" (p. 62, lines 175-179). Trent knows that if he understood the material, he would be more confident and like it more. This is an insightful observation for a student who believes that to learn mathematics means to copy procedures and memorize them. When asked if he thought he understood the material from the units he had just completed, Trent claimed to understand the material "to a certain extent" (p. p. 62, line 215), which does not signify confidence in his understanding. "To a certain extent" means that Trent has a superficial understanding of the material, and this comment made me think that he was aware of this deficit in his knowledge.

Trent had a rocky semester in the LAS lab, with poor attendance and very little material completed in any class session. Trent lacks the motivation to proceed in this course, but throughout the interview he was adamant that he was doing well in this course and completing the material on schedule. By the time of the interview, Trent was in Chapter 5 out of twelve chapters in our textbook. This progress took Trent two semesters to accomplish, so there is clearly a motivational issue that Trent uses to avoid mathematics. In the interview, Trent claimed to have fixed his

motivation issues for the spring semester, and knew that you need to have the mindset of getting work done in order to be successful in this class. He said:

AB: Did you find it difficult or relatively easy to keep up work – with the work?

TS: Um, I felt it easy to keep up with the work. You just have to have the mindset of wanting to.

AB: Okay, so…

TS: And I didn't have that.

AB: When did you not have that?

TS: In the beginning of the year. I do now though. (p. 62, line 201-211)

Trent is being honest here, which is much appreciated; he did not want to keep up with the work, so he didn't. This indicated a clear lack of motivation to complete this course, learn mathematics, and go on to take his next mathematics class at the University.

Trent brought up an interesting incident that happened in the very beginning of the fall semester when he first began attending the LAS lab. We were discussing the extra help Trent received from the athletics department in the form of math tutors, and Trent described his situation as follows:

TS: I liked him, it's just I didn't – I didn't like him, like, watching everything I did. I was like, sitting on the computer and he'd just watch – sit there and watch me, like right next to me. I hated that…I mean he was – he was just doing his job. You know, that's what they told him to do. I just didn't like it though. I didn't feel comfortable.

AB: Okay, but it's okay when I sit and look over your shoulder?

TS: It's just like – just like I told you. Remember when I first got here? Remember I left that first day? On that first day I just walked out?…Yeah that was because you were just sitting next to me, and I was like, I don't like that.

AB: That's my job.

TS: I know. You're doing your job, but I just didn't feel comfortable. I didn't like it.

AB: But you came back.

TS: Yeah.

AB: Why?

TS: Because…

AB: They made you?

TS: Pretty much.

AB: And I still go out there, and sit next to you, and watch what you're doing on the computer.

TS: Yeah, but it's different now. It's different now.

AB: Why?

TS: Because I feel more comfortable…with you – I know you're not. I didn't know you at first. Like, you were – I just didn't know you, you sat next to me, I'll be like, oh no. (pp. 68-69, lines 544-592)

Trent needs to feel comfortable in front of someone in order to do mathematics. He left class on the first day because he felt uncomfortable, but he returned because he

had to. I then worked with him and built a relationship, and now he trusts me to teach him and be non-judgmental towards his mathematics learning faults. Trent avoided the situation at first because it made him uncomfortable (much like he avoids mathematics now, because it makes him uncomfortable). Trent uses avoidance of mathematics in order to keep his confidence high in other aspects of his life. Trent believes he is not good at mathematics, and therefore cannot be confident in his abilities.

Kenny

Kenny rated himself low to average, six on the one to ten scale, for mathematics confidence. His reasons for this were:

> Um, I mean I don't have a very strong math background. You know, I've always struggled with math. You know, but lately, especially with this course, you know, I've been kind of more math oriented. I think about math more often when I'm not in the classroom. So I think now you know, I'm like fear of math is kind of – [lessening] (p. 72, lines 47-50)

Kenny has low confidence in mathematics because of a poor mathematics history, but rates himself above a five because he is trying his best and thinking about the concepts as much as he can in his everyday life. In Kenny's own observation of his learning, he said he began to master problem-solving skills – he noted that he has improved his skills in estimating answers and finding his own mistakes:

> Um, yeah, um, like when you answer a question wrong, it'll give you um, kind of a description of what you need to change about your answer. Like it'll even tell you that the answer is mathematically correct but there's somethin'

you need to change. You know, I like that because then I can actually look on my answer, change it up a bit…And look at it. And I've gotten better at looking at what my answer and picking out what's wrong with it…I'm a lot better at that. (p. 75, lines 167-179)

Kenny observed himself improving in his mathematical reasoning and problem-solving skills, which is insightful and surely a confidence boost in this course.

It is clear that the confidence in mathematics that Kenny gained is not yet at a level high enough for Kenny to feel as though it is all right to get a question wrong. Kenny got frustrated and lost confidence after he worked for a long time on one problem and got the wrong answer, it made him feel like he could not do the work:

KW: I get more frustrated than anything.

AB: Okay, why's that?

KW: Because especially if I worked a long time with something and I feel like it was – it would be right and then it's wrong (p. 75, lines 211-216)

This showed that Kenny has increased his level of confidence in mathematics, but that he still needs to work on his patience in problem solving and his motivation to continue even if his answers are not always correct. Kenny said he gained confidence from repetition (p. 75), and that practice will be his way of remembering the concepts for this course and future courses.

Online Courses and Self-Regulation

Trent

We discussed the nature of online courses in this second interview as well, and how Trent believed this style of class may be beneficial or may be hurting him. One thing Trent felt he needed in mathematics class was approval and/or feedback from the instructors and TA's, not only the computer (p. 64). When we discussed how well he felt this course was preparing him for his next mathematics class, he said:

TS: Um, because it's teaching me that I have to do my work on my own time instead of having someone always there. Like, when I was in high school it'd be like, you have to do this. I just do the s*** myself.

AB: Okay, and the fact that we are self-paced but another class isn't going to be self paced, how do you think that's going to change?

TS: Uh, that's going to be a negative part in my life right there.

AB: Why?

TS: Because I like to do things on my own time. (pp. 64-65, lines 329-340)

Trent enjoys doing work on his own, and claimed that he would be able to complete it on his own for his next classes. It is interesting that Trent feels that his next class will be a negative experience because it will be fast-paced and in a lecture format. This negative attitude in turn will affect Trent's confidence in proceeding with mathematics at the University.

Trent had only positive things to say about the self-paced nature of the course, which is interesting, given that this aspect of the class was a huge reason why he did so poorly during the two semesters he has been enrolled. When asked about the self-pacing, Trent said, "I loved it. I was on my own time" (p. 62, line 183). Trent was so positive about this aspect of the class, that it made me think that he was not aware that

he was doing poorly in the course. Trent ended up failing the spring semester in Math003, and this may lead him to try harder in the future or to be even less confident. He has not been invited back to the LAS lab in the future and will have to attempt a regularly scheduled section of Math003 in the fall. This will still be online, but will have a more rigid schedule, which may help Trent keep up with the work; only time will tell.

Kenny

We discussed the nature of online classes and how this might affect Kenny's mathematics learning or his experience with mathematics overall. Kenny felt that this course helped him build on his prior mathematics knowledge, he said went from only knowing the FOIL method to operating on polynomials of larger degrees (p. 77, line 320). He felt the online program was individualized enough to help him succeed. He referred to the online availability and structuring of materials as a "taskmaster" to help organize the course and make those mental building blocks strong. As far as components and instructional tools that helped Kenny succeed, he said that he did not think the videos had enough practice problems embedded in them, so he therefore preferred to watch the PowerPoint presentations to learn the material. About the videos, Kenny said, "I didn't really like the videos either…they weren't interactive enough for me…I'm a hands-on learner" (p. 79, lines 404-413) which indicates that he felt he needed to have direct interaction with the mathematics in order to learn it.

Kenny was also aware that the course had an obvious track and was planned out for preparation for his next class:

> Um, because it's basically I feel like it's – it's kind of tailored to what I really need to work on…So I mean, it's not just a general review. It's kind of telling me you know, what I need to work on. So now I feel like I – I'm getting the basics that I need. (p. 78, lines 339-344)

He is able to see the scaffolding within the course, and knew it was intended to best prepare him for his next class at the University. Kenny appeared to be quite observant and insightful about his learning and how he benefits from online classes. When asked about the benefits of an online course, Kenny thought that having everything online made it easier to remember to complete his tasks (the opposite of Rick and Trent who require structure to complete tasks). He said:

> You know, as opposed to if you're in a classroom, you had to give your homework but you have to kind of…Yeah, and you have to write it down and then you have to find time to actually sit down and write. But like here you know, you just get on a computer and you do it. So I – I like the computer. (p. 80, lines 459-465)

Kenny showed that he enjoyed learning mathematics from the computer, but that there are some faults with the online program.

Learning and Understanding Math

Trent

When asked about what he learned, Trent claimed he "learned how to figure out the formulas" (p. 59, line 43), but I was not sure what he meant by this. He is likely referring to repetition of problems and learning how to repeat what he has seen on the computer, which does not constitute learning mathematics, but memorizing

procedures. Trent had no memory of the concepts we went over in our first interview. When I asked Trent if he thought he could do the same problems from the first interview again, his response was:

> TS: I mean, I think I could do it. It's just – probably wouldn't want to.
>
> AB: But would you feel confident while doing it?
>
> TS: After the first problem –
>
> AB: Or would you be hesitant.
>
> TS: After the first problem. After you help me through the first problem then I can do it. (p. 63, lines 263-271)

Trent thought he could solve the problems again, but lacks the motivation to even attempt them. He lacks motivation and confidence in his ability to tackle a mathematics problem that may be unfamiliar (or in this case should be somewhat familiar).

When talking about his future here at the University, Trent was unsure of his major and the mathematics class he might need next. He knew he might need statistics, but he heard it was hard (probably because it is so different from other mathematics he has taken previously). Trent was not confident that he would remember the content from this class, yet he said that he will be, but he hesitated and was not convincing. We referred back to Trent's past in mathematics as well, and it is clear that Trent has lacked interest in learning mathematics since high school, or even earlier. Trent said, "um, because in high school I didn't want to learn it at all. I just – I didn't show up, so, like, now I show up and I do the work" (p. 65, line 377). Trent's definition of "showing up" is clearly different than ours in the computer lab, but this

observation is an insightful one on his part. Trent knows he must finish this course for graduation along with another mathematics class, and he claims to know how to do well, but has yet to show the Math003 instructors this effort.

Trent said he did not like the idea of a large lecture hall setting for classes, he would prefer a much smaller class and an instructor rather than a computer. Trent found this setting worthwhile for learning, but not preferred. He enjoys learning alone – perhaps because he is embarrassed to learn mathematics in front of other people because he is quite far behind. When asked about the benefits of working online and on a computer, Trent responded, "Because the computer, um – why? That's a good question. Because I don't like – I don't like learning with a lot of people" (p. 66, lines 404-405). Trent disliked the idea of a regularly scheduled section of Math003. He said, "because – yeah, I hate that. Because, um, it's probably too many students, and I don't know. I just – personally wouldn't like it because I'm not confident about it" (p. 67, lines 460-461). Here Trent showed that he knew his lack of confidence was the reason he was so hesitant about mathematics, and that his confidence level is clearly affecting his learning. He hoped that there might be a small lecture for Math003 in the future, for his benefit and other students like him.

Kenny

Kenny has always had a hard time learning mathematics and really understanding it. In this interview, he recalled learning about polynomials in middle school, but he remembered not understanding the concept then, and felt he had a much better understanding of it now that he had completed some Math003 work on

that topic. Kenny likes structure and practice in order to learn mathematics, and he preferred to learn from the PowerPoint presentations because:

> The PowerPoints, I liked them better than I liked the textbook…because it kind of lays it out for you, this is what you need to learn, these are the examples, you know, do this, and you'll learn you know. And I feel like I learned the – the best with the PowerPoints as opposed to the books. (p. 73, lines 91-97)

He saw the scaffolding in the course layout and appreciates it's help in his learning process. Kenny also saw that he learned best by building on his old mathematics knowledge. He said he enjoys the program because it helps him learn fundamental concepts and then build on them, "yeah, I know cause it starts with the – basic – with the basics. And then it kind of progresses onto the stuff that, you know, they really wanna teach you" (p. 73, lines 102-103). Kenny saw how this organization of material was necessary and very beneficial to his learning process, something that developers of these programs definitely take into account when creating courses.

Out of the three students interviewed, Kenny was the only student in the study who used the program as intended. The best way to understand this material is to go through a lesson using one of the multimedia tools offered on the website, and then begin a pretest to test your knowledge. This progression is expected of all students, but not all of them use the program the way it is intended to be used. Trent and Rick both simply skipped the lesson portion of the program and moved on to the study plan, while Kenny studies, takes notes, and does practice problems all before he tackles his pretest. Kenny also expressed that learning mathematics is understanding

the concepts, while Trent and Rick believed that learning mathematics involves memorization of procedures and formulas. Kenny's method of going through the program is the most effective way to learn from this online course.

While Kenny developed mathematics skills, he was sometimes shocked that his answer felt wrong but was still right, indicating that he had not yet perfected his estimation and generalization skills. Another thing that caused anxiety and confusion, which led to a lack of confidence, was when fractions and variables appeared in problems. This led Kenny to misunderstand some problems and get frustrated, but he never gave up on the class work. Kenny also said that feedback was important to him so that he could build *understanding* in mathematics. When asked about the instantaneous feedback box, Kenny said, "Yeah, I like that because I know that I'm learning better if it's telling me what's wrong with my answer" (p. 76, lines 232-233). Kenny feels that constructive feedback helps his grow. Later on in the interview, Kenny uses the phrase "learn what's wrong," and not "know what's wrong," which impressed me and made me think that he has the desire to understand and grow as a mathematics learner. This is a mature view on understanding, and showed that Kenny is very interested in truly grasping a conceptual understanding of this material in order to be successful in his later statistics course.

MyMathLab Course Choices and Advice

Trent

In order to gain some insight about how the participants used the program, I discussed which aspects I observed them using regularly and why they chose those particular instructional tools. Trent used the "view an example" tool the most in the

program because it showed the solution to a similar problem and he could work the given problem out, side by side, with the program. This showed that Trent "learned" the mathematics by seeing someone else's solution and replicating it. He said he used this tool the most, "because it breaks down how they did it and I just copied exactly what they did" (p. 60, lines 61-62). Trent admitted to copying the computer program's solution in order to arrive at his own solutions, an honest way of saying that he essentially did the least amount of work possible to go through the course. Ironically, this way of proceeding through the class actually takes much longer because students lack a conceptual understanding of the material that they have not reviewed, making it difficult for them to build on their prior knowledge and grow as mathematics learners.

During the interview, Trent did not elaborate on how the website's resources were helpful, just that they helped him throughout the units. He enjoyed that I would answer his questions when he had them while in the LAS lab, but he acknowledged that I never gave him an answer, but made him walk through the steps, "you go through the steps. I wish you gave me the answer" (p. 60, line 91). This comment, along with many others we have seen from Trent, showed that all he is interested in is getting the answers to the given problem, not building an understanding of the concepts. Trent admitted that he could probably learn more if he used the other resources on the course webpage (p. 60, line 106), and that he tried to watch the videos, but they were too one-sided, and he was unable to ask questions of the speakers.

We discussed the forms of feedback that the program offers, and Trent thought that the feedback box in MyMathLab was a helpful form of feedback because it gave him hints as to where he went wrong, "it gave me, like, clues and it, um, just explained, like, how you, like, work the formula" (p. 61, line 139). Trent's use of the word "formula" is another indicator that he has a procedural mindset about mathematics. His comment about the feedback showed that he appreciated being told where to look in his solution for a mistake. When asked about how we could alter the course for future students, Trent thought the amount of material we expect students to learn is too much. He continued to be fixated on the amount of work involved in the class, and no other aspects, when we discussed this. Trent then offered advice to other students: "make sure that they don't slack, because it's self-paced – so, like, if you're a lazy person, it's just going to affect you in a bad way…Just make sure you finish this joint" (p. 70, lines 644-649). He must be aware that there are other students on the team that have not yet finished this course even in their senior year, this should be motivation enough to get through the class. Trent also wanted students to know that this is a review course: "yeah, just be like – just an overview of, like, what you went over in high school" (p. 70, line 658). This comment showed that Trent is aware that he is in a "remedial" level course, and that other students should be aware of what they are getting into.

Kenny

When asked about the computer program's specific instructional tools, Kenny preferred "view an example" to "help me solve this." He noted that "help me solve this" solves the problem at hand, which was helpful but also frustrating because once

the solution had been completed, the program altered the problem so the student had to repeat the process. Kenny elaborated:

> Yeah, I mean, I don't really like "help me solve this" that much especially because after I'm done with the "help me solve this," it changes the problem so I have to do a totally new problem…And I don't like that about it. Um, but I – I think I like the example one better but I use the "Help Me Solve This" more often because I need to know exactly how to do it. (p. 74, lines 124-130)

This showed me that Kenny could see faults in some of the resources he has for this course, but that he understands how to learn from what he is given and can work with his materials to create success. While progressing through the units in this class, Kenny realized that some problems call for more steps than others, and while this was frustrating, this was a great observation that helped him in his problem-solving process. Kenny believed that all of his resources combined helped him be successful (MyMathLab, the Math Learning Assistant (me), the Math Learning Specialist, and Google) (p. 74).

While discussing the disadvantages of this course, Kenny felt that he needed human interaction in order to learn the material (p. 74). This is a common thread for students in developmental mathematics (especially at LAS), who feel they require a bit of extra attention when it comes to mathematics. Kenny defended the MyMathLab's feedback box and said that sometimes, if the program could tell, it would pinpoint where he went wrong in his solution to the problem, and this was quite helpful, but not the only form of feedback he felt he needed. Kenny said in his first interview that he requires extra time with the instructor or TA to be successful,

so this showed that the computer feedback was sufficient when a person was not present, but that he would prefer to hear feedback from an instructor or TA.

When asked how the program might be improved for future students, Kenny suggested more practice problems be embedded in the course material prior to having to take the pretest for each chapter, but then later complained about the number of study plan questions in certain sections. A common theme among these students seems to be that they feel there is too much course material to cover in the time allotted. This is interesting because this course covers approximately the same amount of material that would be covered in a credited course on campus. Kenny then reiterated the reason we set up the course the way we did, so that he could learn the material first before the pretest and have less work to do later:

> It's– I mean, it's important to try to get familiar with the material before you take the pretest cause that way you'll have less "study plan" problems…Yeah, at first I started – I started out not doing that. And I was – kind of suffered from that. Like I think I had like 100 somethin' questions. (p. 81, lines 505-512)

So Kenny understands the importance of the scaffolding MyMathLab uses, and the tools he is offered. He also has attempted to take the "easy way out" and realized that it was in fact harder to do in the long run. It is clear that Kenny learned from his mistakes in the earlier part of the semester.

Kenny offered some advice to future students who will be taking Math003:

> KW: I would say uh, hum, I would say try to make it um, if you're scheduled to make it on time. I mean, it might seem like it's a lot but if

you actually have a steady schedule to come in, routine, then it'll make it a lot easier. You know, than if you just skip and stuff.

AB: What about – what about planning? Getting your stuff done? It's self-paced, so what advice do you have for students to help them with that?

KW: Um, I would say just realize that uh, you're here to try to advance yourself so I mean, you're here to learn. There's people here to help you learn so take advantage of it. (p. 81, lines 522-530)

Kenny understood that this course was difficult to keep up with because it does not have a real "class time" and that this can affect some students negatively. Kenny also expressed some personal reasons why it is important to have developmental mathematics classes in college:

> I'd say it's a big waste of money like I don't know, if they were paying for the classes or their parents are, it's a big waste of money to try to take a class and then find out – after you can't even drop it that you know, that you're not ready for the class. So I mean, it's better if you know that you're ready for the class cause your test score was to get that outta the way, the preparation. (p. 81, lines 544-547)

This is an argument that will never fail to get certain students to take their math seriously. Kenny realized at some point that he was failing and wasting his money, so he decided to take this course for review to boost his confidence and help him succeed in his third attempt at statistics. Kenny admitted in the interview to first dreading the LAS lab environment, but got used to it and got into a routine. He

definitely improved his mathematics learning and problem-solving techniques in the past semester, and this is quite obvious when working individually with him.

Survey II

The final surveys were given to fourteen participants, but only eleven submitted their responses. There were several yes or no questions asked as well as a few open-ended questions. Because the sample of students was so small, only generalizations about these eleven students can be made from the data, and attention given to some of the more interesting open-ended questions. The results are as follows:

Nine out of eleven (82%) students believe that the unit or units they completed between the two surveys were well taught. The two students who did not believe the units were well taught were Olive and Taylor. Nine out of eleven (82%) students thought that the feedback offered in the course was helpful. This is promising for the success of the program, and specific concerns here were elaborated on in open-ended form. Ten out of eleven (91%) students felt confident in their ability to self-regulate their learning throughout the units. This is comparable to the number of students who felt this way prior to the research study, and this could again possibly be due to the fact that these students are typically young and have experienced courses in an online format before. Seven out of eleven (64%) students say they mastered the material in the units they just learned. This was surprising because mastery of the material is not an easy task, and this may be the result of over-confidence from some students in the class.

Do you believe that the feedback offered throughout the unit(s) was helpful?

Trent: Yes – Allowed me to go back and re-check my work.

Kenny: omitted

Chris: Yes – I believe the feedback was useful because it enables students to see what they are doing wrong and what needs to be improved in order to be successful in the course and further mathematics courses.

Melissa: Yes – If I didn't have the instructor and TA's to ask many questions then I would have answered no. Course compass doesn't explain well enough in the prep work, so of course you don't do well on the pretest and have tons of problems that are not hard just the steps to solve were not explained prior.

Taylor: No – There is basically no feedback.

Taylor was the only student who answered no to this question. He claimed that there was no feedback in the course, and to this I assumed he was referring to the internet-based resources because you will see later than he thinks the interaction is useful. Melissa's explanation for there being enough feedback also focused on the human interaction she received in the classroom, and noted that the course website did not provide her with what she felt was enough feedback to move on. Trent and Chris had similar responses that noted the feedback allowed them to check where they went wrong, but the other student's responses do not indicate this being a benefit. Unfortunately for the data, Kenny left many of the open-ended portions of this survey blank, but he responded to many of the questions in the interview.

Did you feel confident in your ability to self-regulate your learning throughout the unit(s)?

Trent: Yes – I feel I can get through the course, just need to put time in.

Kenny: Yes.

Martin: Yes – Yes because I've been teaching myself the material since chapter 1, self-regulation is becoming easier by the unit

Reuben: Yes – I'm finishing a month early.

Taylor: No – To be completely honest, no. The "learning" I got was just me reading an online book. I doubt I'll remember much.

Trent noted here that he needed to put more time into the class, a good observation on his part. His interview reiterates the same thing: he knows what he needs to do to do well in the class, but he isn't doing it. Martin elaborated on how the course has taught him to self-regulate throughout the semester, getting better with each new unit. This is what would be expected of most students to feel by this point in the semester, like they are under control and still able to work at their own pace. Reuben self-regulated his learning so well that he was able to finish the course a month before the last day of classes, an accomplishment many students do not have the motivation, time, and self-efficacy to achieve. Taylor's answers to the open-ended questions in this survey were all quite negative. He was repeating the course for the second time this year, so this could be a reason why he was so negative in his thinking towards mathematics class. He also had used extra time in the LAS lab to try and get his work done and finish the course.

Do you feel confident that you will be able to apply this material in your next class?

Trent: Yes – Been in the class for a year!

Kenny: omitted.

Harry: Yes – Yes, but at the same time no. If I don't constantly apply it, I will end up forgetting. Things learned are perishable, it takes constant practice.

Alex: Yes – My last teacher went too fast. This course helped me understand at a comfortable pace.

Taylor: No – I've been in 003 for 2 semesters now. It just doesn't work, it's a waste.

Trent thought that the length of time he spent in the course would directly correlate to his ability to remember the material for the following year, but this is not the case. Trent spent the last year studying procedural knowledge instead of studying the material and building mathematics content knowledge Harry noted that if he doesn't constantly use what he has learned then he would not remember it, which is something that many students don't realize about mathematics until very late in their education. Alex believed that this course's pace helped him understand the material in his own way so that he could keep up with a face paced course in the future. Taylor believed this course was a waste of his time. Taylor came to LAS at the end of the spring semester, and I suggested to him that he continue with Math003 in LAS and not in the regular lab setting for better results.

Do you have any suggestions or comments for the Developmental Mathematics program at the University? What improvements could be made?

Trent: No.

Kenny: In the wrong answer boxes, more attention to the answer could be given.

Reuben: Better accountability?

Melissa: More TA's to work with only 4 students at a time (4 students for every 1 TA).

Taylor: I'm not sure what should be improved, but I know one thing. If students are in 003 then they need actual teachers, not crappy computer programs and online books. This is my second semester taking this class and I still don't know enough to pass/complete the course. It's upsetting.

It was interesting that Kenny chose this piece of advice for the program because he defended the answer boxes in his one-on-one interview saying that they pinpoint a spot in the problem where he might have gone wrong. He suggested more clarification for future students to perform better. Reuben suggested better accountability but did not give a way for this to occur. Maybe he felt that there was not enough accountability in his section of Math003. Melissa had an unrealistic vision for the labs of the future with four TA's, but she stressed the need for extra help, so she must have felt that there was not enough one-on-one assistance in the regular section of the course. Taylor took a negative spin on things again and said that he felt the computer program was "crappy" and that he has been in the course for a long time now. Many students taking developmental mathematics share his feelings and many of these students require the individualization of the LAS lab for success.

What advice would you give to students who will be taking this course in the future?

Trent: Get it done!!!!

Kenny: Remember that you are here for a reason.

Harry: It takes dedication and focus. To succeed you really need to pace yourself in an area that is away from everyone. Some people find it difficult to learn online. Personally, I think it is great and convenient. Then again, I live on my own so I don't worry about people bothering me.

Martin: Stay ahead of the material, be consistent, make yourself a schedule for when you specifically spend time doing math.

Alex: Prepare before each pretest.

Melissa: Follow prep well and take better notes, it helps when trying to pass pretest.

Olive: That they shouldn't take too much advantage of the self-regulating and that they should do both the videos and PowerPoints because each gives different examples of the material.

Taylor: Don't expect much help from those there. Go to LAS from the start.

All of these students gave interesting and helpful advice. Trent, possibly because he was unable to finish in the year he spent in the class, offered students the advice to get the course completed as soon as they can. Kenny reminded the students to think about why they might be in Math003, and to think about what to improve on in the course. Martin gave great insight and told future students to stay on top of the course work and ensure they have enough time allotted for mathematics each week. Alex and Melissa wanted students to know that the pretests would not be as difficult if students study and prepare before each one. This will help students move through the material quickly and efficiently, while still learning the content. Olive wanted students to know that they should not take advantage of the fact that the course is internet-based

and self-paced, and that this can lead to trouble with completion of the class in the long run. Taylor, always negative in his answers, warned students not to expect much help from the regular section and to go to LAS. This might be true for those few students who truly need the extra assistance, but for many the regular setting will be just as successful.

