A Dissertation

entitled

Distance Learning in the College Mathematics Classroom:

Perspectives of Instructors and Students

by

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Submitted to the Graduate Faculty as partial fulfillment of the requirements for the

Doctor of Philosophy Degree in Curriculum & Instruction

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An Abstract of

Distance Learning in the College Mathematics Classroom: Perspectives of Instructors and Students

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The aim of this study was to allow both college instructors and students an opportunity to give their perspectives on distance learning in the college mathematics classroom. Participants included an eclectic group of college students and instructors with varying years or experience and differing skill sets.

Surveys were implemented to gain insight on participants’ views on distance learning, while interviews were secondarily implemented to gain deeper understanding. Gaining access to participants was difficult, but ultimately 82 instructors and 143 college students were surveyed using SurveyMonkey®. Thirteen instructors and 14 students were then interviewed, using several different methods including: face-to-face, Skype, telephone, and email.

Analysis of the surveys was used to determine both the necessity of implementing the interviews and the nature of the questions involved in the interviewing process.

Both the surveys and interviews aided in finding that while both instructors and students believe distance learning will have a large presence in the future, they perceive
there to be issues relating to integrity and communication. Concerns about methods which should be implemented to ensure students are honest and trustworthy while taking a course without parameters in place to ensure this is happening was a concern. In addition, both instructors and students were uneasy about communication in online classes. Instructors stressed the importance of the motivation of college students, while students were concerned about gaining deep understanding of content.

Additional research in areas regarding integrity, communication, motivation, and deep understanding are encouraged, as these perspectives were most prominent in this research.
I am very thankful to God for providing me with the following people. I have called out His name in frustration so many times over the past few years, it is more than appropriate I thank Him for all his countless blessings. First and foremost I thank Him.

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List of Definitions

Below is a list of terms I use in my writing, along with definitions of these terms significant to this research.

Distance learning: In general, distance learning is just that—learning from a distance. Online learning, however, has the connotation that all learning takes place online. For this paper, distance learning and online learning are synonymous.

Hybrid: A hybrid course refers to a course that has features of online courses and features of face-to-face courses. It is a combination of both.

Integrity, specifically student integrity: Student integrity refers to the actions students take (or do not take) to remain honest in the classroom. One of the emergent themes within this study was the concern that students in online classes would find ways to cheat. Because monitoring these types of courses can be difficult, finding ways to be successful may be dishonest. Ways to breach such integrity would be to have someone else take a course for the registered student; get help on assessments (that are not intended to have help); or, use unapproved online resources. When discussing student integrity in this dissertation, it refers to students being honest about their work. Cheating is a catch-all term used to note breaches of integrity.
Chapter One

Introduction and Statement of Problem

How often does a college student use technology? Many would quickly respond, “Constantly.” There is an ever present sound of clicking, dinging, and buzzing as students receive and send texts, update Facebook® pages and tweet about their daily lives. Information is created, shared, uploaded, downloaded, and posted in the blink of an eye. Students are challenged to navigate to a physical destination while staring down at their phone, avoiding obstacles, including other students, doing the same. Technology plays a large role in the lives of current college students.

However, the academic usage of technology within the college classroom is not so obvious. Research is not clear in describing or detailing how teachers and students at the college level feel about technology integration in the classroom.

While technology plays an immense role in students’ lives a more focused research area is needed. Mathematics courses offered online are becoming more prevalent at the college level. At the surface, there are several reasons it seems both instructors and students would be drawn to such courses. The potential flexibility this type of class offers is enticing for both students and instructors. They are able to access the class at their leisure, allowing them to potentially continue with their normally scheduled activities. On the other hand while the flexibility is tempting, students in such courses may feel they are asked to teach themselves concepts and procedures more effectively taught and understood in a traditional, face-to-face format. This study focused on both the perspectives of instructors and students to understand how they felt toward the proliferation of online mathematics courses.
Significance of Problem