Chapter 5 – Discussion & Conclusion

Discussion

This section is organized by research question. Each of the five original questions is discussed in relation to all three interviewees. For some of the research questions, there is a discussion of all the participants (those enrolled in both the Independent Study and regular sections of Math003). Because of the small sample size, broad generalizations are not possible, but information from this research is valuable in showing how students with differing abilities perform in developmental mathematics and what could make each of these students successful.

1. How does a student's history with mathematics affect the student's perceived ability to learn mathematics from an internet-based program?

Trent

In his first survey, Trent claimed in his definition of "developmental math" that it meant that he was learning math he never learned before. This statement is an indication that Trent sees the math content in this course as something that is new to him, and something that he has little confidence with because it is unfamiliar. In his interviews, Trent took no responsibility for his placement into Math003, showing that he had not yet realized that he is the reason he belongs in this course. Trent demonstrated prior learning of the concept of linear equations, but did not make enough connections with his prior knowledge to find a solution to the problem given. Trent had no desire to participate in the portion of the interview that was related directly to mathematics content, showing that his avoidance of mathematics is something he has a hard time working with and getting around. This is directly

linked to his performance in the course and his success (or lack thereof) with the online program. Trent avoids mathematics as much as possible, making it impossible to be successful in his mathematics class.

Kenny

In the first survey, Kenny described "developmental math" as math that is fundamental and was missed in previous years of schooling. Kenny, like Trent, linked the definition of this course to his past mathematical experience (rightly so) and his level of confidence with the subject. Kenny was slightly more positive in his wording than Trent, and claims this mathematics was "missed" before, as opposed to "never learned." This difference in wording might be attributed to Kenny's more positive outlook on learning and understanding mathematics as a whole. Throughout his first interview, Kenny saw himself as having a "deficiency" in mathematics due to lack of understanding, and claimed to have been confused with mathematics since he was in middle school, with the introduction of algebraic thinking. This is an area that many students find confusing (introduction of variables), and it was not surprising that Kenny felt this misunderstanding early in his life had such an effect on his learning. It was very mature of him to realize this, and even more so to feel comfortable talking about it. Kenny understood the reasons he was in Math003, which led him to be motivated and be a strong student. Kenny's prior experiences in mathematics helped him to be successful with this online program.

Rick

Rick describes "developmental math" as the beginning stage of learning math, which puts him into a category of beginners for this material. This displayed a lack of

confidence with this material. Rick also attributed his lack of success thus far in the course to his distractions from mathematics, and his priorities being in the wrong places. Rick showed regret towards his fun-filled college years, while he admitted they were enjoyable to some extent, because he realized that he was still in a non-credit review course going into his second senior year of college. Rick's history with mathematics involved avoiding it and prioritizing other things before it, which had a negative effect on his ability to be successful now with the same material. Rick displayed a small amount of prior knowledge about systems of linear equations, but not enough to create a solution to the problem at hand without being led to perform certain steps. His lack of mathematical thinking over the past few years has left him with difficulties in problem solving, an important aspect needed for success in mathematics. This difficulty, combined with his past experiences with college mathematics led Rick to believe feel under-prepared for this course.

2. What effects do confidence, motivation, and interest have on a student's perceived ability to navigate through an internet-based program?

Trent

Trent was distracted from the beginning of the first interview, showing that he had little motivation to stay alert and focused for the interview, and very little interest in answering questions that directly related to mathematics content. This lack of interest had a direct effect on Trent's success in the course, making it difficult for him to be motivated to stay attentive in class and do mathematics work for long periods of time. Trent repeatedly asked for my approval before moving on with his solution or feeling confident with it. This occurred 16 times during the interview, and it is a key

to analysis of Trent's mathematical understanding. Trent requires reassurance from an "expert" source, specifically a teacher, not a computer. For students with this type of issue in problem solving and in mathematics, developmental courses taught through an online program may not be the most beneficial, and may make these students feel as though they are not successful in the class.

Trent has low confidence in mathematics because he feels that the problems take too long. This is a common theme among many students, who feel that mathematics problems tend to have too many steps. Trent could be feeling this way because he views learning and understanding as memorization, and therefore cannot grasp the importance of working through a problem on his own to discover a solution. The length of mathematics problems seems less daunting when an understanding is developed between the various steps performed. Trent tended to avoid my mathematical questions as well, attempting to distract me from the solution path to the problem. Trent said in his second interview that he felt confident with something when he was good at it, and that if he understood mathematics, he would feel more confident with it. Trent knows he lacks a conceptual understanding of mathematics, but displayed no motivation to achieve an understanding through learning. Trent first avoided this course entirely after our first class meeting because he felt uncomfortable, but once he built a relationship with me he felt more at ease in the class. This was an insightful observation for him to make, and it showed me that his comfort level is important to his success in a class. Unfortunately, Trent did not pass Math003 this past year, due to his lack of confidence, motivation, and interest in the course.

Kenny

During the first interview, Kenny displayed confidence in his ability to self-regulate his work, but little confidence in his mathematics ability. These two go hand-in-hand for success in this course, and Kenny was aware that these were things he must work on throughout his time in the LAS lab. Kenny was insightful in his understanding of mathematics and its relationship to the real world. He understood that in order for him to learn the material, he had to think about it outside of class and attempt to relate it to his real life. This is important for his mathematics learning, because Kenny learns from seeing things in front of him, either worked out or demonstrated for him, and he is aware of this facet of his learning even in the first interview. This awareness could be due to Kenny's lengthy experience with college-level mathematics and this University and his knowledge of what has and has not worked for him in the past.

In his second interview, we see that Kenny again lacks confidence in the subject because of his poor mathematical history. Kenny saw himself improve his mathematical reasoning and problem-solving skills, which was insightful and surely a confidence boost in this course. He felt that by the time of the second interview, his confidence with mathematics had increased from before, but that he still needed to work on his patience in problem solving as well as motivation to continue even if his answers are not always correct. Kenny saw in his past what did not work for him in mathematics, and he applied this knowledge of his own understanding to the course this past semester.

Rick

After his first interview, it was obvious that, based on his past experiences, Rick lacked the motivation to learn and understand mathematics. Rick claimed that this past semester was different, but in the end was unable to finish the course due to a family emergency and sickness. This was unfortunate because of the show of motivation I saw this semester that I had not seen in any previous semester when he was enrolled in my course. During the mathematical content portion of the interview, Rick's lack of confidence in his abilities was even clearer; he questioned himself before answering anything and had little prior knowledge to help himself along. He was not confident in his solutions to either problem, because he questioned the pathway to the answer the entire time. Rick's lack of confidence affected his performance in the course because he had a hard time working alone on the mathematics and feeling like he was getting anywhere. Rick felt he needed modeling to succeed in mathematics, which is a possible indication that the online course is not a good fit for his mathematics needs.

Whole Group

In the first survey, nine out of fifteen participants (60%) rated themselves a 5 (on a scale from one to five) on their confidence to self-regulate their work in this course. This percentage is quite high, but does not directly relate to the students' confidence with mathematics in particular. Many of these students had taken online courses before and this was at the start of the semester, so that could affect their confidence level. Regardless, confidence in self-regulation in the context of Math003 should lead to success in the online classroom environment. There were also two out

of fifteen participants (13%) who rated themselves below a 4 on the scale. This low rating could be due to a lack of experience with online courses, or the admission that self-regulation in the context of this course is difficult for them, which is a mature observation for students who are so young.

In the second survey, when asked if students felt confident that they could apply this material in their next class, many students had positive answers. Trent, who said, "Yes – Been in the class for a year," attributes the time in the course to his success in later courses. He did not mention how much he learned and how this might affect his future. Harry said, "Yes – Yes, but at the same time no. If I don't constantly apply it, I will end up forgetting. Things learned are perishable, it takes constant practice," and made the observation that mathematics must be exercised like a muscle, and that time away from it makes it harder. Alex said, "Yes – My last teacher went too fast. This course helped me understand at a comfortable pace," attributing his learning in this course to his ability to learn on his own in a self-paced manner. Besides Trent, these participants all attributed their confidence to something they learned this semester about themselves as a learner. While Trent claimed he is confident to apply his knowledge later, time spent in a course does not equal success. The only student with a negative answer was Taylor, who said, "No – I've been in 003 for 2 semesters now. It just doesn't work, it's a waste." Taylor did not have confidence in his mathematical knowledge because he had struggled so much with this course in the past. By the end of the semester, Taylor joined LAS and has been recommended to continue there in the fall for extra attention and more individualized instruction.

3. What effect does a student's perceived ability to self-regulate her/his learning and keep up with a self-paced course have on her/his success in an internet-based mathematics class?

Trent

On the first survey, Trent rated himself a 5 (from 1 to 5) on his confidence to self-regulate his learning. When discussing the self-paced nature of the course, Trent said, "I loved it. I was on my own time" (script citation). Trent was positive about this aspect of the class, it made me think that he was not aware that he was doing poorly in the course. I suspect students like this are in total denial with essentially no grasp of the reality of their situation. There seems to be a negative correlation between perceived ability to self-regulate and success. Trent did feel that the computer lacked necessary qualities that an instructor would bring to the class, like the ability to ask questions and stop the lesson when there is confusion. These factors led Trent to feel that this setting for the course may not be the best for him, despite his over-confidence in his abilities to self-regulate his own learning. Trent's lack of prior knowledge had a significant impact on his self-regulation in the context of Math003 as well, his lack of understanding of early concepts led him to feel less confident when learning new concepts, and he focused on rote memorization because he felt this would be the best way to learn the material.

In his daily logs, Trent spent an average of 50 minutes on the program each time he logged in. While he had poor attendance and this might affect this number, he also did not spend a long period of time on the program at any one given time. This shows Trent's lack of effort in this course due to his inability to self-regulate his

learning effectively. Also visible in his daily logs, Trent only tried new materials (videos) on two out of five days, which showed his lack of motivation to use course tools other than the Study Plan and his perceived understanding that the videos were not helpful in understanding the material. Trent was unable to self-regulate his learning in a way that explored new options on the course website and allowed for growth as a mathematics learner. Trent feared his next course at the University because he felt that it would be too fast-paced, showing his preference for the slow nature of Math003 Independent Study. Trent also realized that he needed to put more time into this course in order to be successful, but this effort and extra time was not seen before the end of the spring semester. Trent knows how to improve his learning, but does not take action.

Kenny

In his first interview, Kenny indicated that an aspect of learning missing from the online course was interaction with an instructor. My presence in the lab, as well as the presence of the Math Learning Specialist, allowed Kenny to feel more at ease, but his confidence in his ability to self-regulate his learning was not all he felt was necessary for success. Kenny's mature attitude toward learning mathematics made his time in this course a bit easier for him than the other students, but he still understood that there was a lot of effort involved in his success and that he had much to learn to be successful in the course.

From his daily logs, it is evident that Kenny put a lot of effort into this course. His average time spent on the program was 2.5 hours per session with the computer, much higher than Trent's. Kenny clearly had more motivation to stay on top of the

material in this course, and his self-regulation in the context of this course worked well throughout his time in the lab. Kenny also noted in his logs that he tried the PowerPoint presentations one day in the lab and learned that he enjoyed them the most out of all of the online tools. Kenny spent time exploring the course website to find what worked best for his learning, something that some of the other students were not able to do in the course. This led Kenny to be successful in the course throughout the semester.

Rick

In his interview, Rick was confident in his ability to self-regulate his learning, and enjoyed that he could do his work anywhere for this online class. While he claimed to be able to do his work anywhere, Rick rarely put in time outside of the lab on his coursework. He noted that procrastination was his biggest bully in this and other online courses because he felt they were less important than courses he attended in a lecture setting. His lack of attention to online courses in general clearly had an effect on his success in this course in the past, and became an issue for him in this lab as well. Rick was unable to complete the semester due to several issues, and this incompletion surely affected his confidence in his ability to pass the class in the future.

4. Is there a connection between a student's conception of understanding and learning mathematics and her/his approach to an internet-based mathematics course?

Trent

Trent's idea of understanding a concept was to copy the steps to a solution and repeat them until they were memorized. In many cases, Trent did not care to repeat the process for practice and was satisfied when he came to a correct conclusion for a problem. This had a direct effect on the way he proceeded in the course. Because Trent felt that he only needed to memorize and practice steps, he rarely watched any videos of lessons, read the textbook, or viewed the PowerPoint presentations. In the avoidance process, Trent used only the Study Plan to further his knowledge, limiting his understanding to formulae and procedures. This unfortunate progression did not allow Trent to grow as a mathematics learner or expand his conception of understanding mathematics. This progression will have an impact on how Trent proceeds in mathematics in the future. Trent's Daily Logs indicate that he used the Study Plan and the videos each 40% of the recorded time he was in the lab. In his second interview, Trent noted that he did not enjoy the videos and that the Study Plan was his method of choice for learning. This indicates an immature approach to learning math, and a lack of motivation in Trent to try new techniques to improve his understanding. These findings, as well as Trent's low level of confidence led him to be hesitant and unsure about mathematics. He was unable to be successful in the internet-based course.

Kenny

Kenny's need for "extra clarification" in mathematics class and his self-proclaimed need for social interaction were evident in his first interview. He did not seem to need approval, like Trent, but was clearly in need of human interaction of some kind to feel confident. This could be a sign of some immaturity that might lessen or disappear with time, or it could be some deep part of his psyche that is linked to his learning of mathematics. While Kenny displayed immaturity at some points, he was mature in his thinking about the necessity of this course. Kenny was aware that he needed this review course, and that he was not the only student in this similar position. This is a mature attitude for him to have, and this had a direct link to his success in the course in comparison to the other interviewees. In his Daily Logs, Kenny recorded that he used PowerPoint presentations for instruction 75% of the recorded time he was in the lab. This showed his ability to explore his options and find the best teaching tool for him on the course webpage. Kenny's mature attitude toward learning and understanding had a direct link to his success with the internet-based program. Kenny learned from the beginning what not to do on the program and what should be done in order for him to truly understand the material.

Rick

Rick, like Trent, displayed a lack of knowledge of how to understand mathematics. Rick and Trent had similar views on learning: that it comes with practice and memorization. These views did not help Rick to be successful this semester, and led him down a similar track as Trent in an attempt to complete the material for the course. Rick also spent the majority of his time in the class on the Study Plan for the first chapter, doing the same questions repeatedly until he got the

correct answer. Without some review of a lesson or the concepts that were introduced in each chapter, this approach to the material does not provide for much mathematical learning. Rick's conception (or lack there of) of understanding mathematics directly linked to his poor performance in the course, much like Trent.

5. What kinds of feedback are students looking for in a mathematics class? Does the internet-based course offer the feedback necessary for these students to feel they can succeed?

Trent

In his first survey, Trent said feedback was important because it helped him stay motivated (the feedback Trent needs must be missing from this course, given the motivational issues that we have seen). In his first interview, Trent made it clear that he found an instructor presence in the classroom to be necessary. Direct modeling by an instructor is how Trent believed he would be most successful in mathematics. During the mathematical content portion of the interview, Trent repeatedly asked for clarification or approval to move on to the next step in the solution process, proving that his learning requires constant verification from an outside source to feel productive. His clear need for clarification and approval from another source was not met through the online resources, so he looked to the instructors present in the room for a cue to move on with material. In the second interview and survey, Trent showed his need for feedback to see where he went wrong, as well as his advice for future students in the course: "Get it done!!!" After analyzing the data, it is clear that Trent needs to take his own advice in order to pass this course.

Kenny

Kenny feels he couldn't "grasp the material" without feedback (which was quite vague). He stressed the importance of instructor feedback for success in a course, and felt that the computer did a good job with feedback, but that a person's presence made a huge difference in his confidence level to proceed. This is a clear

indication that Kenny belonged in the Independent Study section due to his need for extra clarification, and that without the extra presence the LAS lab offered him, Kenny might not have felt so accomplished in the course.

Kenny understood how to learn from the materials he was given, and believed that if he used all of the website's resources at some point, that he would achieve success. Kenny could see the scaffolding of the course and how this helped him build on his prior knowledge. He felt that the feedback offered from the internet-based course materials was enough to pinpoint where a solution path went wrong, but was not enough to learn from. When asked to give advice to other students, Kenny said, "Remember that you are here for a reason." This showed me that he understood his placement into the course and used it as a stepping-stone to learn how to learn and eventually be confident and successful in mathematics.

Rick

Rick believed feedback could help him learn from the mistakes he made in problem solving. In his interview, he said that he needed organization to take a class seriously, and that the online nature of this course did not allow him to feel it was as serious as his other classes. Rick felt that the program did not offer him enough structure, which could just be his opinion and the way he chose to progress through the units. He also noted that he felt that he needed approval in order to succeed, like Trent, in solving a problem. This indicated Rick's need for an instructor presence in his courses at all times, to keep him on task, focused, and organized. This type of feedback is what Rick felt he needed to succeed in the course. Because he was unable to complete a second interview, I do not know for sure if Rick felt that this

course was helpful and if he felt the feedback was enough to truly learn and understand the material at hand. Due to his lack of motivation to approach the work on his own, I would speculate that Rick found this course less effective than he might have found a lecture-based course.

Whole Group

Some participants mentioned the online program specifically in their answers to Survey I and Survey II questions regarding feedback. Melissa is the only student who stated clearly that the program was not enough help for her. She felt that the program did not do a good enough job of explaining certain concepts, and that the Teaching Assistants and instructors were necessary for her success. Martin and Karl both said they felt there was enough information to learn from the program. This supports the differences in learning styles that can be seen within a developmental mathematics course and how these differences make it difficult for all students to feel they are getting the best instruction possible (Boylan, 2002; Boylan et al., 1999; Higbee & Thomas, 1999; Kinney & Robertson, 2003; Miles, 2000; Perez, 1998; Roueche & Kirk, 1974; Waycaster, 2001). Feedback is necessary for students to perform well in any class, and it is clear that the feedback from this particular online course does not help all students enrolled feel successful.

Conclusion

This study makes evident the stigma associated with students who are placed in developmental mathematics (Bassarear, 1986; Higbee & Thomas, 1999). Trent is embarrassed to take Math003 in the regular setting because he is not confident in his abilities and is nervous to do poorly at something in front of other people. The stigma

of placement into this course has Trent thinking that it is ideal to prepare for his next class at LAS, a place where very few people have to know he is enrolled in the course and struggling with it. Rick felt the stigma as well in the three and a half years he avoided developmental mathematics prior to this past semester. Rick, like Trent, felt that the course was "remedial" and that is was embarrassing to be taking the course in a large setting for so many years in a row, so he avoided it completely. The stigma associated with the course does not seem to affect Kenny as much as the other two students, but he does prefer to be working one-on-one in the LAS lab than any other location on campus. Research should be conducted to address the stigma associated with being enrolled in developmental courses, and focus on helping students to feel less "remedial" and more confident and focused on learning.

According to Arlington (2003), students in developmental mathematics courses tend to credit their failures to external factors as opposed to something under their control. This is obvious when analyzing the interviews from Trent and Rick, who both claim they are in developmental mathematics because someone made them go, or they were placed into the course by someone else. Neither of these students attributes his placement to his poor mathematics ability or lack of motivation in the subject, but to factors out of his hands. This credit to external factors is also present when both of these students ask for approval of their work throughout the content portion of their interviews.

Trent and Rick did not seem to be able to proceed with a solution to a problem without having an authority figure tell them that they were on the right track (usually me or the computer program). This shows both low self-efficacy in mathematics as

well as a means to credit failures to outside factors. If they proceed with a problem solution and I have been helping them along, a wrong answer can be blamed on me in the future, and not on their mathematics skills, or lack thereof. Self-efficacy is directly linked to prior experience (Bandura, 1997), and we saw from the interviews that Trent and Rick have had negative prior experiences with mathematics, and felt failure in the subject before. Both Trent and Rick are student athletes at the University, and while being a star in athletics gives students the perks of academic advisors to communicate with teachers and the luxury of private tutors, athletes tend to be underserved academically as well. Students who are not athletes but experience troubles with mathematics like Rick has would have been asked to leave the University after their third attempt at math; this type of behavior under-serves our athletes academically in the long run. Being a star in one domain hinders the time and effort that a person can put into other domains outside of athletics, so these students have less time and energy to put forth to mathematics because the University values their time and energy spent in athletics and offers few negative consequences for poor performance in mathematics.

Based on the results of this study, it is clear that not all students benefit from the current design of the internet-based learning environment that is available for developmental mathematics at the University (Pearson's MyMathLab). Motivation in the context of Math003 is necessary for the completion of developmental mathematics in the current setting, but many students lack the motivation and drive to take the course seriously and learn the material. There are flaws in the design of the learning environment we use on campus, and likely on other campuses for similar

populations of students. Self-discipline in the context of the course is crucial for student success in these online courses (Heubeck, 2008), but this requires maturity and responsibility from students, many of whom do not exhibit these qualities in their first years of college. From studies completed in the past, it is clear that developmental level courses must be structured according to prior research on successes and failures of these types of courses (Boylan, 2002). Differentiating instruction for this population of students imperative.

For the students in Math003 Independent Study to be successful in the online course, student-teacher interaction is necessary. Designing developmental mathematics courses that keep this in mind will benefit more students than limiting the options to computer-based technology only for learning and understanding. If students are given an opportunity to learn in a classroom or a hybrid setting for developmental courses, success rates may go up for small student populations that truly struggle with all aspects of the internet-based course. Offering differentiated instruction for these types of courses is costly, and many schools are forced to limit their developmental courses to internet-based environments because it saves money. Research should examine the cost of giving students options for learning mathematics to determine if it is worthwhile and leads to greater student success.

While not a focus of this study, we did gain information about the extent to which developmental mathematics courses prepare these students for their credit-bearing mathematics courses. It is clear from the first interview that Rick and Trent have little prior knowledge in mathematics, and struggle with solving systems of linear equations without guidance from an authority figure. These two students lack

the confidence to complete a mathematical task on their own. Due to technical difficulties, the content portion of Kenny's interview was not recorded, but he stated repeatedly in his first interview, and second as well, that mathematics was becoming more interesting and that he was gaining confidence in the subject. Rick and Trent used the developmental online course materials incorrectly, and therefore were not successful in learning and understanding the material. It is unlikely that these two students will be able to recall and apply information from this course in any subsequent mathematics courses. Kenny began the course by using the program incorrectly, but soon learned that he progressed at a faster pace when he utilized the materials in the way he was told to. Kenny believed he was learning the material, and I would agree with this assessment. I have no doubt that he will be able to apply the material from this developmental mathematics course in his next course here at the University.

Students who proceed through internet-based courses as they were intended will gain more knowledge and confidence than those who do not proceed as directed. Utilizing the internet resources as intended will help students "prepare" for their future college-level mathematics courses better than attempting to do less work to get by. This is true for most courses. The level of preparation for future courses is determined by the student in developmental mathematics computer-based courses, which means the students are in control of their future mathematics success when they enter the course. More research could determine a more defined line of "preparation" based on assessments of some kind, and this might help us understand if students really do feel prepared for the future mathematics courses. The University

of focus in this study released a retention report stating that students who entered the University in the 2006-2007 school year, at the developmental level of mathematics, had a 78.4% third year retention rate (Task Force on Student Retention and Graduation, 2010, p. 21). This statistic also includes the four other levels of developmental mathematics other than Math003 offered by the University.

Finding the correct fit for a student for developmental mathematics is a difficult task, especially when there are few options available. If a University offered multiple types of developmental mathematics courses (face-to-face, online, hybrid, one-on-one tutoring), a process would be needed to determine where each student belongs (other than a placement exam). I believe that the options listed above are all suited for developmental mathematics students and their differing learning styles. If a student's placement exam score places her/him into developmental mathematics, then there should be another process after the placement test that will determine how well the student works in different environments. Some students are placed into developmental mathematics because they are not good test-takers but may have excellent math skills. These students are typically successful in the online course because it is truly a review course for them. Other students, who may never have learned this material or have serious past issues with mathematics, might benefit from a different form of instruction.

All students placed into developmental mathematics should be screened using a survey and interview process that will help authorities on campus determine which type of course is the best fit for each. This is a costly and time-consuming process, but if it leads to students who are better prepared for future courses and have the

appropriate tools available for learning, then it is worth the cost in the long run. Future research is needed to determine what kind of questions would address the perspectives of each of the different instructional options for developmental courses. The results could inform universities of ways to screen their students in order to allow the opportunity for the appropriate developmental mathematics experience for every student. More research on computer-based technologies is critical as the world shifts into new technology-focused curricula for developmental mathematics students.

Internet-based courses only work well for some students; to build conceptual understanding students must be invested in their learning. This research shows that courses like Math003 at this University can only create success for students who are self-motivated, self-confident, and have the ability to keep up with the work in the course. As a result of this study, we have gained some insight into how these characteristics play out in individual cases. Not all students can gain the understanding they need to move on with mathematics from online developmental mathematics courses. Trent will not be successful in an online course unless he attempts to understand how to learn and grow as a mathematics learner. Once he understands how this will work for him, he may find success in the course, or he may need to try a different type of mathematics course (lecture-based perhaps) to be successful. Kenny's attitude towards mathematics was more positive than the other interviewees, and he had a good understanding of how mathematics should be learned and understood. He can and will be successful in mathematics, but just requires more time to learn than other students. Rick managed to avoid mathematics for a total of four years, and currently possesses less prior knowledge available to use than he did

when he first came to college. His avoidance and lack of motivation will affect his mathematics learning negatively if he does not begin to think about how the material should be learned and understood.

Based on these observations of student learning (or its absence), I would suggest that students have the option of taking developmental mathematics online or in a lecture format. This option would give students the ability to learn whichever way they feel would be best suited for them. Unfortunately, it would no longer be self-paced in a lecture format, but students who require traditional teaching to learn would benefit more from there being an option available. With this suggestion in mind, future research should focus on the population of students who do not find success in online classes, and what can be done to help these students with their mathematics learning. Future research should also focus on the various types of developmental courses offered: online only, lecture format, hybrid courses, etc. This will help differentiate between who can be successful in what types of environments and how to pinpoint these differences from the start of one's college education. Another focus of future research should be on students' past experiences in mathematics, specifically in algebraic thinking, and these effects on their current mathematics learning. These areas of inquiry would all provide new information to the field of developmental mathematics and help students be successful in review courses such as the one offered at this University.

Appendix A – Instruments

Consent Form – Interview Subjects

Project Title	*The Nature of Self-Regulation, Scaffolding, and Feedback in a Computer-Based Developmental Mathematics Classroom.*
Purpose of the Study	*This research is being conducted by Dr. Lawrence Clark and Allison Bell, Master's Candidate. We are inviting you to participate in this research project because you are a student enrolled in MATH003-Independent Study. The purpose of this research project is to explore the use of computer-based instructional resources in the Developmental Mathematics program at this University.*
Procedures	*The procedures involve a survey of questions and a background interview prior to your completion of a computer-based instructional unit. The survey and interview questions asked will relate to your experience in the developmental math program, your past mathematics experiences, and your content knowledge of a specific math concept. During your engagement with one computer-based unit you will be asked to complete a data collection log detailing your activities. Upon completion of the computer-based unit, a follow up survey and interview will be conducted to assess your experiences with and perspectives on the computer-based unit.*
Potential Risks and Discomforts	*There are no risks to students who participate in this study.*
Potential Benefits	*The benefits to you include increased individual time with the GA, self-reflection on past mathematics experiences, and an opportunity to reflect on this course. We hope that, in the future, other people might benefit from this study through improved understanding of the Developmental Mathematics program, struggles faced by students in this program, and how this program could be improved for future students.*
Confidentiality	*Any potential loss of confidentiality will be minimized by storing data on a password-protected computer or in a locked filing cabinet (depending on the source of the data). Any survey or interview data will be anonymously recorded and will not contain information to identify you.* *This research project involves making videotapes of you. These tapes will allow the Principal and Student Investigators an opportunity to review each interview session repeatedly without losing any important information. The Principal and Student Investigators will be the only persons with access to these tapes. They will be stored on a password-protected computer and will be destroyed no later than ten years after this study.* *___ I agree to be videotaped during my participation in this study.* *___ I do not agree to be videotaped during my participation in this study.* *All participants will also be given an opportunity to review transcripts from their interviews. This is to insure that your transcriptions accurately reflect the answers to the interview questions.* *If we write a report or article about this research project, your identity will be protected to the maximum extent possible. Your information may be shared with representatives of the University or governmental authorities if you or someone else is in danger or if we are required to do so by law.*
Medical Treatment	*The University does not provide any medical, hospitalization or other insurance for participants in this research study, nor will the provide any medical treatment or compensation for any injury sustained as a result of participation in this research study, except as required by law.*

Appendix A – Instruments

Right to Withdraw and Questions	*Your participation in this research is completely voluntary. You may choose not to take part at all. If you decide to participate in this research, you may stop participating at any time. If you decide not to participate in this study or if you stop participating at any time, you will not be penalized or lose any benefits to which you otherwise qualify.* *If you decide to stop taking part in the study, if you have questions, concerns, or complaints, or if you need to report an injury related to the research, please contact the investigator, Dr. Lawrence Clark at 2311 Benjamin Building, College Park, MD 20742; phone: 301 405 3324; e-mail: lmclark@umd.edu. You may also contact the student investigator, Allison Bell, at 3125 South Campus Dining Hall, College Park, 20742; phone: (w) 301-314-7699, (c) 301-509-1473; e-mail: albell@umd.edu.*	
Participant Rights	*If you have questions about your rights as a research participant or wish to report a research-related injury, please contact:* **Institutional Review Board Office** **0101 Lee Building** **College Park, Maryland, 20742** **E-mail: irb@umd.edu** ***Telephone: 301-405-0678*** *This research has been reviewed according to the University IRB procedures for research involving human subjects.*	
Statement of Consent	*Your signature indicates that you are at least 18 years of age; you have read this consent form or have had it read to you; your questions have been answered to your satisfaction and you voluntarily agree to participate in this research study. You will receive a copy of this signed consent form* *If you agree to participate, please sign your name below.*	
Signature and Date	**NAME OF SUBJECT** **[Please Print]**	
	SIGNATURE OF SUBJECT	
	DATE	

Appendix A – Instruments

Consent Form – Non-Interviewed Subjects

Project Title	*The Nature of Self-Regulation, Scaffolding, and Feedback in a Computer-Based Developmental Mathematics Classroom.*
Purpose of the Study	*This research is being conducted by Dr. Lawrence Clark and Allison Bell, Master's Candidate. We are inviting you to participate in this research project because you are a student enrolled in MATH003-Independent Study. The purpose of this research project is to explore the use of computer-based instructional resources in the Developmental Mathematics program at the University.*
Procedures	*The procedures involve your completion of two surveys. The first survey will be completed at the beginning of the semester. The first survey consists of questions that relate to your history with mathematics, your perceptions of the Developmental Math program, and your needs as a math learner. The second survey will be completed after your completion of a computer-based instructional unit. The second survey will consist of questions that assess your experiences with and perspectives on the computer-based instructional unit.*
Potential Risks and Discomforts	*There are no risks to students who participate in this study.*
Potential Benefits	*There are no known benefits to you for participating in this study.* *We hope that, in the future, other people might benefit from this study through improved understanding of the Developmental Mathematics program at the University, struggles faced by students in this program, and how this program could be improved for future students.*
Confidentiality	*Any potential loss of confidentiality will be minimized by storing data on a password-protected computer or in a locked filing cabinet (depending on the source of the data). Any survey or interview data will be anonymously recorded and will not contain information to identify you. If we write a report or article about this research project, your identity will be protected to the maximum extent possible. Your information may be shared with representatives of the University or governmental authorities if you or someone else is in danger or if we are required to do so by law.*
Medical Treatment	*The University does not provide any medical, hospitalization or other insurance for participants in this research study, nor will the University provide any medical treatment or compensation for any injury sustained as a result of participation in this research study, except as required by law.*
Right to Withdraw and Questions	*Your participation in this research is completely voluntary. You may choose not to take part at all. If you decide to participate in this research, you may stop participating at any time. If you decide not to participate in this study or if you stop participating at any time, you will not be penalized or lose any benefits to which you otherwise qualify.* *If you decide to stop taking part in the study, if you have questions, concerns, or complaints, or if you need to report an injury related to the research, please contact the investigator, Dr. Lawrence Clark at 2311 Benjamin Building, College Park, MD 20742; phone: 301 405 3324; e-*

	mail: lmclark@umd.edu. You may also contact the student investigator, Allison Bell, at 3125 South Campus Dining Hall, College Park, 20742; phone: (w) 301-314-7699, (c) 301-509-1473; e-mail: albell@umd.edu.	
Participant Rights	*If you have questions about your rights as a research participant or wish to report a research-related injury, please contact:* **Institutional Review Board Office** **0101 Lee Building** **College Park, Maryland, 20742** **E-mail: irb@umd.edu** ***Telephone: 301-405-0678*** *This research has been reviewed according to the University IRB procedures for research involving human subjects.*	
Statement of Consent	*Your signature indicates that you are at least 18 years of age; you have read this consent form or have had it read to you; your questions have been answered to your satisfaction and you voluntarily agree to participate in this research study. You will receive a copy of this signed consent form.* *If you agree to participate, please sign your name below.*	
Signature and Date	**NAME OF SUBJECT** **[Please Print]**	
	SIGNATURE OF SUBJECT	
	DATE	

Appendix A – Instruments

Survey I
Name: _____
Date: _____

Please answer the following questions honestly. Circle Yes or No depending on your response, if asked, elaborate on your answers.

1. Is this your first time taking this course?

   Yes No

2. Do you feel you were accurately placed into this course?

   Yes No

3. Have you had experience with computer-based or internet-based instruction in the past?
   Yes No

4. If the University offered this course taught by an instructor in a small lecture, would you have registered for it?
   Yes No

5. Is feedback in math class important to you?

   Yes No

6. If you responded 'Yes', explain why you feel that feedback is important.

7. If you responded 'No', please explain why feedback is not important.

8. This course is self-paced. Rate yourself (0-5) on your confidence to self-regulate your work and keep up with the course.

   Confident Not Confident

   5 4 3 2 1

9. Do you believe students should receive credit for completing this course?

   Yes No
   Explain why or why not:

10. What kind of in-class support do you feel is necessary for you to succeed in a math class?

11. What kind of out-of-class support do you feel is necessary for you to succeed in a math class?

12. What does "developmental math" mean to you?

Interview I

Cognitive/Background Interview (Solving Systems of Equations)

1. Interview Protocol:

Introduction

First I would like to thank you for your willingness to take the time to participate in this interview with me. Your thoughts and actions will be very valuable to me.

I have had the chance to observe you in this class, and I was hoping to gain a deeper understanding of some of your methods of approaching and thinking about specific problems, as well as your perceptions of your own math confidence, ability, and understanding.

I will begin by asking you a few questions about this course and your experience with mathematics in general. Please answer honestly and to the best of your ability. Try to avoid one-word answers. I will ask for clarification if necessary.

I will then ask you to do some math operations on linear equations. The questions I will ask should be familiar content to you. I am not concerned with the correctness of your answers, but more with your reasoning and the thinking that led you to that answer. Please think aloud while answering these questions, I will ask questions for clarification if necessary.

Finally, I would like you to know that this interview has no affect on your final grade or performance in my course. Your participation is greatly appreciated and I will be the only person viewing the recording of this interview. If anything, this time should help me better understand your ways of thinking and allow me to cater our individual class sessions to you in a more helpful way.

2. Perceptions of Math Confidence, Ability, and Understanding

1. Can you explain how you came to be a student in MATH003?

2. Is this your first time taking this course?

3. What does it mean to you to be in "developmental math"?

4. What were your thoughts when you discovered this course was non-credit?

5. Do you think computer-based instruction will help you learn this material?

6. Have you had experience with computer-based or internet-based instruction in the past? If yes, what was this experience, and how could you describe its benefits? What about its drawbacks?

7. Have you struggled with math in the past?

8. Did you do well in mathematics at the high school level?

9. Is there an experience, or set of experiences that you have had in mathematics class that have affected your attitude towards the subject? If yes, can you describe this incidence (or multiple instances) and how you feel they affected you?

10. What support in a class is necessary in order for you to succeed (instructor, TA, homework, one-on-one time, slow-pace, feedback, other forms of support, etc…)?

11. Do you think feedback is necessary to do well in a class?

12. What kinds of feedback are the most helpful for you?

13. How confident are you in your ability to succeed in a self-paced course?

14. Does the nature of this course (open-lab time, self-paced, no time-limit) effect the way in which you plan to proceed in the class?

15. Do you have a registered learning disability? If yes, how do you believe this has affected your ability to learn and understand mathematics?

16. Do you enjoy math? Why or why not?

17. Do you think a review course, like this one, is necessary to have at the University?

3. Solving systems of linear equations of multiple forms:

[Provide student with paper and pencil]
1. What is a linear equation?
2. What is a system of linear equations?
3. What do you think it means to solve a system of linear equations?

[Provide student with the first problem: solve this system of equations: $3x + 2y = 8$; $x = 12 – 2y$]
4. What is the first thing you think of when you see this problem?
5. How would you begin to solve this? (Explain)
6. Please solve this problem while thinking aloud.

[Provide the student enough time to complete the task and elicit verbal explanations for paths taken to solve this problem…solution is (26, 7)]
7. Do you believe this is the correct answer?
8. How confident are you that you solved this problem correctly?

9. Do you remember this concept from any previous math course you have had?

[[Provide student with the third problem: solve this system of equations: $2x – 6y = 8$; $4x + 50 = y$]]

10. What is the first thing you think of when you see this problem?
11. Does this problem look similar to the last? Why or why not?
12. How would you begin to solve this? (Explain)
13. Please solve this problem while thinking aloud.

[Provide the student enough time to complete the task and elicit verbal explanations for paths taken to solve this problem…solution is (3, 4)]

14. Do you believe this is the correct answer?
15. How confident are you that you solved this problem correctly?
16. Can you relate this problem to the previous problem? What is similar and what is different?

[Provide student with the second problem: solve this system of equations: $2x + y = 10$; $5x – 2y = 7$]
17. What is the first thing you think of when you see this problem?
18. Does this problem look similar to the previous problems I gave you? Why or why not?
19. How would you begin to solve this? (Explain)
20. Please solve this problem while thinking aloud.

[Provide the student enough time to complete the task and elicit verbal explanations for paths taken to solve this problem…the solution is (-14, -6)]
21. Do you believe this is the correct answer?
22. How confident are you that you solved this problem correctly?
23. Can you relate this problem to the previous problems? What is similar and what is different?

[Provide student with the fourth problem: solve this system of equations: $5x – 3y = 11$; $2x – 6y = -10$]
24. What is the first thing you think of when you see this problem?
25. Does this problem look similar to the previous problems I gave you? Why or why not?
26. How would you begin to solve this? (Explain)
27. Please solve this problem while thinking aloud.

[Provide the student enough time to complete the task and elicit verbal explanations for paths taken to solve this problem…the solution is (4, -7)]
28. Do you believe this is the correct answer?
29. How confident are you that you solved this problem correctly?
30. Can you relate this problem to the previous problems? What is similar and what is different?
31. Do you see any patterns forming between the problems we have discussed?

32. What is a system of linear equations? Has your definition changed since the beginning of the interview?
33. Do you feel confident in your ability to perform similar tasks on your own?

Appendix A – Instruments

Daily Log

Name: _____

MATH003 – Independent Study – Daily Log

Date: _____ Time spent on course webpage: _____

Section(s) worked: _____

Instructional Method of Choice:

Number of Problems Completed: _____

Did you try anything new on the website during today's lesson? _____

Appendix A – Instruments

Interview II

Follow-Up Interview Protocol:

Introduction

First I would like to thank you for your willingness to take the time to participate in this interview with me. Your thoughts and actions will be very valuable to me.

I have had the chance to observe you in this class, and I was hoping to gain a deeper understanding of some of your methods of approaching and thinking about specific problems, as well as your perceptions of your own math confidence, ability, and understanding.

This is a follow-up interview to explore your perceptions of the unit of the course you have just completed and any suggestions you may have for the course after this your experience thus far. I would like to focus on the different components of the online textbook, which components you used to learn the material, and how effective you believe this material was in helping you learn or relearn the concepts in this unit. Please answer honestly and elaborate as much as possible. I will ask for clarification on any question if I feel it necessary.

Interview

1. What is your overall level of confidence in mathematics (rate yourself: 1 being low and 10 being high)?

2. How do you feel you progressed in the unit?

3. Which aspect of the online text did you feel you utilized the most for this unit (PowerPoint, videos, textbook, view an example, etc…)?

4. I can see from your daily log and my observations that you used

   _____ [use observational data/usage data to fill in this blank] the

   most on the course website, did you find this the most helpful? Why or why not?

5. Do you think the choices you made for instructional materials to use throughout this unit were beneficial?

6. Do you think these tools offered the support you needed to succeed in this unit?

7. Do you think the unit offered enough feedback?

8. How do you feel about the type(s) of feedback you received?

9. Is there a type of feedback you would prefer to see in a math class? Did the feedback in this class live up to these expectations?

10. How did you feel about being able to pace yourself throughout this unit?

11. Did you find it difficult or easy to keep up with the work for this unit?

12. Do you think you understand the material from the unit? [I will be specific here, depending on the unit the student was working on…I can use mathematical terminology to elicit a response here as well]

13. Remember the interview we had before the unit? Do you think you might answer the questions about _____ [systems of equations or factoring] in a different way?

14. Do you think you would feel more confident doing the same problems from the previous interview?

15. Do you feel that this course will prepare you for your next class at the University? Why or why not?

16. Do you believe that you will remember the content from this course in order to apply it in your next course?

17. Do you feel that the instruction in this course is helpful?

18. Do you feel it is worthwhile to take this course via an internet-based textbook?

19. If you had had a choice, how would you learn this material?

20. Do you have any suggestions for this course that you think will make it more beneficial for students in the future?

21. Do you have any advice for students taking this course in the future?

Conclusion

I would like to thank you again for participating in this study. Your help has benefited me greatly and if you wish, I can share the final results of this study with you.
Your name will not be mentioned in any final documents in order to protect your identity. Only the Principal Investigator and myself have access to any recordings made throughout this study, and they will be permanently stored on a hard drive that is password-protected. Any written documents submitted during this study will be destroyed once they have been electronically recorded.

If you have any further questions about this study or its uses, please contact me.

Appendix A – Instruments

Survey II

Name: _____

Date: _____

Please answer the following questions honestly. Circle Yes or No depending on your response, if asked, elaborate on your answers.

1. Do you feel that the unit(s) you just completed was well taught in this course?
   Yes No

2. Do you believe that the feedback offered throughout the unit(s) was useful?
   Yes No

   Explain why or why not:

3. Do you feel you obtained the support you needed (from the instructional methods offered online) in order to successfully complete the unit(s)?
   Yes No

4. Did you feel confident in your ability to self-regulate your learning throughout the unit(s)?
   Yes No

   Explain why or why not:

5. Do you feel that you have mastered the material in the unit(s) just completed?
   Yes No

6. Do you feel confident that you will be able to apply this material in your next math class?
   Yes No

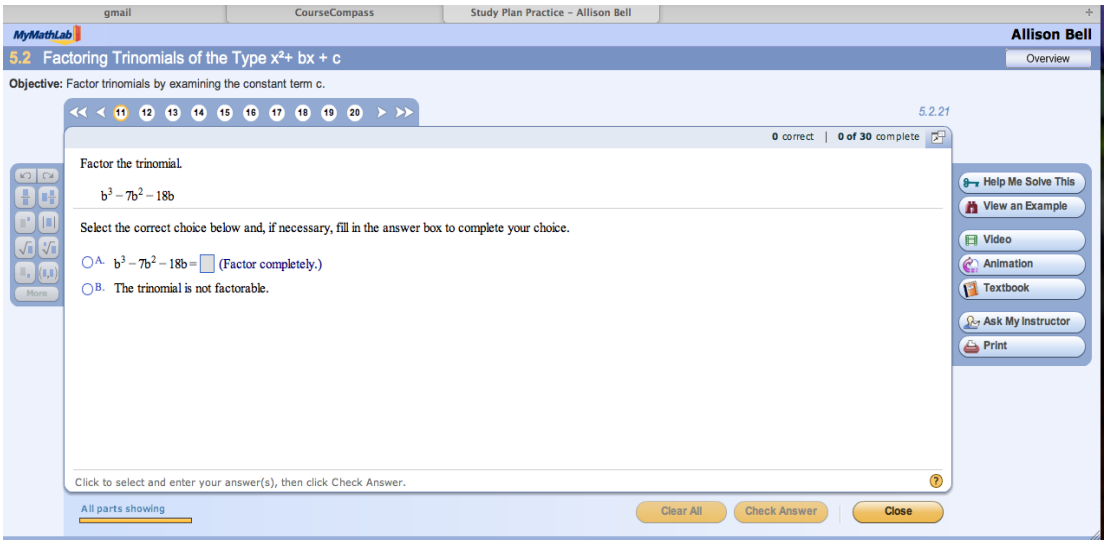
   Explain why or why not:

7. Do you have any suggestions or comments for the Developmental Mathematics program at the University? What improvements could be made?

8. What advice would you give to students who will be taking this course in the future?

Appendix B – MyMathLab Course Materials

Sample Study Plan Question



Retrieved April 11, 2011, from: www.coursecompass.com

Appendix B – MyMathLab Course Materials

Trent's Online Progress

Pretest Scores

Results from entire course to date.

Results from entire course to date.	Correct/ Total	Score	Time Spent	Date Worked	Actions
Chapter One Pretest		--			-- Choose -- Go
Chapter Two Pretest		--			-- Choose -- Go
Chapter Three Pretest		--			-- Choose -- Go
Chapter Four Pretest		--			-- Choose -- Go
Chapter Five Pretest		--			-- Choose -- Go
Chapter Six Pretest		--			-- Choose -- Go
Chapter Seven Pretest		--			-- Choose -- Go
Chapter Eight Pretest		--			-- Choose -- Go
Chapter Nine Pretest		--			-- Choose -- Go
Chapter Ten Pretest		--			-- Choose -- Go
Chapter Eleven Pretest		--			-- Choose -- Go
Chapter Twelve Pretest		--			-- Choose -- Go
Appendix Pretest		--			-- Choose -- Go

Retrieved April 11, 2011, from: www.coursecompass.com

Notice that Trent has not completed any pretests up to this point. He solely uses the study plan to go through the material on the course webpage.

Study Plan

Book Contents for All Topics	Correct	Worked	Questions	Time Spent
Ch. 0: Orientation Questions for Students			8	
Ch. 1: Introduction to Real Numbers and Algebraic Expressions			227	
Ch. 2: Solving Equations and Inequalities			152	
Ch. 3: Graphs of Linear Equations			76	
Ch. 4: Polynomials: Operations	4	4	230	6m 22s
4.1 Integers as Exponents			50	
4.2 Exponents and Scientific Notation			26	
4.3 Introduction to Polynomials			32	
4.4 Addition and Subtraction of Polynomials			18	
4.5 Multiplication of Polynomials			29	
4.6 Special Products			32	
4.7 Operations with Polynomials in Several Variables			25	
4.8 Division of Polynomials	4	4	18	6m 22s
Ch. 5: Polynomials: Factoring			229	
Ch. 6: Rational Expressions and Equations			96	
Ch. 7: Graphs, Functions, and Applications			99	
Ch. 8: Systems of Equations			29	
Ch. 9: More on Inequalities			98	
Ch. 10: Radical Expressions, Equations, and Functions			102	
Ch. 11: Quadratic Equations and Functions			97	
Ch. 12: Exponential and Logarithmic Functions			75	
Ch. Appendix: Appendixes			33	
Total: All Chapters	4	4	1551	6m 22s

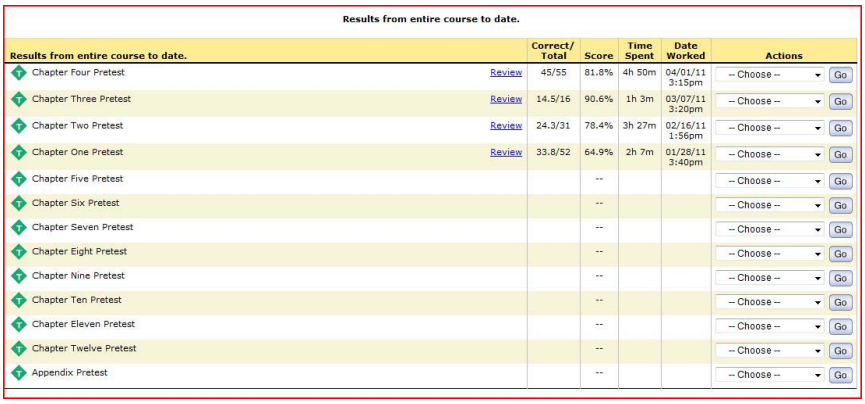
Retrieved April 11, 2011, from: www.coursecompass.com

Note: Trent did not have this account long before the date this data was retrieved, so these numbers cannot be used for this study.

Appendix B – MyMathLab Course Materials

Kenny's Online Progress

Pretest Scores



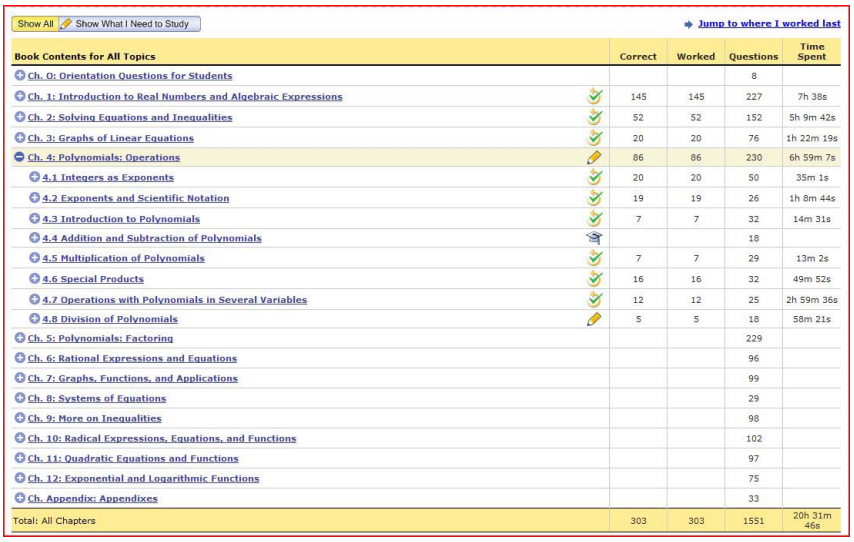
Results from entire course to date.

Results from entire course to date.		Correct/ Total	Score	Time Spent	Date Worked	Actions
Chapter Four Pretest	Review	45/55	81.8%	4h 50m	04/01/11 3:15pm	-- Choose -- Go
Chapter Three Pretest	Review	14.5/16	90.6%	1h 3m	03/07/11 3:20pm	-- Choose -- Go
Chapter Two Pretest	Review	24.3/31	78.4%	3h 27m	02/16/11 1:56pm	-- Choose -- Go
Chapter One Pretest	Review	33.8/52	64.9%	2h 7m	01/28/11 3:40pm	-- Choose -- Go
Chapter Five Pretest			--			-- Choose -- Go
Chapter Six Pretest			--			-- Choose -- Go
Chapter Seven Pretest			--			-- Choose -- Go
Chapter Eight Pretest			--			-- Choose -- Go
Chapter Nine Pretest			--			-- Choose -- Go
Chapter Ten Pretest			--			-- Choose -- Go
Chapter Eleven Pretest			--			-- Choose -- Go
Chapter Twelve Pretest			--			-- Choose -- Go
Appendix Pretest			--			-- Choose -- Go

Retrieved April 11, 2011, from: www.coursecompass.com

Notice that Kenny has attempted several pretests before moving on to the Study Plan.