From the instructor perspective. In a preliminary research study developed to explore a software program (Miller, 2009), students’ reactions were explored as they looked at three different demonstrations of the Pythagorean Theorem using Geometer's Sketchpad (GSP). They then used paper and pencil methods to prove the Pythagorean Theorem. It was hypothesized that every student would rave that they not only loved GSP, but that they loved it much more than paper and pencil techniques. Students did like the software and found it to be beneficial, deepening their understanding of the Pythagorean Theorem, however not necessarily more beneficial than paper-pencil methods. While the research design was not necessarily intended to compare the two methods, but more to find the beneficial and non-beneficial aspects of both the software and non-software methods, several students ended up declaring they liked the paper and pencil techniques better than the software techniques.

There are several possible reasons for these conclusions, but the point is technology will not be liked just because it is technology. The technology needs to be relevant to the students. These preliminary findings defend what Zhao, Tan, and Mishra (2000) and Ouzts and Palombo (2004) found, stating technology is geared towards teachers and teaching, not towards students and learning. While the lessons utilizing GSP were originally thought to be more effective, students were not necessarily understanding or learning the material more deeply or clearly.

Questions arose as to the value in spending so much time preparing and understanding the software to receive only a lukewarm student response. I spent a lot of
time and energy, learning GSP because I believed the students would understand concepts more clearly when taught with this software program. If utilizing GSP did not improve student understanding, the efficiency of this type of technology integration remains questionable in my mind.

GeoGebra®, a similar, newer software program has entered the scene. While keeping up on current trends in technology is inherently important to some instructors, others may wonder what will be coming down the pike next and if it is worth their while to take the time to learn it.

Integrating technology generally causes a shift in the classroom environment, placing more responsibility on the learner and less on the teacher during actual instruction time. The teacher's role is not unimportant, but the role during the class is usually more of a facilitator, and not a teacher or lecturer (Adams, 1997). While this constructivist-type environment has been emphasized in the education community, some students question the objective of class, when they could engage in the activities in the comfort of their own home.

**From the student perspective.** I have personal experience as a student in courses incorporating technology. In one particular course, a professor taught live to half the class, while the other half took the same course, taught by the same professor, online. (I was in the live class.) The professor audio-taped the in-class discussions and posted them online for the distance learning students. This posting was beneficial as well, for the in-class students who were unable to attend class or if they needed to review an unclear or confusing concept or topic.

The technology aspect seemed great to the students who participated on a regular
basis in the classroom, however the students who were online did not seem to fare so well. Online student participation was minimal at best, however it is difficult to determine the culprit of their scarcity. The inadequate participation could have been due to the students’ lack of motivation. While in many cases students in online settings are motivated, it may not always be the case. Conceptual comprehension could have also played a role in the lack of participation as struggling students may attempt to hide behind the computer screen. In some instances technology acts as a barrier to conceptual comprehension as the student uses valuable time and effort trying to learn the software. Technological literacy could also have played a role.

One aspect of courses offered completely online is flexibility. The positive aspect of the flexibility the course allows can also be seen as a negative aspect of structure, encouraging extreme procrastination. As a student I enjoyed having the freedom to work on assignments on my own schedule, however there were many times I craved having face-to-face interaction with the instructor (and other students) for clarification of concepts.

Much like any manipulative or supplemental used to aid student understanding, it is imperative the supporting material itself is not a barrier to understanding the curriculum of the course. Students experience frustration when they are unable to understand curriculum due to either lack of comprehension or inexperience of technology. Dogan-Dunlap (2003) reports similar findings when students attempted to use Mathematica® in a college classroom, and learning was hindered due to software struggle. Giving college students a voice regarding their perspective on online learning is valuable as students’ experiences vary greatly. My personal perspective was one driving
factor for the purpose of this study, as I looked to see if other students perceived online course in the same way I did as a student.