Study Plan



Show All | Show What I Need to Study — Jump to where I worked last

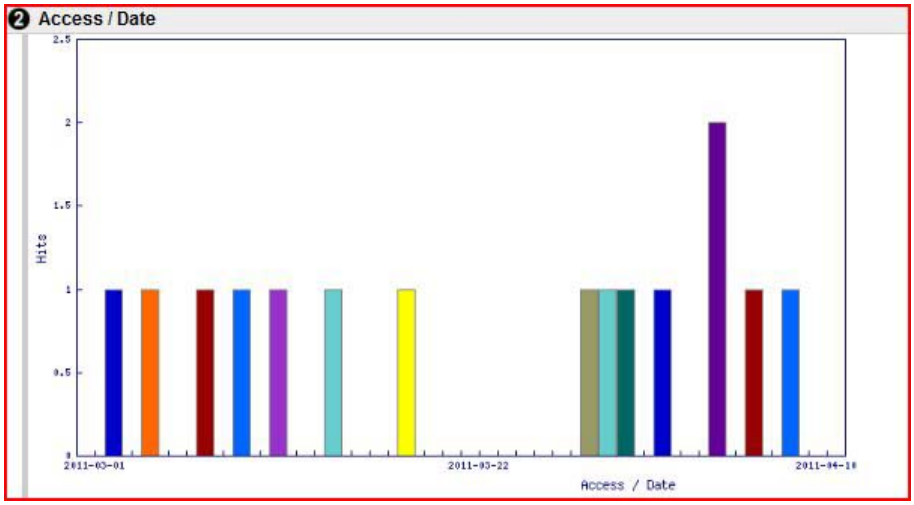
Book Contents for All Topics	Correct	Worked	Questions	Time Spent
Ch. 0: Orientation Questions for Students			8	
Ch. 1: Introduction to Real Numbers and Algebraic Expressions	145	145	227	7h 38s
Ch. 2: Solving Equations and Inequalities	52	52	152	5h 9m 42s
Ch. 3: Graphs of Linear Equations	20	20	76	1h 22m 19s
Ch. 4: Polynomials: Operations	86	86	230	6h 59m 7s
4.1 Integers as Exponents	20	20	50	35m 1s
4.2 Exponents and Scientific Notation	19	19	26	1h 8m 44s
4.3 Introduction to Polynomials	7	7	32	14m 31s
4.4 Addition and Subtraction of Polynomials			18	
4.5 Multiplication of Polynomials	7	7	29	13m 2s
4.6 Special Products	16	16	32	49m 52s
4.7 Operations with Polynomials in Several Variables	12	12	25	2h 59m 36s
4.8 Division of Polynomials	5	5	18	58m 21s
Ch. 5: Polynomials: Factoring			229	
Ch. 6: Rational Expressions and Equations			96	
Ch. 7: Graphs, Functions, and Applications			99	
Ch. 8: Systems of Equations			29	
Ch. 9: More on Inequalities			98	
Ch. 10: Radical Expressions, Equations, and Functions			102	
Ch. 11: Quadratic Equations and Functions			97	
Ch. 12: Exponential and Logarithmic Functions			75	
Ch. Appendix: Appendixes			33	
Total: All Chapters	303	303	1551	20h 31m 46s

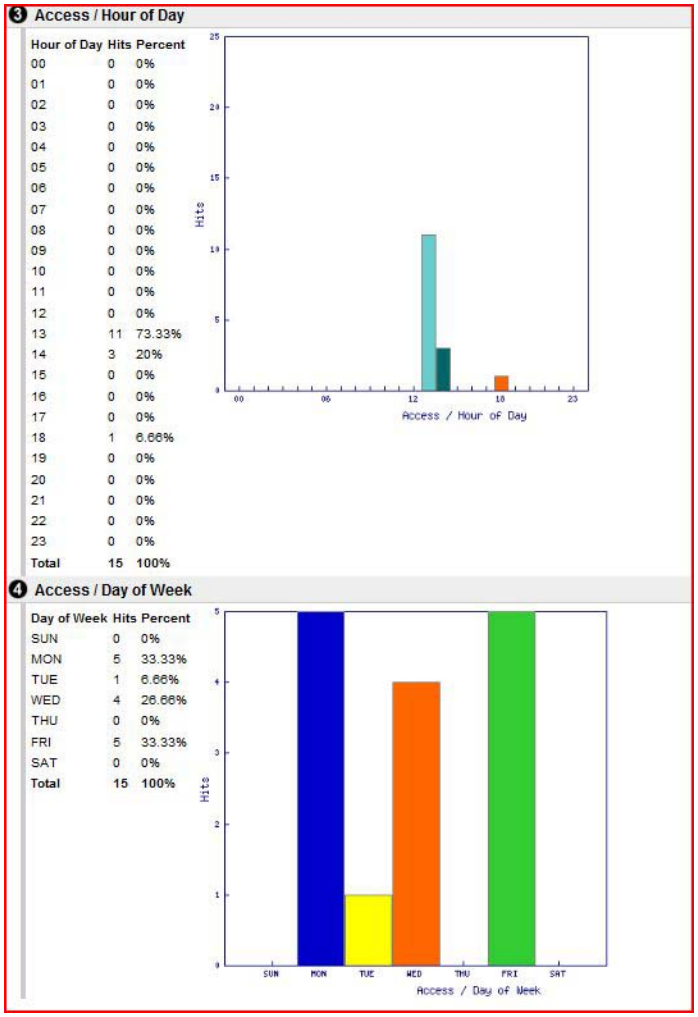
Retrieved April 11, 2011, from: www.coursecompass.com

Notice that Kenny has completed problems from many more chapters than Trent has shown above. Note: Kenny has had this account for a longer period of time than Trent.

Appendix B – MyMathLab Course Materials

Access by Date, Time and Day of the Week



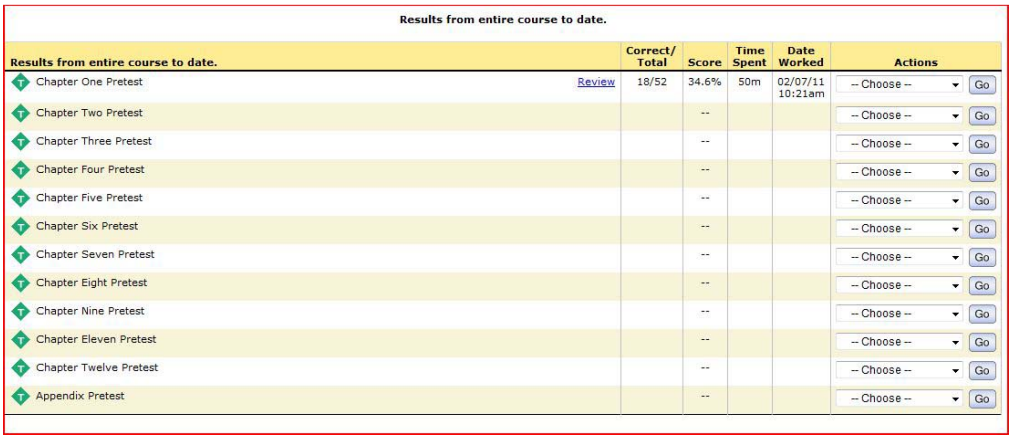


Retrieved April 11, 2011, from: www.coursecompass.com

Appendix B – MyMathLab Course Materials

Rick's Online Progress

Pretest Scores



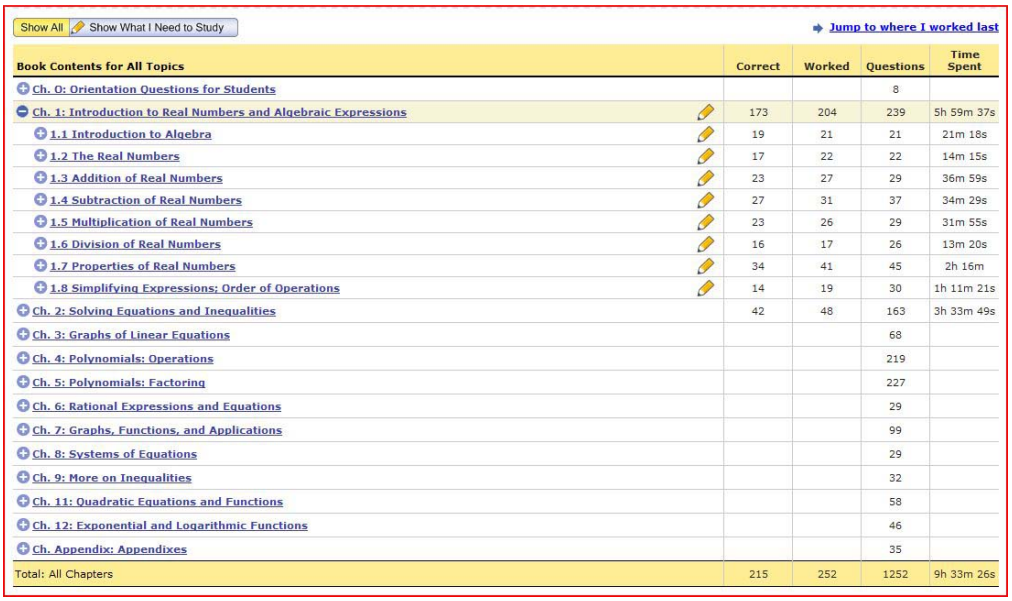
Results from entire course to date.

Results from entire course to date.		Correct/ Total	Score	Time Spent	Date Worked	Actions
Chapter One Pretest	Review	18/52	34.6%	50m	02/07/11 10:21am	-- Choose -- Go
Chapter Two Pretest			--			-- Choose -- Go
Chapter Three Pretest			--			-- Choose -- Go
Chapter Four Pretest			--			-- Choose -- Go
Chapter Five Pretest			--			-- Choose -- Go
Chapter Six Pretest			--			-- Choose -- Go
Chapter Seven Pretest			--			-- Choose -- Go
Chapter Eight Pretest			--			-- Choose -- Go
Chapter Nine Pretest			--			-- Choose -- Go
Chapter Eleven Pretest			--			-- Choose -- Go
Chapter Twelve Pretest			--			-- Choose -- Go
Appendix Pretest			--			-- Choose -- Go

Retrieved April 11, 2011, from: www.coursecompass.com

Notice that Rick has only attempted to take one pretest on the course webpage as of several weeks into the semester.

Study Plan



Show All | Show What I Need to Study

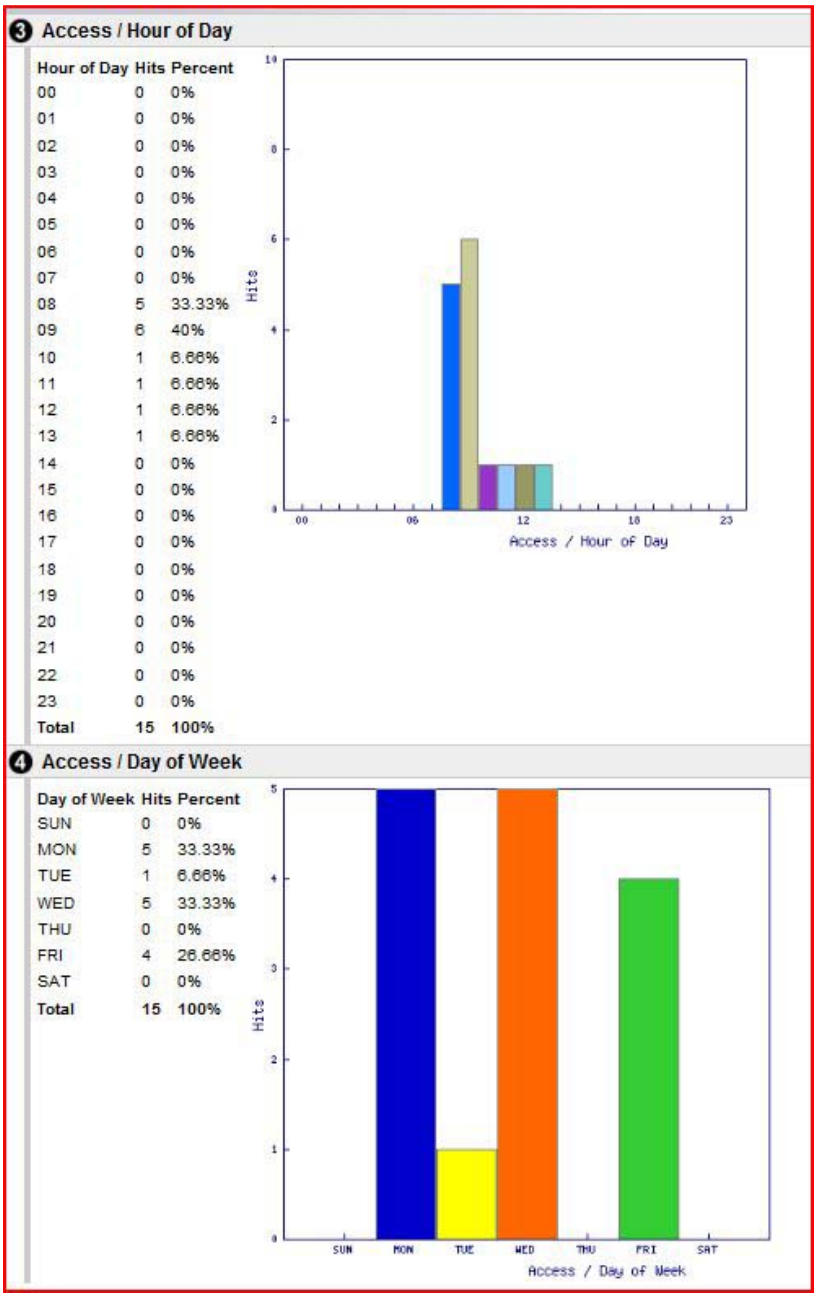
Jump to where I worked last

Book Contents for All Topics	Correct	Worked	Questions	Time Spent
Ch. 0: Orientation Questions for Students			8	
Ch. 1: Introduction to Real Numbers and Algebraic Expressions	173	204	239	5h 59m 37s
1.1 Introduction to Algebra	19	21	21	21m 18s
1.2 The Real Numbers	17	22	22	14m 15s
1.3 Addition of Real Numbers	23	27	29	36m 59s
1.4 Subtraction of Real Numbers	27	31	37	34m 29s
1.5 Multiplication of Real Numbers	23	26	29	31m 55s
1.6 Division of Real Numbers	16	17	26	13m 20s
1.7 Properties of Real Numbers	34	41	45	2h 16m
1.8 Simplifying Expressions; Order of Operations	14	19	30	1h 11m 21s
Ch. 2: Solving Equations and Inequalities	42	48	163	3h 33m 49s
Ch. 3: Graphs of Linear Equations			68	
Ch. 4: Polynomials: Operations			219	
Ch. 5: Polynomials: Factoring			227	
Ch. 6: Rational Expressions and Equations			29	
Ch. 7: Graphs, Functions, and Applications			99	
Ch. 8: Systems of Equations			29	
Ch. 9: More on Inequalities			32	
Ch. 11: Quadratic Equations and Functions			58	
Ch. 12: Exponential and Logarithmic Functions			46	
Ch. Appendix: Appendixes			35	
Total: All Chapters	215	252	1252	9h 33m 26s

Retrieved April 11, 2011, from: www.coursecompass.com

Notice that Rick has completed some material from each section in the first chapter.

Access by Date, Time and Day of the Week



3 Access / Hour of Day

Hour of Day	Hits	Percent
00	0	0%
01	0	0%
02	0	0%
03	0	0%
04	0	0%
05	0	0%
06	0	0%
07	0	0%
08	5	33.33%
09	6	40%
10	1	6.66%
11	1	6.66%
12	1	6.66%
13	1	6.66%
14	0	0%
15	0	0%
16	0	0%
17	0	0%
18	0	0%
19	0	0%
20	0	0%
21	0	0%
22	0	0%
23	0	0%
Total	**15**	**100%**

4 Access / Day of Week

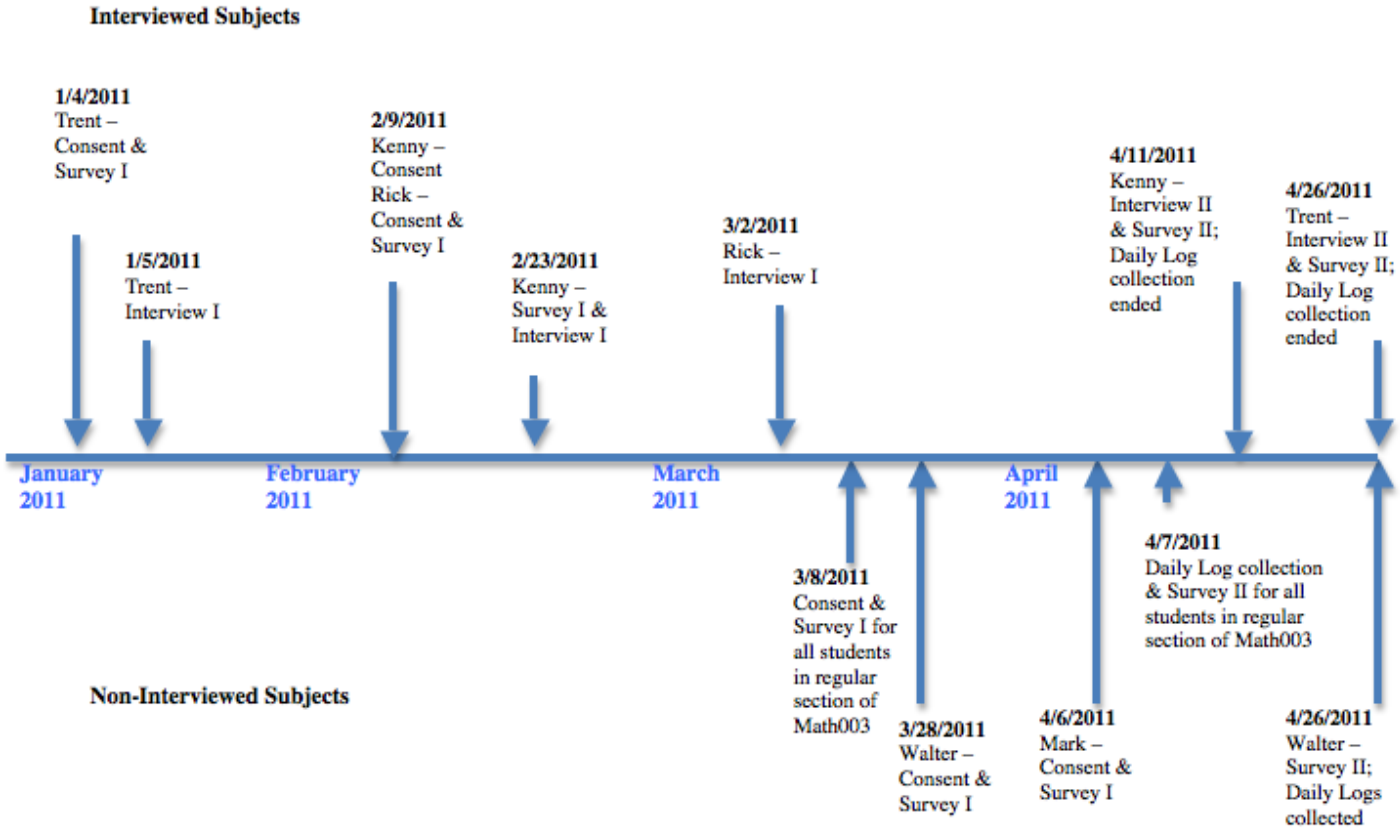
Day of Week	Hits	Percent
SUN	0	0%
MON	5	33.33%
TUE	1	6.66%
WED	5	33.33%
THU	0	0%
FRI	4	26.66%
SAT	0	0%
Total	**15**	**100%**

Retrieved April 11, 2011, from: www.coursecompass.com

Appendix C – Data Collection Timeline

Components	Consent	Survey 1	Interview 1	Daily Logs	Survey 2	Interview 2
Students						
Trent	1/4/2011	1/4/2011	1/5/2011	6	4/26/2011	4/26/2011
Kenny	2/9/2011	2/23/2011	2/23/2011	8	4/11/2011	4/11/2011
Rick	2/9/2011	2/9/2011	3/2/2011	0	Incomplete	Incomplete
Mark	4/6/2011	4/6/2011	N/A	3	Incomplete	N/A
Walter	3/28/2011	3/28/2011	N/A	6	4/26/2011	N/A
Chris	3/8/2011	3/8/2011	N/A	13	4/7/2011	N/A
Harry	3/8/2011	3/8/2011	N/A	5	4/7/2011	N/A
Martin	3/8/2011	3/8/2011	N/A	0	4/7/2011	N/A
Reuben	3/8/2011	3/8/2011	N/A	7	4/7/2011	N/A
Alex	3/8/2011	3/8/2011	N/A	4	4/7/2011	N/A
Kelly	3/8/2011	3/8/2011	N/A	0	Incomplete	N/A
Karl	3/8/2011	3/8/2011	N/A	0	Incomplete	N/A
Melissa	3/8/2011	3/8/2011	N/A	12	4/7/2011	N/A
Olive	3/8/2011	3/8/2011	N/A	0	4/7/2011	N/A
Taylor	3/8/2011	3/8/2011	N/A	3	4/7/2011	N/A

Appendix C – Data Collection Timeline



Appendix D – Interview Transcripts

Trent – Interview I

AB: It is January 5th, 2011 and this is an interview for my master's thesis relating to developmental math and the University. First of all, before I even read my introduction, I have to tell you that several of my teachers will be seeing this, so let's keep your language to, uh, an appropriate level.

TS: Well I'm answering it – verbally and just writing it?

AB: Yes, you're answering it verbally. I'd rather you talk than write anything.

TS: All right. I'm writing it.

AB: Well, I'll give you something to write on in a minute, okay?

TS: Oh, okay. Okay.

AB: All right. First, I'd like to thank you for your willingness to take the time to participate in the interview. Are you texting?

TS: No, I'm listening.

AB: Your thoughts and actions will be very valuable to me. I have had a chance to observe you in this class and I was hoping to get a deeper understanding of some of your methods of approaching and thinking about specific problems, and your perceptions of your own math confidence, ability, and understanding.

I'll begin by asking you a few questions about the course and your experience with math in general. Please answer honestly and to the best of your ability. Try to avoid one-word answers. I will ask for clarification if necessary. I will then ask you to do some math operations on linear equations, which is what you're doing right now.

TS: Oh, okay.

AB: The questions I will ask should be familiar content. I'm not concerned with how correct your answer is but with why you got – how – the thinking and reasoning that lead you to your answer. Please think aloud when you're answering the questions. I will ask questions for clarification if necessary. Finally, I would like you to know that this interview has no effect on your final grade or your performance in this course.

Your participation is greatly appreciated and I will be the only person viewing the recording of this interview. If anything this time should help me better understand your ways of thinking and allow me to cater our individual class sessions to you in a more helpful way. Okay. Can you explain how you became a student in math 003?

TS: Um, they gave me a placement test to see what kind of math I can do.

AB: Okay.

TS: And they decided I was in 003.

AB: Okay. Is this your first time taking the class?

TS: No, I took it last semester.

AB: Okay, and did you take it before that?

TS: No I did not.

AB: STEP?

TS: Yes I did.

AB: Yes. Okay. How long was the program before the last semester?

TS: The STEP program was about three weeks long.

AB: Okay. And what does it mean to be in developmental math?

TS: Um…

AB: That's what it's called online.

TS: It means we're starting to understand – we're trying to get the transition from high school math to college math.

AB: Okay, and, um, do you know that the class is non-credit?

TS: Yeah. Sadly.

AB: So what did you think when you found out that you were in a non-credit class?

TS: I was sad because even though it's like a transition class, I still want credit for it.

AB: Because you are doing work?

TS: Exactly.

AB: Um, do you think that computer based instruction, so how we do this class, will help you learn the material?

TS: Hmmm, No.

AB: Why?

TS: Because I feel like we need an instructor to help us instead of a computer.

AB: Why? What's the difference?

TS: Because for me personally, I work better with a person than a computer.

AB: Okay. Have you had experience with computer based or Internet based instruction in the past? I don't mean 003 or STEP.

TS: Yeah. Yeah.

AB: In high school?

TS: In high school.

AB: What was the experience? What class was it?

TS: Um, geometry, algebra II. We did it on computer.

AB: It was – what did you have to do? Did you have an instructor too?

TS: Yeah.

AB: And then you –

TS: Like our teacher.

AB: And they had you do what on the computer? Just…

TS: Everything.

AB: Everything.

TS: Yeah.

AB: Homework.

TS: Our tests, finals, everything.

AB: Oh, it was all – and it was online? It was a Course Compass?

TS: Nope. It was Study Island.

AB: Okay. It's – actually I think that's part of the course.

TS: Oh.

AB: I haven't checked but did it look similar? Like questions and tests?

TS: Yeah, yeah yeah. Well, kind of.

AB: Um, okay. So if you could describe any benefits of the Internet or online-based course, what would you say?

TS: Um…

AB: Can you think of any?

TS: It – what?

AB: Can you think of any benefits?

TS: Any benefits?

AB: Advantages. Reasons why you might like it over having a teacher?

TS: Because you can work at your own pace I guess.

AB: Okay, but what about drawbacks or disadvantages?

TS: Um, disadvantages? We can't ask the computer questions.

AB: Okay, and have you struggled with math in the past?

TS: Yes.

AB: When?

TS: In high school until now.

AB: Okay, so how did you – or, excuse me, did you do well in math at the high school level? Like your – grade-wise?

TS: Um, my grade – yeah. Grade-wise I was excellent.

AB: Okay. But understanding-wise?

TS: But understanding I wasn't so great.

AB: Okay. So is there any experience or set of experiences that you have had in math class that affected your attitude towards the subject?

TS: Um, yes.

AB: Can you describe the incidents and how you feel that it affected you?

TS: Um, no. Not really. Um…

AB: It's going in your transcript.

TS: No, it's because, um, I don't know. I just don't like people.

AB: Was there, like, one specific teacher or one specific class that made you hate it, or you just have never felt…

TS: I just never felt comfortable with it.

AB: Okay.

TS: I just don't like it.

AB: What about – can you remember in elementary school, like…

TS: Yeah, I liked it.

AB: You liked it?

TS: Yeah, it was fun.

AB: Okay, and did they – did they have different levels? Like, did they have, like, a class for, like, advanced students and then know you all took the same class?

TS: Actually they did have a class. Gate. It was called Gate.

AB: Gate?

TS: Gifted and talented education.

AB: Okay. Okay.

TS: Yeah.

AB: Were you in the Gate class or were you in the lower…

TS: I was in the normal class.

AB: The normal level class. Was there a class below you?

TS: No one – yeah –

AB: Do you know?

TS: Um, yeah. Special ed.

AB: Yeah. Okay.

TS: I wasn't in that.

AB: So if you were in the, like, on level where you were supposed to be at the time in middle school – were you still on level?

TS: Um-hum.

AB: And in high school, were you on level or did you fall behind?

TS: I was – I was on level…

AB: Okay.

TS: But our whole class fell behind.

AB: Okay.

TS: Yeah.

AB: So everybody did poorly?

TS: We all did, yeah.

AB: So what was the highest math class that you got to?

TS: The highest math class? Algebra II.

AB: Algebra II? Okay. Was it algebra II with trig? Did you learn trigonometry or just algebra?

TS: No.

AB: Just algebra?

TS: Don't know trig.

AB: Okay. so what support in a class is necessary for you to succeed? So, support, like, an instructor, a TA, homework, one-on-one time, a slow pace, feedback, or anything else that you…

TS: Um, just feedback.

AB: Like what kind of feedback?

TS: Like, um, like – or if you ask questions, like, do you need help? And that gives me confidence to know that you can help me if I need help. Just stuff like that.

AB: Okay, so just somebody to be there.

TS: Yeah, just be there.

AB: Okay. So do you think feedback is necessary to do well in a class, not just math?

TS: Yeah.

AB: Yeah?

TS: Yeah.

AB: So what kinds of feedback are the most helpful for you? So you said just asking if –

TS: Yeah.

AB: Someone needs help.

TS: If I'm alright, if I need help. That's all I need.

AB: Okay. Anything – not – what about when you get an answer wrong?

TS: If I get an answer wrong, do you – let me show – let me show you how to do it. Do you need help? Just…

AB: What about the computer? Well, yeah. What I do is hopefully the right kind of feedback, but what the computer does, what about that? Like, it just says sorry, you're wrong. Do you think that the little paragraph that they gave you –

TS: Yeah, that's good, yeah.

AB: It's helpful?

TS: Yeah.

AB: Okay.

TS: Yeah.

AB: What – do you want more than that? Like you –

TS: No.

AB: That's enough? Okay. So how confident are you in your ability to succeed in a self-paced class? Like…

TS: I'm very confident.

AB: Oh, okay.

TS: It's just a matter of fact of me not being lazy.

AB: Okay. Being motivated.

TS: Exactly.

AB: So does the nature of this course, meaning open lab time, self-paced and no time limit, affect the way in which you plan to proceed in the class?

TS: Um, no. No.

AB: And do you have a registered learning disability?

TS: Um, I think I do. I have ADHD.

AB: You have ADHD?

TS: Does that count?

AB: Yes, that does count.

TS: Yeah.

AB: So how do you believe this affects your ability to learn and understand math specifically?

TS: Um, because math, it takes time. Like, for me, it takes time to understand the problem. I'm not, um, not patient.

AB: Okay.

TS: So…

AB: Just know your attention span is too short?

TS: Exactly.

AB: Okay, and do you enjoy math?

TS: No.

AB: So why not? Can you think of…

TS: Because you have to think too hard for one problem.

AB: Okay, so it takes too long to do one problem?

TS: Yes.

AB: Okay. So do you think a review course like this class is necessary to have at the University?

TS: Say that again?

AB: Do you think this class is necessary to have?

TS: Yeah it is. That's why I'm here.

AB: Okay. All right. So I'm going to – I gave you paper and pencil, okay.

TS: You going to give me a problem?

AB: I am going to give you some problems. If you look – did you hear the speech in the beginning? I don't care if you get the answer right. I just want to know what you think about the problem. Okay? I guarantee you've seen it at some point in your life before.

TS: All right.

AB: All right?

TS: Yeah.

AB: And actually you saw some of it just five seconds before. So before I even show you any problems and attempt to get you to solve them for me, um, what do you think a linear equation is?

TS: A linear equation is an equation that has to do with lines.

AB: Okay, so any equation with lines in it?

TS: No. Um, linear equation, what's a linear equation?

AB: Well, what – break it up. What's an equation?

TS: An equation is just, like, a math problem that needs to be solved.

AB: Okay. Does something need to be included in it to be an equation?

TS: Yeah, numbers.

AB: Numbers?

TS: Yeah.

AB: Letters? Variables?

TS: Yeah, like – variables like X, Y. Shit like that.

AB: Okay. Okay. I will censor that. Thank you. So what about linear? Like, you – so an equation is numbers, letters, and what does it mean to be linear?

TS: Linear, um, to be – have a line, like a line.

AB: Like a straight line?

TS: Yeah.

AB: Okay. So what – do you know what a system of linear equations is?

TS: More than one line.

AB: Okay, so multiple lines?

TS: Yeah.

AB: All right. So what do you think it means to solve a system of equations – of linear equations?

TS: To solve, it's –

AB: So we have a bunch of lines, and we're looking for an answer. What do you think the answer is?

TS: Um, just going to add up all the lines.

AB: Add them up?

TS: The degrees of the lines I guess. I don't know.

AB: Like the slope – where they're going?

TS: Yeah.

AB: Okay, so there's a couple things about lines. Right? There's slope. There's – you were just doing on the computer just now. X and Y intercepts.

TS: Um-hum.

AB: And, um, you can use, like, an XY table. So you can use – you can plug in any value, right? You can get some answer. That's the beauty of an equation, right? You plug something in and you get an answer, and you know at least one point on that line. All right?

TS: Right. Right.

AB: So to solve a system of linear equations is to just look at it and analyze which direction each line goes in?

TS: No. Um, you ask too many questions,.

AB: I ask too many questions?

TS: Yeah.

AB: So I'm going to say it again, exact same question. See if you change your answer. What do you think it means to solve a system of linear equations?

TS: To – okay. Why are you doing this? All right.

AB: I don't mean to be mean. I'm not trying to – I don't care what the answer is.

TS: No, no, no. I know you're not trying to be mean. I mean – it's a terrible interview now. Um…

AB: Why?

TS: Because you put math in it. I'm trying – I'm telling you how I don't like math and you put math in the interview.

AB: Well that's what I'm interested in actually, is why people who will say they don't like – first of all, why it's okay in society to say that you don't like math, and second of all, why people who don't like it are so scared of it or so adamant not to talk about it.

TS: I'm not scared, but I just don't want to do it.

AB: You don't want to do it.

TS: Yeah.

AB: But you also don't want to talk about it.

TS: True. True.

AB: And we're not even doing a problem.

TS: True.

AB: Is it because you don't have the correct –

TS: It's because –

AB: Vocabulary behind it or you don't feel –

TS: No, it's because I just don't like it.

AB: Okay.

TS: Just like that.

AB: So – so…

TS: I mean if I was good at it, I would like it.

AB: So if you were good at it –

TS: But I'm not good at it, so I don't like it.

AB: So you're good at basketball so you like basketball.

TS: And I'm good at English, so I love English.

AB: Okay, so you love writing?

TS: Yeah. I love writing.

AB: Okay. You know you can be good at math too, right?

TS: If I put – if I put effort in – yeah, I know.

AB: Okay, so what do you think it means to solve a system of linear equations?

TS: All right. What it means to solve a system of linear equations is to find, um – I already said it.

AB: Okay.

TS: That was my answer.

AB: That's your answer?

TS: That's my answer.

AB: To look at them, see –

TS: To – to measure the lines and find out – I don't know.

AB: Okay. So…

TS: I gave you my answer though already.

AB: No, you're right. You did.

TS: Yeah. Yeah.

AB: So if I gave you a problem, which is, by the way, two linear equations that are written differently…

TS: I'm just going to look at it.

AB: That's okay. I'm going to put it here so that the camera can see it too, okay? Which problem I'm looking at. So 3x plus 2y equals eight, and then there's another equation. X equals 12 minus 2y.

TS: Right. Right.

AB: So if someone told you to solve that, what is the first thing that you can think of when you see that?

TS: Um…

AB: Other than if it looks, like, ugly to you, that's okay too. Like, you – it looks like something you don't want to do, right? But if somebody told you to solve that, what would you think about? How do you try to do that?

TS: Um…

AB: Do you have any ideas?

TS: These are two different equations?

AB: Yep. They don't – they are not the same line. So you told me a system of linear equations is a bunch of lines.

TS: Right.

AB: I have two lines.

TS: Um-hum.

AB: So if I want to solve it, and I have two lines, what do you think the answer is going to be.

TS: X something. I don't know.

AB: Do you think it's going to be another equation? Do you think it's going to be a single number? An ordered pair? A slope?

TS: It'll be a single number.

AB: A single number?

TS: Yeah.

AB: Why do you think you – do you have any idea how to find it?

TS: Um, no.

AB: Okay, and how – did those look the same to you? Those two equations?

TS: No. No.

AB: No? What's different?

TS: It's not a number. This X from here.

AB: Okay. Anything else that's different?

TS: Um, no.

AB: So if there's no number on…

TS: Oh, this is multiplication, this is addition. So…

AB: Okay, so what are you thinking?

TS: I'm thinking that…

AB: Talk out loud if you have ideas, okay?

TS: Yeah.

AB: You can write. It doesn't matter what you write. You don't want to write?

TS: I don't want to do it.

AB: Well what were you looking at when you pulled the pen out?

TS: Um…

AB: This is multiplication.

TS: Yeah.

AB: That's subtraction, addition, however you want to look at it. It's the same thing really, right?

TS: Yeah.

AB: Okay, so what were you thinking when you sat up and you looked at it?

TS: I was thinking I wanted to get rid of the 3x – I mean the three, but then I was like, no.

AB: Okay. So you want to get rid of it so it looks like that?

TS: Yeah, that's what I was going to do, but no.

AB: No? Not going to do it?

TS: No. No.

AB: Okay. What about looking at the second one? We have how many Xs?

TS: Twelve. Oh, one.

AB: One, right? One? And up here we have how many?

TS: Three.

AB: Right, but we know what one equals, right?

TS: Um-hum.

AB: Could you find out what three equals?

TS: Um, yeah.

AB: Instead of taking away the three?

TS: Right.

AB: I'm saying you could look down here and say, I've got three up here and I've got one down here. I can multiply all that stuff by three and find out what 3x is equal to.

TS: It would be six.

AB: Six what? Six…

TS: Six –

AB: What are you getting the six from? Three times two?

TS: Yeah.

AB: Okay, so yeah, we're going to have a negative 6y, right?

TS: Um-hum.

AB: What about three times 12?

TS: Thirty-six.

AB: Okay, so can you write that for me?

TS: Where at?

AB: Write – you can just write right below here. We have 36.

TS: Um-hum.

AB: And negative 6y. Okay, so that's 3x, right?

TS: Right. Right.

AB: And then they added what to it?

TS: Two.

AB: Two…

TS: 2y.

AB: Okay.

TS: So it'd be 38y or no?

AB: Why 38y?

TS: Because you just said we have to add two to it.

AB: We're adding 2y to negative 6y.

TS: Oh, so that'd be negative 4y?

AB: Um-hum. There's still a 36. We never did anything to that, right?

TS: Um-hum.

AB: And then what's all the way on the other side?

TS: Eight.

AB: Equals eight. All right. So now if you look at the new line, you have 36 minus 4y equals eight. Does – can you do anything with that, or are you stuck?

TS: Stuck.

AB: Stuck? No way to solve that?

TS: Um, I divide these two? Eight and 36? Or am I trying to get rid of negative four?

AB: Well you told me the system of equations, the answer is going to be a number, right?

TS: Um-hum.

AB: Well, to find a number, we usually have to – we have to get a letter by itself.

TS: So I'm going to get rid of negative four, right?

AB: By doing what?

TS: Subtracting it.

AB: Well, it's multiplied by Y.

TS: So I'm going to divide it. Like that?

AB: Well, if I divide that by negative four, I also need to divide the other information by negative four.

TS: So negative two?

AB: Yep. And what's 36? And that's now – what's 36 divided by negative four?

TS: Um, 12 – nine.

AB: Nine.

TS: So instead of 36 it's nine?

AB: Negative nine. Negative nine plus Y is negative two. That's what you have, right?

TS: Yeah.

AB: So what's Y?

TS: Y is negative two.

AB: But negative nine plus Y is negative two. So Y can't be negative two.

TS: So Y…

AB: Negative nine plus negative two is negative eleven. So if it's negative two I'm not going to get that answer.

TS: So what are you saying? That's – what's the answer? I thought that was it. I thought that was it. I was about to circle it.

AB: You were about to circle it?

TS: Yeah.

AB: But Y isn't by itself. Can you get Y by itself?

TS: Yeah. If I divide the two – negative two?

AB: No, you don't need to divide. It's just the addition. What's the opposite of addition?

TS: Subtraction. So I'm going to subtract, um, negative two? Um…

AB: Other side. Subtract a negative nine. So adding nine. So subtracting a negative.

TS: So add nine to negative two?

AB: Add nine to both sides.

TS: So this is going to cross out and be zero?

AB: Yeah, so this is Y. That's what we want, right? Y is what?

TS: Uh, this is going to be, um, seven.

AB: Yeah.

TS: Yeah.

AB: So you got Y is seven. Y equals seven.

TS: So I'm about to circle it.

AB: Okay. You can circle it. Does circling it make it official?

TS: Yeah, that's it.

AB: Okay, so is that the answer? That's it?

TS: Yeah, that's it. Put the arrows by it.

AB: So the solution to this is Y is seven?

TS: Yeah.

AB: It doesn't matter what X is? It doesn't matter? Okay. We're going to do another – just one like that, and we won't do another. We won't do anything like that. We'll do another one that's very easy.

TS: What – what's the answer though?

AB: Oh, you want to know the answer?

TS: Yeah.

AB: It's not just one number.

TS: It's two?

AB: It's two.

TS: So what's the answer then?

AB: It's (26, 7). It's an ordered pair.

TS: Okay.

AB: Where X is 26 and Y is 7.

TS: Why didn't you tell me that?

AB: Because I wanted to know what you thought the answer would be before I told you. anything So now that you know that the answer is an ordered pair, what's an ordered pair?

TS: Ordered pair is, like, seven…

AB: On a graph.

TS: Oh, yeah, on a graph. It would be, like, seven on the Y-axis and then X would be, like, if I had four, then it'd be four.

AB: Okay. So what – what is it – an ordered pair, like, a linear equation on a graph…

TS: It's like a line.

AB: Is a line.

TS: It's like a line.

AB: An ordered pair is a line?

TS: Yeah.

AB: Seven, four is a line?

TS: I mean it's like a…

AB: I go over seven, I go up four, and I put a what?

TS: A dot.

AB: It's a point.

TS: Yeah.

AB: It's one point on one line.

TS: Right. Right. Right.

AB: Well it can be on lots of different lines, but it's one point, right? On the line that you have.

TS: Yeah. Yeah.

AB: Okay. If my answer is one point, what does it mean to solve a system of linear equations?

TS: To find a point.

AB: What point? Why is it so special?

TS: It's special because you have to graph the point.

AB: I have to graph – I have to graph (26, 7), right?

TS: Yep.

AB: What happens to these lines at 26, seven?

TS: What lines?

AB: These two.

TS: They're going to combine together.

AB: That's where they cross. That's where they meet. So to solve a system of linear equations is to find out where the lines intersect. Just going to put that out there. That's the definition. Okay? So where –

TS: To find where the lines intersect?

AB: Yeah, and they intersect at a point. So one single value. Now once you get to this section later in the class, there's going to be, like, more than two lines sometimes, but I'm just talking about two lines. And a lot of times they'll trick you and they'll say it's the same line, or the lines never intersect. So there's multiple answers, but for all of my questions, there's a single ordered pair answer. There's one answer. Okay? So stick to my script since I haven't yet once for this whole thing. So what's the first thing that you think of when you see this problem?

TS: Um, I think of the last problem.

AB: Okay. My next question. Does it look similar to the last problem?

TS: Yeah.

AB: Why or why not?

TS: It's very similar.

AB: What's – what's so similar? Stop texting, please. I promise I'll let you leave.

TS: I don't want to leave. I just don't want to do this.

AB: Oh. No more interviewing?

TS: Ask me more questions. Ask me more questions. I'll answer –

AB: After – in about a week or so I'll ask you questions, okay?

TS: Yeah.

AB: I need to see the paper, thank you. Um, so how would you begin to solve it?

TS: All right. The way I'd begin to solve this problem is – the way I'm going to solve this is by, um…

AB: You can look at the last problem.

TS: All right.

AB: Since it's – you said it looks like the last problem, so…

TS: It really does.

AB: What's different, like – the first line looks almost exactly the same.

TS: Um-hum.

AB: Now what's different about the second line?

TS: Am I trying – am I trying to get rid of 2x?

AB: Well that's what we did last time, right?

TS: Yeah.

AB: Because we had what as our second line? X equals…

TS: Twelve.

AB: What do we have now as our second line? What's alone?

TS: Y.

AB: So what are we going to be getting rid of?

TS: Going to be getting rid of, um, the Y.

AB: Yeah.

TS: So I just cross it out?

AB: What did you do this time over here? You went from 12 minus 2y to 36 minus 6y.

TS: Um-hum.

AB: What did you do?

TS: What did I do? I just multiplied.

AB: Okay, so now we're going to have to multiply. How many Y's do we need? We need negative six of them.

TS: Yeah.

AB: So negative six times 4x is what?

TS: Twenty-four.

AB: Okay.

TS: So 24 – just 24.

AB: Is it 24, or 24x, or negative 24x or…

TS: Just 24x.

AB: That's – that's also negative, the 24.

TS: Oh, for real?

AB: Yeah, so it's negative six times positive four. You were right. The middle sign is also negative.

TS: Yeah.

AB: Okay. What's negative six times 50?

TS: Negative six times 50 is 300.

AB: Okay. Positive or negative?

TS: Positive.

AB: Negative six times 50 is positive 300?

TS: No, it's negative 300. I was just seeing if you knew.

AB: Yeah. I – I caught the mistake. Thanks for checking.

TS: Yeah.

AB: And that's the same as negative 6y?

TS: Yeah.

AB: Okay? So we take 2x, and then we subtract all that stuff. So just stick that 2x out front, and what's on the other side of the whole thing?

TS: Eight.

AB: Equals eight. All right, so now all we have is Xs. What are you going to do about it? Over here we've got Y equals seven because we had X equals, right? So now we have Y equals. Now we're – our answer's going to be X equals something.

TS: Right.

AB: What does X equal?

TS: X is going to equal eight.

AB: No.

TS: I'm right.

AB: You are not right.

TS: No, I'm correct.

AB: Um, okay. If you want to stick with that as your answer that's fine.

TS: No, I don't. Come on now. All right. It's…

AB: Reasonably close, but not…

TS: Reasonably close, so I'm going to have to…

AB: Only because it's a single digit.

TS: All right, cool, so I'm going to have to say X equals three.

AB: That is right. Can you show me how?

TS: I don't know.

AB: You see it, the answer?

TS: No.

AB: What's two minus 24?

TS: Two minus 24 is 22.

AB: Negative 22.

TS: Negative 22.

AB: So we can combine that and you get negative 22x minus 300 equals eight.

TS: And then I – um, I get rid of this?

AB: You can, but this is 300 and I know it's not divisible by 22. But I bet 300 minus eight is. What's 300 minus eight?

TS: Like, 292 or some…

AB: Okay, so – oh, I'm sorry. It's actually adding, so 300 plus eight is –

TS: Three hundred and eight.

AB: Three hundred and eight. So we have negative 22x is equal to 308. How many times does negative 22 go into 308?

TS: Three times.

AB: How do you know?

TS: Because you said that was the answer.

AB: You have the wrong answer. Maybe.

TS: You got me a ride right now when I leave? Can I get a ride when I leave right now to Cole Field House?

AB: I'm not leaving here. I've got to be here all day.

TS: It would take five minutes. It would take five minutes.

AB: Well, we'd have to walk another 15 minutes to my car.

TS: Dang. Where you park at?

AB: I didn't park **1**5 minutes I parked like ten minutes away. It's over in, uh, I don't know where we are, Comcast.

TS: Yeah, that's far.

AB: I mean commons. That is way too far.

TS: Yeah.

AB: Okay. I realize you're done. Your attention span is – your age in the number of minutes, I've gone way over it. I know. Um, so at the end, we're done. Okay? I won't make you do any more problems. I won't –

TS: The answer is three though, right?

AB: No. I had the wrong answer. I don't know how it got – I don't know how it got so bad. Um, so what is a system of linear equations now that you looked into them?

TS: A system of linear equations is where the two lines meet for that one point.

AB: Okay, has –

TS: Or where they intersect. Where they intersect.

AB: Okay. Has your definition changed since the beginning?

TS: Yes, my definition has changed.

AB: Why?

TS: Because I found out what it meant by doing the problems.

AB: All right. Um, what if – what about doing similar tasks on your own? Do you feel confident in your ability to do this on your own at some point?

TS: Um, I'm confident I could do it on my own. It would just take a long time.

AB: It would just take a long time why?

TS: Because I'll have to figure it out again by myself.

AB: Okay, so you would forget –

TS: I would forget.

AB: How we solved them basically?

TS: Unless I had the notes in front of me.

AB: Okay.

TS: Then I would do it faster.

AB: Okay, so what you're saying is if you have notes in front of you, it's much easier to do the work, so…

TS: Yeah. I have examples in front of me.

AB: I would apply that to this class and take notes.

TS: I have – I have them on the computer, so…

AB: Oh, okay. So you don't need to write them down?

TS: No.

AB: All right. I guess that's the problem with this current generation.

TS: The current generation? We're not the same generation. What's up?

AB: I don't want to be on this. All right. How about – just leave it there. No, don't flip it off the camera this time, you know?

TS: All right. All right.

AB: This is only my first picture on my last interview. But I get to talk about it so it's okay.

TS: Yeah.

Kenny – Interview I

AB: Interview, it is February 23rd at 3:10 p.m. Okay, here we go. All right, Kenny, thank you again for doing this again. I do not think I'm gonna go over the same script, if you don't mind; my little intro speech.

KW: Okay.

AB: Basically, it doesn't affect your grade and um, it'll just give me a little bit of better understanding about you and your past, okay?

KW: Um.

AB: So can you explain how you became – you came to be a student in Math 003?

KW: All right, well, um, I started out at Maryland uh, taking Math 111 uh, because in an orientation I wasn't able to take the placement test so they placed me in Math 111.

AB: Okay, so you never took the Math Placement test?

KW: No, I didn't.

AB: Okay, but you needed Math 111 for your major?

KW: Yes, yes, so I attempted Math 111.

AB: Ok.

KW: The first time I attempted it, uh, I believe I – I believe I dropped it the first time.

AB: Okay.

KW: Well no, no, no, I failed it the first time.

AB: Okay.

KW: So, I uh, attempted to take it the next semester and I dropped the class half way through.

AB: So you had to withdraw?

KW: Yes, I had to withdraw.

AB: So that's on your transcript?

KW: I believe – um, actually not, it's not.

AB: Is a W?

KW: No, there's – there's no W on my transcript to that. So I um –So I took the uh – so I um, went to my advisor and I also started coming to the um, Learning Assistance uh, Service Center.

AB: Okay.

KW: Uh, attempting to start a contract so I could take – either take Math 111 again or the equivalent.

AB: Okay.

KW: Um, and halfway through my – the – the head of the CCJS Department, that's my major, CCJS. She uh, just suggested that I take Stat 100 – Stat 100 so I, you know, wouldn't have to, you know, go through the whole contract and everything.

AB: Appeal process, okay.

KW: Um, so I did that and I found that I actually – that I actually couldn't pass Stat 100 either.

AB: Okay.

KW: So I dropped that. I got a W, um, on my – I have a W on my transcript for that.

AB: So you've got a record of um, a W for Stat 100 but not for one Math 111?

KW: No, I don't believe so.

AB: Okay.

KW: So, I uh, decided again to um, come to the LAS –

AB: Okay.

KW: And they just suggested that I take um, Math 003, the um – so that's how I ended up here.

AB: Okay, and what – what does it mean to you to be in developmental math? Like this course on Testudo, if you look up the title of the course it's called Developmental Mathematics. So what is – what does developmental mean to you?

KW: Um, I think it means that the class – the course would be meant for those people who have a deficiency in many areas of college-level of math, mathematics and um, basically they are taking the course to kind of fill in for those years probably that they weren't able to um, achieve the level of math that they need for college – college level math.

AB: Okay, and does the word development mean something to you like uh, outside of this context?

KW: Development?

AB: Yeah, like, when you develop.

KW: Yeah, when you develop something –

AB: What – what are you doing?

KW: – basically, um, develop. You're basically kind of coaxing it to grow.

AB: Right, and so in this course we'd like to think of it just as so you know, as we're helping you develop the skills that you need to be successful in the next course.

KW: Uh-hum.

AB: That's pretty much how we – we like to think of ourselves. We like to give ourselves a lot of credit but. Um, when you discovered this course was non-credit, what were your first thoughts?

KW: Um, I kind of figured before I even took it that it was gonna be non-credit.

AB: It was gonna be non-credit, why is that?

KW: Uh, because um, I can't really see the college offering credits for uh, taking a course that you really technically shouldn't have to take if – if you're uh – if – if you're um, education before coming to the university was sufficient. You know, they are basically giving you credit for uh, further education.

AB: Right, so it should be – we should be basically thinking of this as this is your high school and middle school level math, right?

KW: Uh-hum.

AB: And this stuff that we're giving you credit for is more at a college level.

KW: Yeah.

AB: Okay, I like that. Um, do you think computer based instruction will help you learn this material, like math specifically?

KW: Yeah, I can see myself uh, actually learning as I go through it. Um, I just completed the second chapter and um, I, you know, I see myself kind of thinking about what I've gone over and on the computer program you know, in my everyday things. You know, just thinking about things in terms of math problems now. So I could see it helping me.

AB: Okay. Um, and have you ever had experience with a computer based or Internet based course or instruction in the past like an online class?

KW: Yeah, yeah, I've taken online classes before.

AB: And how'd they go for you? Like –

KW: It went pretty good.

AB: And what were like the be – what would you say were the benefits versus the drawbacks of having it be online as opposed to lecture based?

KW: Um sometimes I like to just um, get to know other students and the professor just so I could build a rapport with them cause I think I do better sometimes, especially with those harder subjects –

AB: Uh-hum.

KW: – when there's actually a face you know, I can talk to about um, the material.

AB: And what about um, some benefits of online? So the drawback would be no face-to-face time. And I know that you said that um, perhaps math, you don't necessarily need the face-to-face time or do you – do you feel like you do?

KW: I think I would. I mean, I kind of get that here in the – with uh, Dr. **Bethea** and yourself. But uh, a benefit – benefits would be that I can kind of work at my leisure.

AB: Okay, so self-paced?

KW: Yeah, over the last week, I've had you know, some difficulties –

AB: Uh-hum.

KW: So um, it was kind of – it was good to you know, be able to um, say you know, "I can't really come in today so."

AB: But I can make this up at a later date.

KW: Yeah.

AB: Or I can make it up at home.

KW: I can make it up at home.

AB: That's another beauty – online course you could literally be in your pajamas.

KW: Uh-hum.

AB: Right, taking the class.

KW: Yeah, yeah.

AB: So, is that something that you like too that you could do that anywhere?

KW: Yeah, I like that.

AB: Okay. Um, have you struggled with math in the past? And I know we talked about in college but when I say the past I mean um, overall. So like has there been like a trend of –

KW: Yeah, yeah. I've never been a math student, a good math student. Really, I mean, I know uh, I know like starting in sixth grade, that's when the math you know, started to turn to like Algebra. Like before I was fine with the subtraction and addition and all that.

AB: Or like the basic arithmetic facts?

KW: When I got to sixth grade, you know, I was like, "You know, what is this?" cause it had letters and numbers. I always thought Math only inclu – well, before that point, you know, I thought of math only involved numbers.

AB: Yeah, uh-hum. That is a – a common misconception. Um, but will we – what is hard for teachers to explain and what comes across as pretty confusing in middle school and high school years is that those letters represent numbers and it's very difficult to tell young students that –

KW: Yeah.

AB: – when they don't – that's very hard for them to see that in front of their face. Did you do well in math **[clears throat]** excuse me, in high school?

KW: Yeah uh, I got to the trigonometry and pre-calculus level.

AB: Okay.

KW: But um, the reason why I think that I got those good grades is I was making a lot of mistakes on – on the work and there were a lot of students in my class. Like my class, I think it had like 40-50 students, you know, so I think the teachers were just giving people who showed the most effort, the best grades, the ones they actually knew because I'd always be in teacher's face asking them questions. But they you know, really didn't have the time to actually sit down.

AB: Uh-hum, no, there's ver – very little individual attention at the high school level. Um that's – that's great that you got all the way up to pre-calculus. Now, where – what area are you from? Are you from **-?**

KW: Yeah, I'm from PG County uh –

AB: Oh that's right.

KW: – Bowie, Maryland.

AB: That's right. And um, did you – did you have a choice your senior year of what math to take or –

KW: Yeah, I had a choice. Um, I mean, I had – I could choose from those you know, high-level high school type math. So I believe I – I believe in my junior year, I took um, trigonometry and in my uh, senior – no, in my junior year, I took pre-calculus and my senior year I took trigonometry.

AB: Okay, so that – so you had an entire course devoted to trigonometry?

KW: Uh-hum.

AB: Oh wow, okay. We don't – we never offered that in my – in the county that I grew up in so um, that's an interesting choice for some students because it is still a bit of a higher level like uh, but we're not in the realm of calculus or anything like that yet. So if you – besides – in college, have you ever taken statistics?

KW: Stats um –

AB: Besides like basic probability.

KW: Not really. Not really.

AB: Okay, um, is there a specific experience that you had in a math class that affected your attitude towards the subject? So, what I've noticed from your responses is you don't necessarily have a negative attitude towards math, it just hasn't been your thing in the past.

KW: Um.

AB: Is there something that um, led you to feel that way like a specific incident or is it just generally like you struggled?

KW: I'd say college – I'd say with college math, um, I had this – I had one professor um, in my first year of college –

AB: Uh-huh.

KW: – um, I was taking um college Algebra and I would you know, see her a lot of times after class –

AB: Uh-hum.