**From the field’s perspective.** There is research arguing both teachers are excited and willing to integrate technology and there is research arguing the opposite. Much of the conflicting research, however, is at the elementary or secondary level and not the college level (Beyerback, Walsh, & Vannatta, 2001; Christensen, 2002; Earle, 2002; Ertmer, 2005; Li, 2007). The same is true for the attitudes of students toward technology integration. Much of the research focuses on elementary or secondary classrooms, but has not included the views of college students or faculty (Buteau, Marshall, Jarvis, & Lavicza, 2010; Maryam, 2001). The aim of this study is to focus on technology usage in general; to allow college students and college professors to voice their opinions on technology integration in the classroom. Because technology integration at the college level is becoming more and more prevalent, providing descriptive accounts about how technology is being integrated and how the different parties perceive and experience this integration is valuable.

**Positive Attitudes.** Based on the amount of technology students use on an everyday basis for personal/social use it would seem obvious that students would welcome the use of technology in the classroom. According to Li (2007), secondary students believe technology can make learning more efficient, while changing the pedagogical nature of the classroom, making it more relevant to the real world. Li (2007) adds secondary students can see technology as a part of their future, most likely being an integral part of their work place.

Media portrays technology as both a motivational and fun way for students to
learn. Challis (2001) agrees, stating teachers' attitudes need to reflect the positive attitudes towards technology that the students possess. Making learning more efficient, more relevant and more fun are sufficient reasons for not only students to want technology integration, but also relevant reasons for educators to also want to integrate technology. It seems reasonable instructors would want to make teaching more exciting and efficient, possibly allowing for less preparation time in the future and less time with classroom management issues, while making the content more relevant to the world outside of the school building.

Technology can make learning more efficient. For instance, the mathematics classroom is full of “problems” that can be (and have been) done by hand, without technology. The calculations can be long and tedious, begging for students to make arithmetic mistakes.

Being able to perform calculations on a calculator or computer program can allow students to shift their focus to understanding the mathematics—understanding what is happening within a particular problem—instead of concentrating on the intricacies of the procedure. The integration of technology can aid in shifting the focus from procedural proficiency only, to include more conceptual understanding. The National Council of Teachers of Mathematics (NCTM) emphasizes factual knowledge, procedural proficiency, and conceptual understanding in their standards (NCTM, 2000). Procedural understanding focuses on students being able to correctly complete a procedure, following the directions set forth to them by some sort of experience, whether it be an actual instructor, a textbook, or a computer program. In many cases, being able to find or get the correct outcome equates to success. This success however, depends on the goal of
the course: a step by step procedure, or a deeper understanding of the problem and the meaning of the solution? Students who can correctly follow a procedure and produce a correct outcome do not necessarily understand how or why the procedure works. While being able to correctly complete a mathematical procedure gaining the correct outcome is absolutely important, it is also important for students to understand conceptually why and how the procedure works. If technology takes the tediousness of the procedure away, it is conceivable the students are then able to concentrate on the actual problem at hand, instead of concentrating on performing a procedure that may or may not make any sense to them.

In addition to possibly making learning more efficient, technology can allow students to see things they may not be able to see without the aid of technology. Students can watch the dissection of a frog, take a tour of the Great Wall of China, or construct a dynamic tessellation from their desk.

A graduate level cultural studies class used YouTube® to discover “videos that are relevant to pedagogical and learning purposes” (Trier, 2007, p. 410). If desired, such videos could then be uploaded onto a course management site or platform (such as Black Board®) for all students to view at their convenience. These kinds of experiences are perceived to be much more valuable than looking at static pictures in a textbook, and can be useful in both the secondary and post-secondary classroom. Likewise, in a world where time is of importance, being able to post a finding for classmates to view at a later time can be invaluable.

Many college students are more than just students. College students are pulled in many different directions. Outside the classroom they may participate on athletic teams,
hold down one or more jobs, and even have a family. Being able to view items posted live allows students with hectic schedules to continue participation within the class, only on their own time schedule. With the time of day varying greatly depending on each individual student’s geographic location, the flexibility of online courses allows students with varying schedules to participate in the same courses.