KW: – trying to get clarification. You know, and she'd explain things to me, the concepts, you know, and I would, you know, keep trying to you know, figure this out on my own. And I – she still ended up failing me, you know, even though you know, I kept giving her all this you know, attempt – trying to – all this effort. You know, and I wasn't really used to that because in high school, you know, I tended to talk to my teachers a lot.

AB: Uh-hum.

KW: So, you know, that kind of – that was kind of a negative –

AB: Like discouraging kind of?

KW: Discoura, yeah.

AB: But it's not that made you wanna stop altogether? It just makes you feel like the effort you're putting in isn't getting you somewhere or at least that's what it sounds like to me.

KW: Yes, so I had to repeat the course. That was the first time I'd ever –

AB: Oh, that was the firs time you took 111? So then the second time?

KW: No, no, no, no. This was my first – because I – I went to a community college first. So in my first year of college um –

AB: That's when you took math the first time?

KW: Um.

AB: Okay, oh okay. Um, so what support in class is necessary in order for you to succeed? So I'm gonna give you my options again like last time, okay?

KW: Um.

AB: Um, I have a few things listed and please add to it if there's something I'm missing. Um, some things that I've thought about before are your instructor, your TA, the homework, one-on-one time, um, pacing either fast or slow, um, feedback and then anything else that you can think of. So is there like, and I don't mean just mean math, I might wanna get math specific because we are

talking about math here but in general, in class, what helps you succeed, what extra support?

KW: What helps me succeed? Um, I think – I think just when the teacher – when uh, or the professor or instructor is just available like you know, maybe beyond the office hours.

AB: Okay.

KW: Cause some – some professors – some professors and instructors, they – it's like they'll be there – and the reason why I say instructors is sometimes they use graduate students like you.

AB: Uh-hum, uh-hum. Very much so in the Math Department too.

KW: Yeah, like – and sometimes a lot of these you know, graduate students you know, they're not that much older than me, you know. They wanna have you know, you know, social life. So you know, they'll sit there for two hours for their office hours and they're gone.

AB: Uh-hum.

KW: You know and I – I – I really can't operate like that because sometimes I might need extra attent – extra attention. Not attention really but extra clarification with the class.

AB: Right, or even just the fact – like somebody – like somebody to be there in case.

KW: Uh-hum.

AB: Not even necessarily for the support for through every question but.

KW: And I've – I've tried uh, the tutors or anything but they're kind of expensive.

AB: Yes.

KW: And I've also uh, looked for like um, to maybe uh, tutors online. And that's not really – there's not really um, a service that I'm – I would be comfortable paying my money for, you know.

AB: I actually – I don't know of too many online tutoring services. I actually know of one for statistics, which I'll give you the information for when you are leaving 003. But I haven't heard too much good stuff about the like, you mean like a chat, an online chat?

KW: Yeah, yeah, I think an online chat or maybe like a video chat –

AB: Uh-hum.

KW: – so I could actually show them my work.

AB: Yeah, I used to – I used to do – I used to video chat with my students um, that I tutored when we couldn't like find a good time to like, both be on campus so that actually works really well cause they would just like hold up the graph, and you know, "Is this how this work?" Um, so um, maybe we can uh, set you up with some ideas before you start um, Math 111 or – I mean, Stat 100 again.

KW: Yeah, I appreciate that.

AB: Um, to help you out. What about some things like um, I know you mentioned the one-on-one time, there's a lack of it and office hours. Um, yeah, grad students are crazy busy and all want to try and have a life so we – we try to keep to our 20 hours a week but usually I offer more time here and there if students need it. Um, what about homework? Is homework like a necessity for you or?

KW: Yeah, I mean, I think I need to actually do work on that – in that actual course –

AB: Yeah, like continuously?

KW: – each week in order to keep it in my mind because like I tend to forget over time like um, I believe um, I had done some work on Sunday for uh, Math 111 and I kind of forgot exactly what I was doing cause I know it was uh, looking at word problems for inequalities and making formulas from that you know, but I – I had to kind of refresh myself. So to actually – I mean, I like to try to do – when I'm taking a math class, like college level math, I try to um, do something everyday that's dealing with it so I could just keep it fresh in my mind.

AB: Okay, that's great. And um, one other thing I wanna talk – like touch on a little bit is pacing. So you have like um, I know in our course it's self-paced and we'll – we'll talk just a tiny bit about that in one second but um, as far as pacing in other courses go, uh, at the college level, is it too fast for you or is it a good level for you or how do you feel about like?

KW: Um, sometimes it can be fast. Like I know when I was – when I was in one – Math 111, it was at a pretty reasonable pace but the Stat 100, it was a smaller class. And I think most of the students kind of got what was going on –

AB: Okay.

KW: – while I would you know, kind of be stuck maybe like two steps behind everyone else.

AB: So it was a little too fast paced for you in 100?

KW: Um.

AB: Okay.

KW: Yeah, so I probably try Math 111 when I um, when I actually um –

AB: I prefer Math 111 honestly so.

KW: Um.

AB: We prepare you slightly better for 111 than Stat 100. There's not too much of a difference but I do prefer 111 as well. Um, do you think feedback is necessary to do well in a class?

KW: Yeah, I think so.

AB: And what kinds of feedback are most helpful for you?

KW: Um, I think like when I take a quiz and they mark um, you know, what – what like – if I made an error in a step or something like that cause I tend to do that a lot or like I might make an error like for example for inequalities, I might not you know, flip the inequalities –

AB: Uh-hum, okay.

KW: – when you multiply or divide by a negative number. I tend to do that a lot. So just so I could know that the reason why I got the wrong answer wasn't because I don't understand the concept but because I just need to kind of pay attention to details.

AB: Okay.

KW: So –

AB: So you would much prefer – like let's do an example. Say you got an 89 on your test.

KW: Um.

AB: Okay? Would you prefer to see a bunch of x's and points marked off and a nice 89, B+ at the top of your test or would you prefer to see a test with no grade and just a bunch of comments wherever you did things wrong?

KW: I think the comments where I did things wrong might help. But I mean, again, the grade kind of helps too because it gives me an idea of you know, how well I actually did on –higher. Yeah.

AB: Okay, cause then here's my other example. Is you got a 50 on the test. Would you rather see a 50 with a bunch of x's or would you rather see a paper covered in comments?

KW: Well, I think the comments I would rather see.

AB: Comments still?

KW: Yeah.

AB: Why do you think um – why do you think written feedback like as opposed to numerical feedback is better for you?

KW: Uh, because I would probably just you know, read the comments you know, when I'm studying for like the exam. Like if that's a quiz and to study for the exam, I'd probably go over the homework and then use that quiz and just look at the comments just so when I'm studying I don't you know, make the same mistakes.

AB: Have you ever gotten a paper back um – well hopefully at the college level, but even at high school level from a math teacher that doesn't say what you did wrong but just says that you have points off?

KW: Yeah, I've gotten that.

AB: And how's that make you feel to just get points off and not have an explanation?

KW: I don't really like that. Normally, what I would do is just ask the instructor why I got that off.

AB: Okay.

KW: Or the TA.

AB: It's a good – it's a good call because sometimes we don't – math people don't like to write but we should. Um, so how confident are you in your ability to succeed in a self-paced course?

KW: A self-paced course?

AB: Uh-hum.

KW: Um, I'm pretty confident.

AB: Okay. And does the nature of this course with the open lab time, being self-paced and no true time limit to when you're done, does that affect the way in which you plan to proceed in this class?

KW: A little bit. Um, I'm not gonna be as you know, stressed about you know, deadlines.

AB: Okay.

KW: I mean, I know that I have a – a couple – I have three ex – three tests that I have to take, written tests. So I mean, I'll try to stick somewhat to that deadline but like if I'm a couple days behind, you know, it's not going to really stress me out.

AB: Okay, um, what about the fact that we have open lab time? And I know you said you liked that about last week because you could say, "Sorry, I'm just gonna come for a little bit of extra time this week." But does that – the fact that you – specifically, you do have a set schedule here, right, but we are open from 8:30-4:30 so theoretically if you want to you could come in anytime or not come in anytime.

So what does that – how does that make you feel like do you like the fact that we have these options of you being able to come in anytime um, or is it a little bit stressful because you know that just because I said I'd be there from 1:30-3:30 doesn't like mean I have to. I could come from 2:00-4:00, you know.

KW: Well, I mean, I try to stick to the schedule that I set. Um, I mean, and you know, that kind of helps because I can kind of schedule when I'm gonna be here like it's an actual you know, course. Well it is a course but you know, like a –

AB: Make it feel a little bit more traditional?

KW: – traditional, like class, yeah.

AB: Okay, does that help you?

KW: Yeah.

AB: Like to have a set schedule?

KW: Uh-hum.

AB: Yeah, we – we have a set schedule for all of our students and we prefer that it be – that they feel that way. That it's like, "This is my class time and this is supposed to be when I'm devoting myself to this course." Um, do you have a registered learning disability?

KW: No.

AB: Okay. And um, do you enjoy math?

KW: Uh, now a little bit.

AB: A little, why now as opposed to – what's the difference?

KW: Well I mean, I didn't really enjoy the cause level math per say before a lot of times it would just be these theories and you know, all these numbers and stuff like I know there was something involving an r. I had a lot of trouble with that.

AB: Uh-hum when you were in statistics, uh-hum.

KW: Yeah, and I – I was having a lot of trouble with that. You know, and like coefficients and all that, you know, but now you know, with the um, course compass, there's a lot of um, uh, word problems that has to do with the real world.

AB: Okay, and those –

KW: And that's you know, when I think of math, I like to think about its application to the real world.

AB: Right, I do too and um – actually, one of the best ways to uh, take math and apply it to the real world is through statistics a lot of time because um, there's really no way to do statistics without an example.

KW: Yeah.

AB: Like we have to have some kind of data or something to mess around with so we are dealing with real life stuff but I see what you mean because in Math 003, a lot of our real life questions are about money, they're about travel, like they're about things that we do on a daily basis so I feel like – is it easier for you to make a connection between what you're learning now and what kind of math skills you've developed over the last few years?

KW: Yeah.

AB: Okay.

KW: Yeah, I think so.

AB: And you mentioned liking word problems so is it difficult for you to pick apart the parts in the word problem?

KW: Not really anymore. Like I mean I'm kind of starting to learn to do that.

AB: Okay.

KW: Like you know, uh, I mean, I like you know, actually looking at what the word problem entails. Kind of looking at certain words in it and turning that into you know, formulas.

AB: Okay, that's what people don't like so I'm glad that you like that. So that's good. And do you think a review course like this class Math 003, is necessary to have at the University?

KW: Uh, yeah, I think so.

AB: Okay.

KW: Cause there's a lot of students who you know, are probably are like me that really didn't get the math uh, preparation that they need for college level.

AB: And what would you say to someone who says something like, "It's not necessary because you're in college so you should know this material already"?

KW: I mean, I would just tell them to look at uh, like the news reports about you know, kids in America and how they're deficiencies in math and science.

AB: And one more thing, which isn't – is not in here. Um, if I – I'm gonna tell you a – a statistic which is accurate from a few years ago but it was that 15 percent of incoming freshman had to be enrolled in Math 003 because they couldn't perform on the placement test. What do you think when you hear of something like that?

KW: I'm not surprised.

AB: Not surprised? Why is – because of the same issues you were discussing with what we see on the news everyday and all the?

KW: Yeah, yeah, I see like in – especially, like different groups of students like uh, females, African Americans, Latinos, you know. So I mean, you have all these groups of people who are –

AB: It's a lot of literature on the achievement gap.

KW: Yeah, so joining uh, higher education then of course, you're gonna have – have to have you know uh, programs like this.

AB: Uh-hum. And interesting that we see so much research about it at the public school level but we see so little about it at the higher ed level. They're starting to do a lot more though for higher educations and it's great, I think. Um, but that's –

KW: I don't – I don't think um – I don't think universities and colleges really wanna be known uh, for their uh, students not being able to do college level math.

AB: Right, we pride ourselves on, "This is the SAT score we require for our students to get in." Not, "Fifteen percent of our freshmen have to take a non-credit developmental math class."

KW: They probably try to keep that on the hush hush.

AB: They do. They really do. Um, and they try and get students out of it as quickly as possible so they can get to credit stuff. Um, but that's the – that's the end of the first part of the interview. Um, like I said, I may ask you in like a couple of weeks to just do a – a few math problems with me again just to think through em. Um, if you don't mind doing that if uh –

KW: Yeah, I'll do it.

AB: And then we'll have our second interview in I wanna say a month so I'm gonna give you a little bit of time to fill out a couple of those sheets for me to see how your progress is going, monitor you online and then I'll interview you again after a few weeks of a little more working with the program.

KW: Okay, when you say monitoring me online?

AB: I just mean that I can like see how you're doing on your study plan and everything like that.

KW: Okay.

AB: Yeah, we just like to check up on you guys.

KW: All right.

AB: We're not putting pressure on you or anything. We just wanna see where you are and how far you're getting and things like that.

KW: Okay.

AB: Okay?

KW: Great.

AB: Great. Just kidding. Yeah. And that's all –

Rick – Interview I

AB: Is the interview with Rick on March 1st, 2011. All right – well that sounds like I just broke it. Okay. There you go. That way no face, and when you have to write, just write right in front of it, okay? So I have to read this. I know I already read you a script before. It's boring, but first I'd like to thank you for your willingness to take the – to participate in my interview with me.

Your thoughts and actions will be very valuable. I've got the chance to observe you and I was hoping to gain a deeper understanding of some of your methods of approaching and thinking about specific problems as well as your perceptions of your own math confidence, ability, and understanding. I will be asking you a few questions about this course and your experience with math in general. Please answer honestly and to the best of your ability. Try to avoid one-word answers. I will ask for clarification if necessary.

Now I'm going to ask you to do some math operations on linear equations. The questions I'm going to ask should be familiar content to you. I'm not really concerned with the correctness of your answers but more with your reasoning and the thinking that led you to that answer. So while we're doing the math problems, please think aloud while answering the questions. And, again, I'll ask for questions – for clarification if I need it.

Finally, I would like you to note this interview has no effect on your final grade or performance in this class. Your participation is greatly appreciated and I will be the only person viewing this recording of the interview. If anything – the time here should help me better understand your ways of thinking and allow me to cater any individual time to you in a more helpful way. Okay, so can you explain how you came to be a student in math 003?

RT: Uh, it was – it was what I – what I – when I took the pretest, when I first got it, uh…

AB: Into Maryland?

RT: Into Maryland.

AB: Math Placement Test?

RT: Yeah.

AB: Okay.

RT: That's what I was – that's what – this is where I placed.

AB: Okay, and, um, is this your first time taking this course?

RT: No it's not.

AB: Okay. Um, when you took it, have you taken it in the "regular" setting before…

RT: I have.

AB: Like in one of the big labs?

RT: I have.

AB: How was that?

RT: Uh, it – it was helpful.

AB: Yeah?

RT: It was helpful to have somebody, uh, walk around and, you know, be able to just communicate with everybody.

AB: Did you, uh, how far did you get when you took it in, like, the big lab?

RT: I got – I got –I got pretty far.

AB: Okay.

RT: And then I just – I just – I had to, uh, retake it that next semester and then just started slacking.

AB: From then on?

RT: Yeah.

AB: Was that your freshman year?

RT: That was my freshman year.

AB: Okay, so then – and what – this is your senior year?

RT: Yeah.

AB: So it took – so how many years were you out of 003, like, registered but not…

RT: But not taking it?

AB: Taking it. Did you have five years in – or you had four years of eligibility, but is this your fifth year here?

RT: I still have one year left to play.

AB: Oh, so you've only been here for four years?

RT: Yeah.

AB: Okay. So the – two years of not taking it? Okay, and then you came back? Okay, so to you, what does it mean? Um, Math003 is actually – the title of the course is developmental math.

RT: Um-hum.

AB: So what does it mean to you to be in developmental math?

RT: Um, I mean at this point it's – it's not what I planned.

AB: Okay.

RT: But, uh, I mean I know I'm here for, uh, lack of effort.

AB: Okay.

RT: But, um, I mean I've got to get it done. It's – it's time, so.

AB: What does developmental mean to you?

RT: Um…

AB: Like, just if you had to describe what you're learning to somebody else?

RT: Developmental, uh, maybe it's just – I guess, like the beginning stage, the learning stage, the – the necessary things you need to – to continue, like to be able to take math.

AB: Okay, and, um, I don't know – I assume you know this because you took it before, but what were your first thoughts when you discovered that this class is not credit? Like, your freshman year when you got in, I don't – can you remember? Who knows. I can't remember my freshman year, but…

RT: Yeah.

AB: When you first got here and they told you, "you have to do all this work, three credits worth of work, but we're not going to give you any credits." How does that make you feel?

RT: I mean at that point you – I mean you sit this – sit this out to the side and then you say, well, I got 12 other credits I need to worry about, and then it doesn't help that it's self-paced, that you do wherever you want and, you know? So…

AB: And that you can, like, take it again.

RT: Yeah.

AB: Like, pick up where you left off. So it could just keep going and going for several years unfortunately for you mostly because –

RT: Yeah.

AB: That's just a long time to do the same thing. Um, okay. So do you think that – I know you said that you did really well the first semester that you took it and got pretty far, um, and then just kind of stopped caring about it, but – for – as far as the type of instruction, do you think computer-based instruction will help you learn this material?

RT: Well, I mean, it is helping me.

AB: Okay.

RT: Uh, if I get to a question that – or – yeah, a question that I'm not – not familiar with, I just look at the example.

AB: Okay.

RT: And I – I'll write the example down and then, uh, and then I write the question down too as, you know, the original question on a piece of paper and just work it out.

AB: Like, work through the same steps?

RT: Yeah.

AB: Okay. Um, do you think that you're learning the math behind it, or do you think that you're more learning, like, a procedure of how to complete something?

RT: I think – yeah, I think I'm – it's just like me learning how to – it's more like me memorizing it than actually learning it.

AB: Okay. So it kind of like learning how to solve the same problems that you'd seen before. Kind of like a repetition.

RT: Yeah.

AB: Like if I gave you something you'd seen on the program in the last couple of weeks you'd probably be able to figure it out because you remember the steps?

RT: I just do it over and over again, so, uh, until I remember it.

AB: Okay. Well the computer helps you with that assuming you do it about 20 times. Have you had experience with computer-based or Internet-based instruction in the past? And I know that you took 003 before and…

RT: Yeah.

AB: Um, I assume because it was several years ago that you may have even been my student. Who even knows, but I used to be a TA for it for it in my undergrad, and it was the lifetime library. Do you remember that?

RT: Uh-yeah

AB: The bookshelf and you had to pick the book?

RT: Yeah.

AB: Yeah, that was quite possibly the worst program every invented for this course, but besides that and, like, this class is Internet-based, have you had any other computer based or Internet based classes, like, any online courses?

RT: Yeah I have.

AB: Okay. Um, what was your experience with those classes? Like, how would you describe the benefits of having an online course as opposed to…

RT: Um, I think the benefits of having online courses, like, most of the things are, like, you don't have to sit in the class.

AB: Yeah.

RT: Like, you know, so, like, you can do, like, most of it on your own time.

AB: Okay.

RT: So, of course there's deadlines, but…

AB: Okay, what about drawbacks because you're not sitting in class. No one's sitting there reminding you to do this, that, and the other.

RT: Yeah. I mean you wait until the last minute.

AB: Okay, so procrastination? Would you turn in things for – those online classes, were your things turned in on time or were they…

RT: On time.

AB: On time? Okay. Um, have you struggled with math in the past, like, in high school, middle school, earlier in college?

RT: Uh, honestly? In the – in high school, not so much.

AB: You didn't struggle?

RT: Not – not really.

AB: That's my next – how well did you do in – in math at the high school level is my next question, so…

RT: It was – it was, uh – I wasn't bad. I was average.

AB: Okay. Do you know, um, I know it was a long time ago, but do you know what your last math class was in high school your senior – did you take math your senior year?

RT: I did. I took, uh, stats.

AB: Statistics? Did you go to school in this area?

RT: South Carolina.

AB: Oh, South Carolina? Okay. Did they require four years of math?

RT: Uh, three.

AB: Three? So you took an extra year?

RT: It was – it was four years.

AB: Oh, it was four, but the last year you get to decide, right?

RT: Yeah.

AB: So my guess – it's senior year of high school and you have options. Calculus, AP calculus, AP statistics, or statistics?

RT: Right. Statistics.

AB: And statistics? Okay. Those – those were, like, your options though, right?

RT: Yeah.

AB: Okay. Just checking. That's usually what most people choose anyway. Um, is there any experience or, like, a set of experiences that you had in math class that has affected your attitude towards the subject? Um, I know this is a strange question. So, like, an example would be, like, a teacher that either you, like, loved and, wow, math was so interesting with that teacher, or a teacher that you – that was awful and, like, you were turned off from math after that. So those are just, like, some examples. Not necessarily a teacher but a situation. Has that ever happened to you?

RT: No.

AB: Or, like, totally changed your attitude towards math?

RT: Well, when – well, I was preparing for the SAT.

AB: Okay.

RT: I needed – I know the type of score I needed for my math, so that kind of made me focus in more my senior year of high school.

AB: So you, like, motivated yourself to do it?

RT: Yeah.

AB: Because of SATs? Okay, and then did you – did you take, like, a course – an SAT prep class?

RT: Um, yeah.

AB: Yeah? Did you have a math person?

RT: I don't remember. I think that was all computer stuff. I can't –

AB: All online?

RT: They made all the seniors, uh, take, uh, SAT prep. Juniors, juniors. That was my junior year.

AB: Okay, so you took that class but it was – they just had you doing, like, things on online?

RT: Yeah, so we just basically did what we wanted.

AB: Okay. So was – it wasn't that helpful?

RT: Not really.

AB: Okay. And then you said, um, just the – you took Math003 in the fall of – I don't know what year that – 2000 –

RT: '07.

AB: Okay, so – I feel ancient, so you took – I'm not. Uh, you took it in the fall of 2007 and then took it again in the spring but kind of gave up. Was it a different teacher in the spring?

RT: Um…

AB: Like was there a reason or just football, friends, partying, whatever?

RT: It was, uh, I think just the fact that I wasn't going to get a credit for it.

AB: Okay.

RT: And, uh…

AB: And it was your second time doing it?

RT: Yeah, it was my second time doing it.

AB: Did you have to pick up from the beginning your second time or did they let you start from where you left off?

RT: Well I think – I think I took another pretest, and it was just so long since I did math, and I didn't really realize that, like, math is one of those things that you have to keep doing in order to remember it because you just completely forget everything. You know?

AB: Are you remembering now?

RT: I – I am. I'm starting to remember it again.

AB: Okay. Awesome. Um, so in any class, not necessarily math, what support, um, is necessary in order for you to succeed? And I have some examples. So an instructor, a TA, homework, one-on-one time, a slow pace, feedback, or anything else that you can think of. So what do you need to be successful?

RT: In any class? I mean I – I think you need, uh, you need standards. You need, you know, uh, due dates I think. I think you –

AB: Expectations?

RT: Yeah, expectations. I also think that – I mean, it is important that a teacher is around and is communicating with – with the student or the student, like, have a teacher to communicate when they need to. Um…

AB: What about the pace of a class for you to do well, not necessarily math? I know this is self-paced, but for any other course that you've taken, like, is it too fast, too slow? What helps you?

RT: Uh, I mean I think it's hard to do, uh, to be successful, or for me to be successful in the class. Not to be successful in the class, but to take the class areas that is self-paced.

AB: Okay. Because why? What's the main reason for you behind that?

RT: Because, I mean, you know, Monday you say why – I have work I need to do for this class but, I mean, it's not due until the end of the week, so – and then two hours before it's due online, you know, then that's when you're doing it.

AB: Okay, and one other thing. Um, oh, it's my next question. Hold on. Do you think feedback is necessary to do well in a class?

RT: I think it is if you're struggling.

AB: Okay.

RT: And you really don't – you're not 100 percent sure about what's going on.

AB: Okay, and what kinds of feedback are the most helpful for you?

RT: Uh, I mean it – as far as math, just showing me how to work through a problem. If I – if I can see it, I can – I can basically teach myself.

AB: Okay. Um, what about, like, I don't – and I was an education major so we have lots of discussions, it's great, and one of them is about grades versus words on a paper. So what would be more helpful to you? To see that you got an 89 percent on a test, or to see that you have comments on your test where you did things wrong that help you figure out where you went wrong?

RT: Uh, the comments.

AB: Okay, and, um, say that a 50 on your test, still you'd rather see comments than a 50? Because a 50 would mean more comments.

RT: Yeah, the –

AB: More red marks or whatever.

RT: Well, me personally, when I get a test back and…

AB: Do you look at it, or do you just –

RT: I mean, I look at it, and I look at, like, if there are comments, I look at the comments and I'll usually write them down.

AB: Okay.

RT: Or if the teacher's talking, going over the test or the quiz, and if it's an answer I got wrong, I – I write what I should have did right.

AB: Okay. Um, what – how confident are you in your ability to succeed in a self based class?

RT: Uh, at this point in my life, I'm very confident.

AB: Okay. What about, like, freshman year?

RT: Three years ago? No.

AB: Okay. Um, does the nature of this class with open lab time, being self-paced, and no real time limit besides when you want to graduate, um, does it affect the way in which you plan to proceed in this course?

RT: Um, well, like I said, I did – I guess it all depends on timing. I was young, you know. I just – just got to college. I was doing a million things and I wasn't worried about a math course.

AB: Not math?

RT: Yeah.

AB: So now, after having that experience, do you think that none of those things that could hinder somebody else's success would hurt you, or do you think that the – it could end up in the end?

RT: Uh, I mean it – it could end up hurting me.

AB: Okay.

RT: Uh, hopefully it doesn't.

AB: I hope not too. Um, did – and this is just for every – all my students. Do you have a registered learning disability?

RT: I do.

AB: And how do you believe this affected your ability to learn and understand math? Has it at all in the past or present?

RT: Well, I – I think with – I don't think it does with me. Just understanding my disability and knowing, like, what's going on. It – it helped me out more.

AB: Do you mind saying what that is?

RT: Uh, I don't mind. I've got, uh, ADD.

AB: Okay.

RT: Um, I have a prescription for Adderall.

AB: Okay.

RT: But I – I – I don't take it.

AB: Okay.

RT: I just don't like the way it makes me feel, uh…

AB: Okay. Did – can you – I mean obviously you don't take the Adderall, so off of Adderall, can you concentrate, or is it –

RT: Yeah, I can, but I can only do it in – in – in – in certain – certain spurts of time.

AB: Okay, so do you like that you get a break and then you get to come back?

RT: I – yeah. That helps a lot, like, an hour, then a break, then come back an hour, then just doing – rather than doing two hours straight.

AB: Okay, and do you enjoy math?

RT: I – it's a challenge, and I'm – I'm – I mean I'm real competitive so, like, some days I come in here and it's fun, like, okay, let's knock it out. There's other days, I'm like, uh…

AB: Okay, so when you do like it, why do you think that you like it? Do you have –

RT: It's challenging.

AB: What part of it makes you feel good?

RT: Um, it's challenging. Like I said, I'm able – I mean just to – the fact that I'm – I'm kind of teaching it to myself.

AB: Um-hum.

RT: And, uh, I don't know. I mean I guess I like that. Some days when I'm not tired – dog tired.

AB: Yeah, and then when you see "fantastic!" or something like that.

RT: Yeah.

AB: Makes you feel good, right? So that's, personally, why I like math because there's always a right answer, and I usually know that I'm right – when I got it right because I feel good about it, and I'm like, "oh, I did that. I think I did those steps right." And, you know, then you get the test back and see what happens. But, um, do you think a review course like this is necessary to have at the University? Specifically for students who did poorly on their placement exam.

RT: I think so. I mean I think it's – I think it's good to have.

AB: Okay.

RT: I mean I think some people just need extra help.

AB: Okay. So, uh, my last question is not on here, but my last question before the math is do you – okay. Plenty of time. Do you think that, um, you would have done – you would have been successful in – what do you have to take for your major? Math 110? Math 111? One of those 100 level math classes your first semester freshman year?

RT: No.

AB: No? And second semester freshman year? Even…

RT: Just – I mean just school in general wasn't important to me.

AB: It wasn't your priority?

RT: No it wasn't.

AB: Okay, so what was your priority? Just, anything but school?

RT: Football and having fun.

AB: Okay. Um, it sounds fun, but…

RT: Yeah, I know.

AB: Was it fun? Was it worth?

RT: Yeah, it was. No it wasn't. If I could do it all over again, I'd definitely change.

AB: Okay. I had to stay an extra semester because I didn't do enough stuff, I ended up graduating late too, so it's no big deal. Um, okay. Now I want to ask you a little bit about some math stuff. So I only have two questions that I want to ask you, um, but before I actually do the math, I want to ask you a little bit about linear equations, which – are you in chapter three yet?

RT: No.

AB: Okay, so that's your next chapter. So in – if you can just tell me what you think when you hear some of these terms. So, to you, what is a linear equation?

RT: Um, well I know it's – I don't know if I can explain it.

AB: Okay. Is there –

RT: I'm sure it's –

AB: Are you thinking of, like, a picture or…

RT: No, I'm thinking…

AB: Some numbers?

RT: I'm thinking of an equation with something like Y equals X – I don't know, plus three.

AB: Y equals X plus three is actually a linear equation. But does it – do you know what it would look like, like, if I'd have graphed it? What does linear mean?

RT: Um, not sure.

AB: Okay. Um, so to clarify for what – my next question. Linear equation, you're absolutely right, looks like Y equals – typically it looks like Y equals – usually we see it as MX plus B. Does that ring a bell at all? It's, like, from a long time ago.

RT: Okay.

AB: It's just a way of looking at an equation. It's a Y and an X. Those are your only two variables. No exponents. No nothing fancy. Just some numbers, a Y and an X. Um, a linear equation, linear, um, just signifies that it's going to be a straight line. So no matter what graph I make, I don't care which way it's going, it's a straight line. Goes on forever and ever, and that's what that –

RT: Okay. I remember that.

AB: What you just said – you remember now?

RT: I do.

AB: Okay. So what you just said is correct if I graphed – I don't – what'd you say? Y equals two X plus three? It would just be a straight line on a piece of paper. So if you're thinking about one linear equation, what's a system of linear equations do you think?

RT: Not sure.

AB: Okay. And, uh, if you're not quite positive about what a system is, if someone told you to solve a system, what – what is – what do you think when you hear solve? Like, what does that mean to you?

RT: Uh, to find the answer.

AB: Find the answer. So if I gave you – perfect. If I gave you this – is this the right one? If I give you this and I said – I just want the camera to be able to see it, and I said solve it, what would it – what would you – would that mean to you? Like if I said find the answer but, I mean, what are they asking for in that? Can you tell?

RT: Well, I think they're saying that – I think they're asking me if I can find X then I can find Y.

AB: Okay, so they're saying solve, like, find me what X represents and what Y represents?

RT: Yeah.

AB: Okay, so how would – if you had to solve this, how would you begin to solve that?

RT: Um…

AB: What are you – what are you thinking about it when you see it?

RT: See, I –

AB: Because you're right. When it says solve you need an X and a Y.

RT: I don't remember, but I'm thinking that I probably will try to get – I don't know. I'm not sure.

AB: Okay.

RT: If I see it once…

AB: You see somebody else solve it?

RT: Then I can do it. Yeah, then I'll be able to…

AB: Okay. Can I give you a hint? How about that? Because we're going to solve it together.

RT: Okay.

AB: And you're going to have to think out loud when we solve it, so I want to hear what you're thinking.

RT: All right.

AB: So my hint is that – I know that you've heard this before but it's probably a really long time ago. It's called the substitution method of solving an equation.

RT: Um-hum.

AB: So my hint is that we have this whole thing that's miss – that's got X and Y on the same side, right?

RT: Um-hum.

AB: And this second line, they told me what X equals. So I'm – somehow want this line to only have Ys in it so then I can solve for Y using the second line. Do you – that helps at all.

RT: Um, so you want this to only have Ys in it?

AB: Yeah. How can you do that? Like, using all the information that you have, because we have 3x plus 2y equals 8. We know that.

RT: Well, I would get rid of X.

AB: By doing what?

RT: Um, solving this I guess, but I'm not sure.

AB: Well we already know what X equals, right?

RT: Okay. Uh, yeah.

AB: Here on the second line.

RT: Um-hum.

AB: To get rid of it, in my opinion is, like, to divide by – like, get it out of the equation all together. We don't really have to do that. We can just replace X here…

RT: Um-hum.

AB: With this information here.

RT: All right.

AB: Can you try to do that? Can you work that out?

RT: Then I guess this is probably wrong. No, me – I'm really not sure.

AB: Okay, so you have here a three and a – three times X. Right?

RT: Um-hum.

AB: That's what that means. So you – you're right. Can I see your pen? Here, except that you're adding. Instead you're just going to substitute this whole thing.

RT: For X.

AB: For X.

RT: Okay.

AB: And then keep writing. I mean this is 3x. Now we've got plus 2y is equal to eight.

RT: Yeah.

AB: So see what – if you can simplify from there. If we've got parentheses and then, like, a number out front, what – what does that mean? What have you got to do for that?

RT: I mean you've got to, uh, multiply by…

AB: Um-hum. Distributive property. Three, yeah.

RT: Actually this…

AB: So you did three times 12.

RT: Um-hum.

AB: Now what are you doing? What are you thinking?

RT: I feel like I can just cross these two out.

AB: But right here is fine, sorry.

RT: Ok…

AB: Um, so if you three times this…

RT: Um-hum.

AB: Well we did three times this, right? Before you can cancel anything out, you've got to distribute this three here.

RT: All right.

AB: Then you can start adding stuff to that. You can do plus 2y. Now you can combine them.

RT: I know. Uh, I'm trying to think. Uh, do I, uh, I added both sides now, right?

AB: You add something, is that what you are you asking?

RT: Um-hum.

AB: You can add something. You can subtract something. I mean the way that we – we have one letter now, right? Just Y and, like, a bunch of numbers. And you told me that solving is finding the answer.

RT: Um-hum.

AB: So my guess is I want to know what Y equals.

RT: Okay.

AB: So to get –

RT: So then I solve for Y.

AB: Yep.

RT: So I will…

AB: And that – you can do that in a bunch of ways. There's a way that's only a few steps, and then there's a way that there's a couple more steps, but you have all positive numbers, I mean it's all – it's your call.

RT: So do I add the 36 and then just divide four by…

AB: Um-hum.

RT: All right.

AB: So get rid of the 36. But it's positive so you're not going to add it to those sides. You're going to subtract it from both sides.

RT: So it looks like that?

AB: How'd you get this over here?

RT: Are you – am I dividing that? I divided.

AB: You said – well here you subtracted eight, right?

RT: Um-hum.

AB: If you subtract eight from eight…

RT: It's nothing.

AB: It's nothing, so it's zero. So you're right. You're right. Just zero, not seven.

RT: Oh.

AB: That's right.

RT: Okay. Oh, I was trying to find the final answer for that. That's why I put seven.

AB: Oh, you're saying the final answer is seven.

RT: Yeah.

AB: Yes, the final answer is seven.

RT: That's what I was –

AB: Y equals seven. So you did it in your head. Why is it seven?

RT: Twenty-eight divided by four, four divided by –

AB: Okay, so you found Y. Do you think that's all they want you to find?

RT: No. Probably not.

AB: Probably not? Why?

RT: There's just always more in math problems.

AB: So you've got Y equals seven. And look up here, they have X equals something.

RT: Yeah.

AB: Right? Um, do you think that we could figure out what X equals?

RT: Um, why not?

AB: Yeah, I know. Why not? Looks like it might be fun, for me at least. And what's Y?

RT: Uh, seven.

AB: Yeah, so now we can just do two times – yeah.

RT: So should I solve this? You want me to…

AB: What do you mean?

RT: Oh, that's just it?

AB: Well, if you put in – in order to solve –

RT: I mean I plug them in.

AB: Right, if you plug them in, you should get eight.

RT: Oh, okay. Yeah.

AB: That's what – that's what your answer is telling me.

RT: Cool.

AB: So your answer is telling me that three times seven minus four is eight. It's not, but that's okay. I don't know where the math went wrong. Um, okay. So you're

– what I see is right. So do you, first of all, how confident are you that you solved this problem correctly?

RT: Um, not really. I – I kind of had, like, maybe, like, adjusted what it is – what I had to do. But, like, if I – if I would have seen – if you had a piece of paper that was already solved, then I just could have looked at it to see, like, what I just could have like, done.

AB: Do you think you have a photographic memory?

RT: Yeah.

AB: Okay.

RT: I did.

AB: It's nice isn't it? I do too. Um, and do you remember this concept? Like, this – the systems of equations from previous math classes that you had?

RT: Um, as – the more I started doing them, yeah.

AB: Yeah?

RT: I started remembering, like, what I needed to do.

AB: Okay. I'm going to give you one more, and it's different. I want to see if you can think – it doesn't look like that, but it's pretty similar. Okay?

RT: All right.

AB: Do your best. So this is the other one.

RT: Um-hum.

AB: Now it looks kind of weird, right? Because this time we have, like, X – we can actually put them side-by-side so the camera can see. We have X equals on this side, and it, like, it was already solved for, right?

RT: Yeah.

AB: We don't have that over here.

RT: Yeah.

AB: So if you – you can either try it do it the same way that we did this problem here, or think of another way. Now if you learn by example and, like, by model – modeling and education, then that might not be the best thing is to think of your own way. But if you can remember how to solve this particular type – the way that these are set up – this is set up to do substitution, which is exactly what you did. You took what X equals and you substituted it where you solve X up here. Okay? This can be solved the exact same way. You just have to rearrange some stuff before you can do that. Or it's set up to be solved in a process that we call elimination, which is where you completely eliminate one of the variables.

RT: All right.

AB: Now when you first look at it, what are you thinking besides, ew?

RT: Um, yeah. I've got to make it smaller.

AB: Got to what?

RT: Make it smaller.

AB: What do you mean?

RT: Um, I want to – I – well, I mean I know it's not right. It's probably not right, but I – I can't – I just can't add equations can I?

AB: Actually, that's what the elimination method does is just adds the equations.

RT: Okay.

AB: But we don't just add – like – try adding them the way they are now. Let's add them now and then we'll see…

RT: I mean add my – just do like this?

AB: Yep, that's what I mean, um-hum. You're right, by the way. Okay, so you get what?

RT: Uh, 17.

AB: Okay, so now we're stuck with that, right?

RT: Yeah.

AB: Do you think there's some way that we could figure out how to add these together? Like, change one of them somehow to add them together and only have one variable in the bottom? Because I don't really, like, when I add those together it doesn't really tell me anything. Like, I've got a whole bunch of crap at the top, a bunch of numbers, and then you add them together and you still have two variables and a number.

RT: Okay.

AB: So I'm still confused. I don't know what X and Y equal. Is there any way to change one of these equations so that when we add them, like, here we get 2x plus 5x equals 7x? Y minus 2y is negative Y? I want one of those to be zero so that I just have X or I just have Y. Is there a way to do that?

RT: You can –

AB: Because you're right. Like, the way that I set it up, that's exactly how you want to do it. Go ahead. Keep talking.

RT: You said to be just Y, so in other words you want just, like, say 6x equals a number.

AB: Exactly.

RT: Okay. Um…

AB: So I want, like – when I look at it, I think of, like, I want to say two plus five is seven. I want something plus something is zero. Like, I want zero to be one of these answers at the bottom. So the two numbers have to be opposite of each other to do that, right?

RT: Okay.

AB: Like over here, eight minute eight was zero. I want that over here.

RT: I got you.

AB: I want, like, I don't know. This is two. This is five. So, like, ten minus ten or something like that, or…

RT: Oh, I got you. I remember.

AB: Two minus two.

RT: Uh, you've got to get that, uh…

AB: Well what number do you think you want to use, first of all, like could you –

RT: Ten.

AB: You want to use ten?

RT: Yeah.

AB: So two times what is ten?

RT: Five.

AB: Okay, so if I have to multiply this by five, in order to keep it all equal, I have to multiply that by five and that by five because that equal sign means that if I do something to the left, I have to do it to the right. Okay?

RT: Okay.

AB: So this one will be times two.

RT: Yeah.

AB: Times two, times two, times two. Is there an easier way to do it? You could not use ten. Look at the – look at what's in front of Y.

RT: Two. So I can use two?

AB: Right. If you just multiply that whole top line by two…

RT: I see.

AB: What do you get? You get a positive 2y and a negative 2y. They cancel out.

RT: Okay. Yeah. That's right.

AB: Okay, so let's try that, and you can just rewrite the whole thing at the bottom. So what are you doing now?

RT: Oh, that's wrong.

AB: What are you doing now?

RT: Uh, you won't understand this later.

AB: I want you to multiply this whole thing by two.

RT: Okay.

AB: First, and then you can solve. I know that you like to solve things in your head.

RT: I'm multiplying 2x – I'm sorry.

AB: No, it's okay.

RT: That would be 4x. Uh, equals 20.

AB: What happened to this? Still have plus two Y. I just want the whole thing multiplied by two. Stick a two in front of the Y for now. And then rewrite this right underneath. 5x minus 2y equals seven. All right. That's all. That's what I wanted you to see.

RT: All right.

AB: Plus 2y minus 2y. Now you can add – you stick a Y under there and add them like you wanted to before.

RT: That's all? Okay.

AB: What would you get?

RT: Um, 9x is 27.

AB: So what's X?

RT: Three.

AB: Okay. That was, like, two steps.

RT: Yeah it was.

AB: I like that. I don't know about you, but…

RT: No, I do.

AB: That's easier than this way.

RT: A lot easier.

AB: Yeah, so – but we're not – remember, we got Y and then we got X. So find X for me.

RT: Okay.

AB: I'm sorry. You found X. Find Y for me. So X is three.

RT: Um-hum. But this – does this – am I still doing it from – from this equation…?

AB: Um-hum.

RT: Or am I just plugging this in?

AB: Oh – what – say that again? Say – ask your question again.

RT: Am I just doing it from – never mind. I got you.

AB: So what are you doing? What was X equal to?

RT: Three.

AB: Um-hum, so five times three. Is that what you're doing?

RT: Fifteen – I – that wasn't what I was doing. That's probably what I needed to do though. Um, okay. This is what I'm asking.

AB: Okay.

RT: So this is just – I'm not even looking at this.

AB: You can look at that. That's your original question. I don't want you to look at this.

RT: Oh, yeah. I'm not.

AB: But if we're looking – these are the two original equations. You can keep looking at that. So all I know is this information. This is the stuff I know right now.

RT: Yeah.

AB: What can you tell me – I need to find Y with that information. You can ignore all that stuff down there except that it got you to that.

RT: Okay. So but – should I plug that X in to three?

AB: Um-hum. You mean three into X?

RT: Yeah, that's what I meant.

AB: Yeah.

RT: All right.

AB: That's what I thought you were doing down there, but I gave away the answer.

RT: Yeah, well that's what I was going to do.

AB: Okay.

RT: Um…

AB: Are you – so you must be using this one.

RT: Yeah.

AB: Okay, so it's 15 and minus…

RT: But I don't multiply that by these do I?

AB: No. No. That's what we're looking for. We still have one variable because we have to solve for it. So we still – still have a Y.

RT: All right, um…

AB: Looks like this one doesn't it?

RT: Yeah. All right, I got you.

AB: If we subtracted seven, what's 15 minus seven? Eight. So Y is –

RT: Y is four.

AB: Okay, so X is three and Y is four.

RT: Yeah.

AB: How confident are you that your answer is correct?

RT: Um, I mean I'm not real confident.

AB: Okay.

RT: I'm hoping it's right.

AB: Um, it is.

RT: Okay.

AB: Three comma four. That's my answer, so when you – when you find a system of equations, when you're solving it like that, you find an X and a Y value. Does that mean anything to you, like X having an X and a Y value together?

RT: Yeah, it does.

AB: If you – could you graph it, like, could you put it on a coordinate plane? Do you know what a coordinate plane is? The X and Y axis?

RT: I could.

AB: Okay. Um, do you have any idea what that mean – like the solution of the system of equations is? We've got two lines, and we end up with one point. Two lines and one point. Do you know what that – how that can be an answer?

RT: Two lines and one point?

AB: Yeah. Well we start with all this mess, right?

RT: Yeah.

AB: And your final answer here was negative two, seven. That's your answer, right?

RT: Um-hum.

AB: And your answer here is three, four. So you have – you started off with two lines and you end up with a point as your answer. What do you think that means? Do you have any idea?

RT: As far as graphing it?

AB: Yeah.

RT: Uh, yeah that – on the graphing, you go negative two and go up to seven.

AB: Okay. What happens to the two lines at that point do you think?

RT: I don't – I don't know.

AB: Oh, that's weird.

RT: Maybe they probably cross.

AB: They probably do, right? They do. They definitely cross. Um, so do you see any patterns for me between any of the things that – that we did? Like this problem versus this problem? Does it look similar to you?

RT: It does.

AB: Why? What – what is – what's similar and what's different?

RT: Um, the only thing that's – that's different, I think, is that it's more than one line. It's more than one – one problem to solve for – solution to solve for.

AB: Okay. So there's two equations. Is that –

RT: Yeah.

AB: That's what's different from things you've seen before you mean? Okay. What about different between each other? Is there – are there any differences?

RT: Um, in how you solve it?

AB: Um-hum, or how it looks, or…

RT: I don't think so.

AB: Not really? Um, so now what is a system of linear equations?

RT: Um, you got me.

AB: Say it again.

RT: It's a never-ending line.

AB: It's a never-ending line? Just one?

RT: Uh, two.

AB: Okay. Could it be more?

RT: It could be, yeah.

AB: Okay.

RT: As many as you want.

AB: As many as I want? Uh, has your definition changed since the beginning of this part of the interview?

RT: Of course.

AB: Do you feel confident in your ability to perform similar tasks on your own?

RT: Yeah.

AB: Yeah? Good because in the next chapter you'll be graphing linear equations. And that's it, Ronnie.

RT: We're done?

AB: Yeah, we're done.

RT: Okay.

AB: Plenty of time for you to get to class, right?

RT: Yeah.

AB: Yeah? Okay. Make it stop.

Trent – Interview II

AB: Okay. I have to redo my introduction because I have to. I'm so –

TS: How long is it?

AB: Not too long.

TS: All right.

AB: Right there.

TS: Oh, okay.

AB: First, I'd like to thank you for your willingness to take the time to participate in this interview with me. Your thoughts and actions will be very valuable. I have had a chance to observe you in this class and I was hoping to gain a deeper understanding of some of your methods of approaching and thinking about specific problems as well as your perceptions of your own math confidence, ability, and understanding.

This follow up interview is to explore your perceptions of the unit, of the course you've just completed, and any suggestions you might have for the course after your experience. Thus far, I would like to focus on the different components of the online textbook, which components you used to learn the material, and how effective you believe the material was in helping you learn or relearn the concepts of the units. Please answer honestly and elaborate as much as possible. I will ask for clarification on any question if I feel it necessary. Ready?

TS: Um-hum.

AB: What is your overall level of confidence in math? Rate yourself one being low and ten being high.

TS: About like a six.

AB: Okay. Why?

TS: Because I get lazy and the problems are, like, always too long, or it takes too long to, like, solve the formula.

AB: So how does that affect your confidence?

TS: Um, makes it go down because I like to be good at things. Sometimes I'm good at it.

AB: How do you feel you progressed in the chapter that you just completed?

TS: Um, progressed, I think I did well because I learned how to figure out the formulas. I didn't know how to do it before.

AB: Okay. Which aspect of the online text did you feel that you used the most for this unit? The PowerPoint, videos, textbook, "view an example", "help me solve this"…

TS: I used "view an example."

AB: Okay, so most –

TS: All the time. All the time.

AB: Okay. Not "help me solve this" one?

TS: No.

AB: Okay. Why – why not because it changes the problem?

TS: I mean – no, it's just because it breaks down how they did it and I just copied exactly what they did.

AB: Okay, so just the step by step?

TS: Yeah.

AB: Thank you.

TS: You're welcome.

AB: I can see, uh, from your daily log and my observations that you used the "view an example" or – yeah, view an example and the – and me as a source the most.

TS: Um-hum.

AB: Did you find those two things the most helpful? Why or why not?

TS: Yeah because you helped me and it helped me.

AB: Okay, so I already know why, you know, an example helped you. How come I helped you?

TS: Because I just ask you a question and you answered it.

AB: Okay.

TS: Because you know how to do the problem.

AB: Okay, so I give you the answer or go through the steps or…

TS: You go through the steps. I wish you gave me the answer.

AB: Okay. Do you think the choices you made for instructional materials to use throughout the chapter were beneficial?

TS: Like – like what?

AB: Like you only really used "view an example" and to ask me or Dr. Bethea or whoever was there a question, right?

TS: Yeah.

AB: Was that beneficial or do you think that you could have gotten more out of it if you'd used PowerPoints and videos and the textbook and stuff like that?

TS: Um, if I use all that, I'll probably – it'd be, like, more beneficial because I learn more.

AB: Okay, and I know that you tried the videos.

TS: Yeah.

AB: What did you think about it?

TS: They were all right, but I couldn't answer any questions, so…

AB: What do you mean?

TS: Like I can't ask them questions.

AB: Oh, you can't ask them questions.

TS: Yeah.

AB: Yeah, okay. Did you have a lot of questions when you were watching the videos?

TS: I had a couple.

AB: Okay. Do you think that the unit that you just did offered enough feedback?

TS: Um, feedback like what?

AB: Like a response to a wrong answer or…

TS: Oh, yeah. Yeah, it did. Yeah.

AB: So that it – when it come up, it said sorry, that's not correct? Did the little explanation help you figure out why?

TS: Yeah. It gave me, like, clues and it, um, just explained, like, how you, like, work the formula.

AB: Okay.

TS: So I'll go and redo it.

AB: Do you think all the tools that we just talked about – so "view an example," PowerPoint, video, the feedback, do you think all of that offered the support that you needed to succeed?

TS: Um, yes.

AB: Yeah? So it's enough to get through this class, those things?

TS: Yeah. Yeah.

AB: How do you – uh, how do you feel about the feedback you received? So not just that it offered enough feedback, but do you think that that's – that that is the only feedback you'd need?

TS: Um, no.

AB: No? Why? What's missing?

TS: Um, feedback from you guys I guess.

AB: Okay. Um, so same type of question, is there a type of feedback you prefer to see in math – in a math class, not just this type of math class, just any math class?

TS: Um…

AB: No?

TS: I can't think of any.

AB: Okay, so what would make you feel more confident in your math ability? Knowing that you got things right, or knowing that you understand how to do something?

TS: Knowing that I understand how to do it.

AB: Okay.

TS: I wouldn't be, like, hesitant to do it.

AB: Okay. How did you feel about being able to pace yourself throughout the unit?

TS: I loved it. I was on my own time.

AB: Okay, and you were able to get enough done, or…

TS: Yeah.

AB: Yeah? Even though we're in chapter four and we've got a lot more to go?

TS: Yeah.

AB: Even that's –

TS: Chapter five.

AB: You're right, you did just finish chapter four, congratulations.

TS: Yeah.

AB: Did you find it difficult or relatively easy to keep up work – with the work?

TS: Um, I felt it easy to keep up with the work. You just have to have the mindset of wanting to.

AB: Okay, so…

TS: And I didn't have that.

AB: When did you not have that?

TS: In the beginning of the year. I do now though.

AB: Okay. Do you think you understand the material from the chapter?

TS: Um, yeah I understand it to a certain extent.

AB: So you just finished chapter four.

TS: Yeah.

AB: But in between when – our first interview and now, you finished chapter four.

TS: Right.

AB: So that's polynomials. So addition, subtraction, multiplication, division. Do you really understand what you're doing when you do that?

TS: Yeah.

AB: Yeah? So you think it's going to help you in your next chapter, because your next chapter is factoring polynomials?

TS: Um, yeah. I'm doing good in the next chapter. I'm in 5.2.

AB: Okay, good. Remember the interview we had before the unit?

TS: Yep. The first one?

AB: Yeah. Yeah.

TS: Um-hum.

AB: Do you, um, do you think that you might answer the questions that I asked you about systems of equations in a different way? Do you remember the questions?

TS: Uh, probably. I probably did.

AB: Why?

TS: Um, honestly I don't know. I don't remember, so…

AB: You don't remember the questions that we went over?

TS: No I don't.

AB: Okay, um, do you think you would feel more confident doing the same types of problems that we did in the first interview?

TS: Um…

AB: Even though you can't remember exactly what type of problem they were.

TS: I mean, I think I could do it. It's just – probably wouldn't want to.

AB: But would you feel confident while doing it?

TS: After the first problem –

AB: Or would you be hesitant.

TS: After the first problem. After you help me through the first problem then I can do it.

AB: Okay, so after a little bit of help?

TS: Yeah.

AB: Okay. Um, do you feel that this class will prepare you for your next class in Maryland?

TS: Um, yes.

AB: What is your next class?

TS: Um, whatever next math I take is.

AB: Do you know what that is for your major?

TS: Not yet. Oh, for my major? I'm Family Science.

AB: So that would be math 111, it's statistics.

TS: Yeah probably, but I'm going to drop that class. I'm going to drop my major, so I'm going to be undecided.

AB: You don't know what you want to do?

TS: No. Probably be communications.

AB: Okay. That's the same. That's still math 111.

TS: For real?

AB: Yeah. Statistics.

TS: Yeah, so I'll probably take 111.

AB: Have you ever taken statistics before?

TS: No, but I've heard it's hard.

AB: It is hard. So do you think that the stuff that you're doing now is going to prepare you for a harder class?

TS: Uh, yeah.

AB: Do you think you'll be ready to do that?

TS: Yeah. Yeah.

AB: Okay.

TS: Yeah.

AB: Sure about that?

TS: Yeah. I like challenges.

AB: Oh, good. Okay. So why do you think that it'll prepare you? Why or why not?

TS: Um, because it's teaching me that I have to do my work on my own time instead of having someone always there. Like, when I was in high school it'd be like, you have to do this. I just do the shit myself.

AB: Okay, and the fact that we are self-paced but another class isn't going to be self paced, how do you think that's going to change?

TS: Uh, that's going to be a negative part in my life right there.

AB: Why?

TS: Because I like to do things on my own time.

AB: Okay. So when your teacher tells you that your homework is due in two days, are you going to have homework done in two days?

TS: Yeah. I'm going to have to.

AB: All right. Do you think that you're still going to work with somebody over in athletics when you're taking math 111?

TS: Um-hum.

AB: Okay. Um, do you think that you're going to remember the content that you learned in this class in order to apply it in your next class?

TS: Learn the content in this class and apply it to the next one?

AB: Yeah. Like do you think you're going to remember the stuff that we went over in this class, or do you think you're just going to do it, forget it, and then have to move on to the next?

TS: Um, I'll probably remember it.

AB: Okay. Are you being honest?

TS: I'm being honest.

AB: Okay.

TS: I told you I was.

AB: Okay, so why – why do you think you'll remember it now when you didn't remember it from high school? What's different about now?

TS: Um, because in high school I didn't want to learn it at all.

AB: Okay.

TS: I just – I didn't show up, so, like, now I show up and I do the work.

AB: Okay.

TS: So – and I know I need it, so…

AB: Okay, so you know you need it for math 111 so you better remember it from math 111?

TS: Yeah.

AB: Okay. Math 111's a lot different than the stuff that you're working on now, so that's – that's why we want you to get into the later stuff because it's more applicable to what you're going to learn next semester or over the summer or however you take that class. Um, do you think the instruction in this class is helpful?

TS: Um, yes.

AB: Okay. Do you think it's worthwhile to take this class via an Internet based textbook?

TS: Um-hum.

AB: Okay. Why?

TS: Um is the question is it a good thing to take it because it's on the computer?

AB: Right, what's – why the computer versus in a class?

TS: Because the computer, um – why? That's a good question? Because I don't like – I don't like learning with a lot of people.

AB: Okay, so you don't like the big classes?

TS: No.

AB: So what's an – what's an ideal math class for you?

TS: Like, five to nine students.

AB: And one – one instructor or the computer?

TS: One instructor. One instructor.

AB: So you would prefer for somebody to be teaching you?

TS: Yeah.

AB: Rather than learning off of the computer?

TS: Yeah.

AB: So the videos were more helpful probably then the PowerPoint, but you just couldn't ask questions because you like somebody to talk to you?

TS: True. True.

AB: Yeah?

TS: Yeah.

AB: Okay, so it's still worthwhile for you to take it on the Internet, or you don't think it's worthwhile to take this class on the Internet? Yeah? You're still getting something out of it?

TS: Yeah.

AB: Why, because we're in a small –

TS: It's small and, like, I'm learning by myself.

AB: Okay, so have you ever had to sit in the regular 003 classroom?

TS: No.

AB: So it's about 40 computers…

TS: Um-hum.

AB: In a big lab, and two TAs and a teacher. So there's three people and 40 kids. What do you think? No?

TS: I hate that.

AB: Why not? Why do you say hate? That's a pretty strong word.

TS: Because – yeah, I hate that. Because, um, it's probably too many students, and I don't know. I just – personally wouldn't like it because I'm not confident about it.

AB: So you want somebody there?

TS: Yeah.

AB: Okay, so you –

TS: And I like it to be just, like, one-on-one really.

AB: Okay. Okay. Um, if you had a choice now, how would you learn this material? Would you prefer that tiny classroom or what we have going on now?

TS: I like what you guys have going on now, but if I had a choice, it would probably be a small classroom.

AB: Okay, so…

TS: Like seven students.

AB: If we – if we gave you the opportunity to register online, and we gave you a lecture – like a small lecture, 15 or below students, and a choice of the computer-based, you would choose the 15 or below lecture? The tiny lecture? Fifteen students is not too many students – or is not a lot of students, but it is the minimum number.

TS: Is that was – are you all going to do that since I asked for it?

AB: Are we going to do it?

TS: Yeah.

AB: No, that – actually the reason that I'm doing the research now and, like, the reason I wanted to do this study is because I want to know if students would really benefit from that. I don't really think that the online system works for everybody.

TS: Um-hum.

AB: I think that a lot of people need student-teacher interaction, but they don't realize that until they get into the online thing and they – it isn't working for them. So, for me, I would love for the university – we don't really have the money right now, but to offer a small lecture. I would love to teach it. At a slower pace that takes two semesters to complete the course instead of one.

TS: Yeah.

AB: So it'd be longer and still non credit because it's math 003, but that's my – that would be my, like, goal. Would you take a course like that?

TS: Yeah.

AB: Even though it would take a year?

TS: Yeah.

AB: Just because I'm teaching it or why?

TS: Because you're teaching it.

AB: Because I'm a good teacher or what?

TS: Yeah. And I'm more comfortable with you with math. I don't know why.

AB: When I'm there or as opposed to – what about an – do you have a math tutor in athletics?

TS: Um, I did.

AB: You didn't like him or…

TS: I didn't like him.

AB: Well, him or her?

TS: I mean, he was a good dude – it was a him.

AB: Smart?

TS: He was my only guy – yeah, Greg.

AB: Oh, okay.

TS: Yeah.

AB: Yeah, I know him. Okay.

TS: I liked him, it's just I didn't – I didn't like him, like, watching everything I did. I was like, sitting on the computer and he'd just watch – sit there and watch me, like right next to me. I hated that.

AB: Okay.

TS: Yeah.

AB: So he was too – too one-on-one?

TS: I mean he was – he was just doing his job. You know, that's what they told him to do. I just didn't like it though. I didn't feel comfortable.

AB: Okay, but it's okay when I sit and look over your shoulder?

TS: It's just like – just like I told you. Remember when I first got here? Remember I left that first day? On that first day I just walked out?

AB: Uh, um-hum.

TS: Yeah that was because you were just sitting next to me, and I was like, I don't like that.

AB: That's my job.

TS: I know. You're doing your job, but I just didn't feel comfortable. I didn't like it.

AB: But you came back.

TS: Yeah.

AB: Why?

TS: Because…

AB: They made you?

TS: Pretty much.

AB: And I still go out there, and sit next to you, and watch what you're doing on the computer.

TS: Yeah, but it's different now. It's different now.

AB: Why?

TS: Because I feel more comfortable –

AB: Because you know –

TS: With you – I know you're not. I didn't know you at first. Like, you were – I just didn't know you, you sat next to me, I'll be like, oh no.

AB: All right. All right. So do you have any suggestions for this course that you think might make it better for students in the future? Like, what would you change if you could change anything?

TS: Um…

AB: I'm talking about anything online…

TS: The length of the – of the whole thing.

AB: Okay.

TS: It shouldn't be 12 chapters. That's a lot of chapters.

AB: Well, we have to cover all the material in those chapter – well, we give you certain sections in each of the chapters depending on what class you have to take next. Like, you're taking math 111, so you have specific stuff that you have to study, right?

TS: Um-hum.

AB: Um, we can't shorten the number of chapters. So what would you suggest would make it better if we still – we can't make it less than 12. What do you think we could improve?

TS: Um…

AB: Is there anything that would make it better?

TS: No, it's pretty good.

AB: It's fine?

TS: Yeah, I mean –

AB: We don't need to make changes on the computer?

TS: I can't think of anything else. I honestly can't, besides the length of the whole thing.

AB: What about more – more people in our lab or…

TS: No, I like the way it is.

AB: Too – okay, small lab, one person there?

TS: Um-hum.

AB: So if you were going to go talk to students that are registering to take this class in the fall…

TS: Um-hum.

AB: What would you – like, what advice would you have for them? What would you tell them?

TS: Make sure that they don't slack, because it's self-paced – so, like, if you're a lazy person, it's just going to affect you in a bad way.

AB: Okay.

TS: Just make sure you finish this joint.

AB: Okay, and any – anything about, like, the type of work they're going to be doing or anything like that? Just make sure –

TS: I'm saying be like –

AB: That you have enough time to get it done?

TS: Yeah, just be like – just an overview of, like, what you went over in high school.

AB: So it's kind of a review?

TS: Yeah.

AB: Okay. All right. I would like to thank you again for participating in this study. Your participation has made a great impact. If you wish, I can share the final results of the study with you. Your name will not be mentioned in any final documents in order to protect your identity.

Only the principal investigator and myself have access to any recordings made, and they will be permanently stored on a hard drive that is password protected. Any written documents you submitted during the study will be destroyed once they've been electronically recorded. If you have any further questions about the study or its uses, please contact me. That's it. Thank you.

TS: You're welcome.

AB: I'm going to graduate!

TS: Yes!

Kenny – Interview II

AB: I don't wanna be on it. Oh, there I am. Okay. I'm just gonna put it near you so that I can hear you. And you know what? Let's just make sure we're double-checking that it is on, cause that's cool when it's working. Okay. So there's two things we're gonna do today, Kenny. This is gonna be the last day that you have to do any participations in study. Are you excited?

KW: Um.

AB: It hasn't been too bad now?

KW: It hasn't, yeah.

AB: Um, so what we're gonna do – we're just gonna do our last interview and then I'm gonna have you fill out this survey. Some of the questions might be a little bit repetitive but this is – that's because I gave the same survey to students who weren't being interviewed.

KW: Uh-hum.

AB: So I never got to hear their interview answers, okay?

KW: All right.

AB: Um, that should take like five minutes to do. So, I have to do my schpeel. First, I would like to thank you for your willingness to the time to participate in this interview with me. Your thoughts and actions will be very valuable. I've had the chance to observe you in this class. I was hoping to gain a deeper understanding of some of your methods of approaching and thinking about specific problems as well as your perceptions of your own math confidence, ability and understanding.

This is a follow up interview to explore your perceptions of the unit or chapters of this course that you have just completed and any suggestions you may have for the course after your experience thus far. I would like to focus on the different components of the online textbook, which components you used to learn the material, and how effective do you believe this material was in helping you learn or relearn the concepts in this unit or chapters. Please answer honestly and elaborate as much as possible. I will ask for clarification on any question if I feel it necessary.

Okay, so what is your overall level of confidence in math? And I want you to rate yourself on a scale of 1 to 10; 1 being low and 10 being high.

KW: Math, I'd say about a 6, if I actually have gone over the material.

AB: Okay.

KW: Six, then, actually.

AB: Okay and why is that um, so close to 5 because 5 would be kind of neutral. So why would a –

KW: Um, I mean I don't have a very strong math background. You know, I've always struggled with math. You know, but lately, especially with this course, you know, I've been kind of more math oriented. I think about math more often

when I'm not in the classroom. So I think now you know, I'm like fear of math is kind of –

AB: It's lessening?

KW: Yeah.

AB: So maybe before – or before this course, would you have rated yourself much lower?

KW: Yeah, probably about a 4.

AB: Okay, well, with that I want you to be above 5. Well there you go. Cause 5 – 5 to me is not necessarily a neutral but kind of like, "Uh, I can't tell really, you know. I don't know so." So how do you feel that you progressed in the chapters that you just completed and I mean since our first interview so you finished 3 and 4 since our first interview. So how do you feel about chapters 3 and 4?

KW: I liked them. Like I especially like polynomials. And I wanted to learn how to work with polynomials cause I remember going over that in like 8th grade and it just – it didn't really register for me back then.

AB: Is the – is the program helping you a little bit better?

KW: Yeah.

AB: Okay, and do you think you progressed through the material at a good pace for yourself?

KW: Uh-hum.

AB: Okay.

KW: Yeah, I would think so.

AB: Which aspect of the online textbook do you think that you utilized the most for the unit?

KW: PowerPoints.

AB: PowerPoints, okay. And then my next question is, I identical pretty much. I can see from your daily log and my observations of watching what you've been doing in the course that you use the PowerPoints the most often. Um, and why – did you find this the most helpful and why or why not?

KW: The PowerPoints, I liked them better than I liked the textbook –

AB: Okay.

KW: – because it kind of lays it out for you, this is what you need to learn, these are the examples, you know, do this, and you'll learn you know. And I feel like I learned the – the best with the PowerPoints as opposed to the books

AB: Okay, is – does the – the ordering of how they present the material, does that work for you a little bit better than –

KW: Yeah, I know cause it starts with the – basic – with the basics. And then it kind of progresses onto the stuff that, you know, they really wanna teach you.

AB: Okay, do you think that the choices that you made for your instructional materials, mainly PowerPoint, but I also noticed that you had said that you um, use – "view this example" a few times?

KW: Yeah, I've tried it.

AB: Um, and "help me solve this" problem, okay? So those choices that you've made for instructional materials, do you think that they were beneficial for you?

KW: Yeah, I think so. I mean, tho – I've used the "view this example" and "help me solve this" problem when I don't really know how to do them or when I'm stuck.

AB: Okay.

KW: And I can't talk to either you or Dr. Bethea.

AB: Okay, so would you – back – piggybacking on what you just said, would you prefer to have just used PowerPoints and then us as opposed to "help me solve this"?

KW: Yeah, I mean, I don't really like "help me solve this" that much especially because after I'm done with the "help me solve this," it changes the problem so I have to do a totally new problem.

AB: Okay, okay.

KW: And I don't like that about it. Um, but I – I think I like the example one better but I use the "Help Me Solve This" more often because I need to know exactly how to do it.

AB: Okay, and it gives you a step-by-step list of what do.

KW: Uh-hum.

AB: You're right though. It is frustrating if you're working on one specific problem and you do "Help Me Solve This" and then you solved it and then you go back and it's a new problem.

KW: New problem. Especially if it's real involved to solve it.

AB: Right, many steps. It just – it takes a lot of time. I understand. Um, do you think that the tools specifically the PowerPoint, and hopefully us, offer the support that you needed to succeed in the unit?

KW: Uh. Yeah, I think altogether.

AB: Like everything combined?

KW: Uh-hum. I think altogether and plus every once in a while, I'll Google somethin' –

AB: Okay.

KW: – just to make sure that you know, I know what I'm doing.

AB: Google is great. Um, do you think that without mine and Dr. Bethea's help in the course that you would feel as confident and feel like you succeeded in the units?

KW: No, I – I don't think so. I think I'd still need a human.

AB: Human interaction?

KW: To talk to, yeah.

AB: Okay. Do you think that the um, these particular chapters and the system itself offered enough feedback for you?

KW: Offer enough feedback? Um, yeah, um, like when you answer a question wrong, it'll give you um, kind of a description of what you need to change about your answer. Like it'll even tell you that the answer is mathematically correct but there's somethin' you need to change. You know, I like that because then I can actually look on my answer, change it up a bit.

AB: Okay.

KW: And look at it. And I've gotten better at looking at what my answer and picking out what's wrong with it.

AB: Okay.

KW: I'm a lot better at that.

AB: Okay, how about kind of before you ever press enter, are you able to kind of think, "Oh, this looks a little off. Maybe I should change something," or do you just check it first?

KW: Yeah, I'll think about that. Like sometimes like I – I know my last problem that I did for chapter 4 –

AB: Just now?

KW: Yeah, I was thinkin', you know –

AB: – this doesn't look right?

KW: Yeah, this can't be right, but it was right, you know.

AB: Okay.

KW: I mean, you know, cause it was such a complicated answer you know so. I mean, I think it involved like a fraction with variables and stuff.

AB: Okay, yeah, then at the end of chapter 4, there's lots of – lots of variables in there. Way more than just one. Um, so it's a pretty similar question but um, do you think the unit offered enough feedback with what we've just – what I've just asked but now I wanna know how do you feel about the type of feedback you received. So, "Sorry, that's incorrect," and then the explanation is typically the feedback you received unless there was a person present.

But as far as sorry that's incorrect, and then a tiny explanation, how did that make you feel to receive that kind of feedback. Like did it make you feel like, "Oh God. I got this wrong and this is horrible," or kind of, "Oh, well, they're trying to help me so I should probably keep pushing through this." What – what were your feelings about it?

KW: I get more frustrated than anything.

AB: Okay, why's that?

KW: Because especially if I worked a long time with something and I feel like it was – it would be right and then it's wrong –

AB: Okay.

KW: – you know, and it kind of makes me uneasy, you know, whenever I answer somethin' –

AB: Yeah.

KW: – you know, whether it's gonna be right or not.

AB: Then you do get instantaneous feedback?

KW: Yeah.

AB: So does that – do you like that aspect of it?

KW: Yeah, I like that because I know that I'm learning better if it's telling me what's wrong with my answer.

AB: Right away because if – what if we – then if we do the same thing a million times, right, and at the end we find out we got all of it wrong.

KW: Yeah, like if it gave – if it just went ahead and gave me partial credit, then I wouldn't learn what's wrong.

AB: Right, 'cause – I like that. Okay. Is there a type of feedback that you prefer to see in math class?

KW: Type of feedback? Um –

AB: Not necessarily computer based. Just in a math class in general. What kinds of things do you wanna hear about either what you've done right or what you've done wrong.

KW: I mean, I like an explanation. I like an explanation.

AB: Okay.

KW: What's wrong and what's not. You know, I think before we have been talking about you know, what I'd like to see on a test or homework assignment. And I'd rather see –

AB: – written out–

KW: – written out, yeah. I'd rather see written out what was wrong. Even if they didn't even mark it off like each individual question. If they just said at the end, you know, you need to work on –

AB: This, that, and that.

KW: Yeah, work on your negative and positives interactions or whatever. You know, just stuff like that.

AB: Okay, and again, piggybacking on the previous question, you would prefer to see nice explanations, do you think that the feedback in this class lived up to your expectations?

KW: Yeah, pretty much. Like I said, like with the um – with the answer, you know, it'll tell you if something is incorrect, what you need to change about it. It doesn't always give you the same that, "Sorry, that's incorrect. Try again," it tells you.

AB: Okay, it does give you some form of an explanation.

KW: Uh-hum.

AB: Whether it's, "You messed up all the way in the beginning or you're really close, you just need to simplify," something like that?

KW: Yeah.

AB: Okay, and how did you feel about being able to pace yourself through out the last two chapters?

KW: Pace myself. Um, I felt –

AB: Think that you were able to do that?

KW: Yeah, I was able to do that.

AB: Okay, I would – I would definitely agree. I thought that um, you did a great job. You accomplished a lot in a short period of time so that's great. And um, how'd you find it difficult or relatively easy to keep up with the work for this um, past unit?

KW: Pretty easy.

AB: Pretty easy?

KW: Pretty easy especially since it's accessible online so.

AB: So you can do that – the work anywhere? Okay. Um, do you think that you understand the material from the chapters? And now I'm talking about chapters 3 and 4. So that's graphing linear equations and operations on polynomials. Do you think you really understand it?

KW: Yeah, I understand it more in depth. Like I mean, I had already been comfort – I mean, I'd already been exposed to um, graphing linear equations but I feel like I know about it more.

AB: Okay, a little more confident in your ability cause it's gonna come up again in a later chapter so. We like to introduce it to you, give you a break and then bring it back up a little bit later for review. And then operations on polynomials, what's – what's your understanding on that do you think?

KW: Like um, I fe –

AB: I know you just finished today so.

KW: Yeah, I know about it. Yeah, now I know – I actually feel like I know how to do operations with polynomials.

AB: Okay, before what did you think about? When you first saw the problems in that chapter?

KW: I probably could've – I probably could've done like simple multiplication. Like I knew the foil method.

AB: Okay.

KW: But you know, if it was let's say um – a binomial and a polynomial like the one with three terms and like one with two terms and one with three terms. I wouldn't know how to do that.

AB: Until now?

KW: Yeah.

AB: Right, okay, great. Um, do you think that this class, Math 003, will prepare you well for your class at Maryland?

KW: Yeah.

AB: Why or why do you think so?

KW: Um, because it's basically I feel like it's – it's kind of tailored to what I really need to work on.

AB: Okay.

KW: So I mean, it's not just a general review. It's kind of telling me you know, what I need to work on. So now I feel like I – I'm getting the basics that I need.

AB: And your next course after this is gonna be Stat100 or Math111?

KW: I'll probably take Math 111.

AB: Okay, okay. I might teach that instead.

KW: Oh you will?

AB: Maybe, maybe.

KW: What in the Fall?

AB: Yeah.

KW: You might teach – as a – as a um, what are they? Individual uh, schedules? What do you call it?

AB: The discussion sections?

KW: Yeah, yes.

AB: No, that's the big lecture.

KW: The big lecture?

AB: Maybe, maybe.

KW: With like all the teachers? With all of the students, 300 students? Wow.

AB: I know. I'm scared. We'll see. We'll see what happens. Um, okay, so that was just a sidebar. I'm excited. Um, so do you believe that you will remember the content from this class in order to apply it at your next class?

KW: Yeah, I think so.

AB: Okay.

KW: I mean, it's just a matter of seeing it on paper and just remembering what to do. And I've done so many of each type of problem.

AB: We do make you do a lot. Was that frustrating?

KW: It's not really. I mean, like I took a typing class in high school and it was just like continuous same things over and over again. And that's how I learned how to type.

AB: So it's the same kind of deal?

KW: Yeah, so I knew that going into it.

AB: Okay. Do you feel that the instruction in this class was helpful? Like the – do you think that the units were presented well? Did you understand the material, things like that? Or did you need to ask questions to get – to understand what the computer was telling you to do?

KW: Nah, I didn't really need to ask questions. I mean, at the beginning but eventually I kind of got it. It was pretty self-explanatory.

AB: Um, do you think it's worthwhile or do you feel that it's worthwhile to take this class via an internet based test – textbook? Excuse me.

KW: Textbook, no. I think – personally, I – I feel like the PowerPoints are enough. Like I wouldn't – the videos, I didn't really like the videos either.

AB: Why's that?

KW: Uh, they just – they – they – they weren't interactive enough for me.

AB: Okay.

KW: I'm a hands on learner so.

AB: So you would prefer to be able to ask questions and things like that?

KW: Uh-huh.

AB: Um, so I'm – before I ask my next question, if it's just you don't like – I know you don't like just the textbook. Um, what if there was something like um, an interactive chat room where you could go and ask questions to your teacher when – while you were online? Would that be something that you would like or is that not –

KW: Yeah, I mean, I don't know – I don't know how that would be practical because of time constraints.

AB: Right, right.

KW: Because I know like Dr. Bethea, she has other people she has to see and stuff. So you know, I mean, personally like when I kind of base what I'm going to do, how I'm gonna respond to when I'm having a problem based on if Dr. Bethea uh, door is opened or not.

AB: Okay.

KW: So I mean, if they could have student – like grad students like you or somethin' that could be in a chat room and help, I mean, I could see – I – I would probably take advantage of that.

AB: Okay.

KW: I would do that right now.

AB: Okay, um, if you had a choice, any way with – no matter what the cost, whatever. How would you choose to learn this material, this basic material?

KW: If I had a choice?

AB: Yeah. Not – I mean it doesn't have to be online. It doesn't have to have a textbook. Whatever – whatever you think is the best way for you to learn, what do you think that is?

KW: Um, as long as it's hands on I'm fine.

AB: Okay.

KW: Um, I think this makes it kind of easy because you kind of have a task – a taskmaster there and you have it laid out for you.

AB: Uh-hum.

KW: You know, as opposed to if you're in a classroom, you had to give your homework but you have to kind of –

AB: Do it **[laughs]**.

KW: Yeah, and you have to write it down and then you have to find time to actually sit down and write. But like here you know, you just get on a computer and you do it. So I – I like the computer.

AB: Okay. So in like this technological world, do you prefer the this?

KW: Yeah.

AB: What about for your next class? Do you think that you could learn Math 111 on an internet-based system?

KW: Yeah, I probably could.

AB: Okay. Um, do you have any suggestions for this course, Math003, in general um, that you think could make it more beneficial for our students in the future?

KW: Um, like we were talking about the um, explanations for the wrong questions. I figured if they were more – if they actually pointed out what's wrong –

AB: Okay.

KW: – with the answer. You know, and then maybe after that, they give you another – another problem to do that's similar.

AB: Okay, just to check that you –

KW: Just to check that you know cause I know why they changed – like when you do the "Help Me Solve This", I know why they change it. It's just kind of frustrating for me.

AB: Right.

KW: Cause I know that I understand the material after I do the "Help Me Solve This." But then they make me do yet another problem.

AB: What about the order that we have everything set up in? How we would like you to go ahead and read through the chapter, then take the pretest, then answer questions, what – how do you think that works for you?

KW: Um, I think that's important.

AB: Okay.

KW: It's– I mean, it's important to try to get familiar with the material before you take the pretest cause that way you'll have less "study plan" problems.

AB: Right, and I think that you are one of few in this section particularly that are doing it exactly the way that we anticipated students doing.

KW: Yeah, at first I started – I started out not doing that. And I was – kind of suffered from that. Like I think I had like 100 somethin' questions.

AB: Right, you gotta learn – you learn quick that you wanna study for your pretest because we give – I mean, if we give you the opportunity to study, please study. You know?

KW: Yeah.

AB: So um, this is my last question. Nice, short interview, I told you. Do you have any advice for students who will be taking this class in the future?

KW: I would say uh, hum, I would say try to make it um, if you're scheduled to make it on time. I mean, it might seem like it's a lot but if you actually have a steady schedule to come in, routine, then it'll make it a lot easier. You know, than if you just skip and stuff.

AB: What about – what about planning? Getting your stuff done? It's self-paced, so what advice do you have for students to help them with that?

KW: Um, I would say just realize that uh, you're here to try to advance yourself so I mean, you're here to learn. There's people here to help you learn so take advantage of it.

AB: Okay, and one more follow up question on that would be that it's a non-credit class, so when students find that out they get really discouraged, really disappointed, you know, it's a lot of work. What kind of – what kind of things would you tell those students who kind of feel like this isn't worth it? Why – why am I stuck here, kind of a thing. Cause I know you chose this for review. But some students are here because they don't – because – well, they just frankly don't want to be, but their test scores were too low.

KW: Test scores were too low.

AB: So what do you think you would say to those students who are kind of battling with, "This doesn't seem worth it. I'm doing all this work and not getting any credit for it"?

KW: I'd say it's a big waste of money like I don't know, if they were paying for the classes or their parents are, it's a big waste of money to try to take a class and then find out – after you can't even drop it that you know, that you're not ready for the class. So I mean, it's better if you know that you're ready for the class cause your test score was to get that outta the way, the preparation.

AB: So you would tell them to stick with it?

KW: Yeah.

AB: And do their work, okay. All right. Is there anything – any other advice that you have for us or anything that you would like to say about the class in general, how you feel about the way that it was set up, or?

KW: Um, I'd say uh, at first I kind of dreaded coming in.

AB: **[Laughs]** Why's that?

KW: You know, sittin' there doing math problems, you know –

AB: Not your favorite subject?

KW: Nah, and for like two hours. But you know, eventually, I kind of learned to like it so.

AB: Good, good, I'm glad. Push your attitude – I'm gonna enforce it on other students. Um, I have to conclude so. I would like to thank you again for participating in this study. Your participation has made a great impact on the study. If you wish, I can share the final results of it with you once it's done. Your name will not be mentioned in any final documents in order to protect your identity.

Only the principal investigator, that's my advisor, and myself have access to any recordings that are made throughout this study and they will be permanently stored on a hard drive that is password protected. Any written documents submitted during this study will be destroyed once they've been electronically recorded. If you have any further questions, please contact me.

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