Technology will continue to morph and change, but is certainly here to stay. For this reason, students feel technology integration in the classroom today is important (Li, 2007). While no one really knows what the future will bring, it is pretty safe to assume technology will be a part of it. In nearly every career, there is some form of technology used. Challis (2001) agreed, emphasizing employability after graduation is important and relies on being technologically literate, if not savvy. This is not to say a blanket statement should be made stating technology instruction will or will not aid a student in their future career, but Challis (2001) instead said if and when technology is chosen to be used in the classroom, future employability should be a consideration. The time spent learning and using technology needs to be worthwhile both in the classroom and in the students' future.

Ertmer (2005) agreed technology integration seems obvious and the pieces are in place for technology integration in the classroom. However, she argues the kind of technology being currently integrated is considered low level, like word processing and basic internet searches. High-level activities involving student exploration and deep thought are not being integrated extensively (Ertmer, 2005). Word processing and internet searches are not technology dependent, meaning a typewritten or hand-written paper can say the same thing as a paper written using a word processor or paper and pencil.
Likewise, internet searches are used where reference materials used to be.

The accuracy of internet-posted information can be sketchy. The technology itself is not aiding in student understanding. It is not allowing the students to explore and investigate to better understand a concept. This low-level usage, however, may be just the first step of using technology in the classroom, with higher level usage to soon follow (Ertmer, 2005). Higher-level usage is normally linked to a more student-centered, constructivist setting, while lower level usage is linked to a teacher-centered, lecture classroom (Becker, 1994). This philosophic link may also be a reason for the slow integration of technology. If the classroom is not constructivist in nature already, it may make more sense to the teacher to use the approach as a low level technology to aid student learning.

Negative Attitudes. Teachers have to want to integrate technology. The technology must be within the realm of what the teacher can and is willing to incorporate (Cohen, 1987). They have to believe technology will benefit their teaching and/or their students' learning directly, and they have to feel this integration, which will most likely cause them some discontent, is worth their time and energy (Zhao, Pugh, Sheldon, & Byers, 2002).

Change in any realm can make people cautious, especially if their beliefs include keeping things status quo. Unfamiliar technology causes caution and fear, so when requiring a change in course style paired with technology integration, feelings of cautiousness and even anxiety can be even more heightened.

Lesson preparation is time consuming. Instructors spend countless hours trying to develop activities, lectures, and readings that will best aid their students in understanding a concept. For instructors, especially veteran instructors, to be asked to make a drastic
change, such as integrating technology into their planning is a hefty demand. Teachers must learn the technology first, decide if it is relevant to their classroom, then strategically incorporate it into appropriate lessons. Cohen (1987) stated because a teacher is the leader of the classroom, if technology does not fall within the teacher’s realm of comfort, the technology will most likely fall by the wayside. In other words, if the teacher does not feel their classroom is in need of a change or upgrade, they would find it irrelevant to incorporate. A veteran teacher may take offense to mandatory technology integration if several years of successful teaching was already completed without it.

Learning a new technology can be difficult. A teacher must find the time, many times outside of work, to learn a technology. Many times teachers who have more experience teaching have less experience using technology. Attempting to learn a new technology may be difficult for a teacher who may not use it on a regular basis outside of the classroom. Some instructors must pay for professional development courses not only with their time, but also using their personal finances.

Based on the obstacles causing instructors to shy away from using technology, the reluctance to want to integrate technology is well grounded. In addition to obstacles in trying to integrate the technology, teachers may see the integration of technology in the classroom as directly detrimental to their job. Supposing technology integration may lessen the necessity of human instruction may leave instructors unmotivated to be a part of integration.

An avenue of technology integration at the college level is the choice of using online/distance learning courses. While these courses have both positive and negative
effects on student learning and classroom atmosphere, the instructor option of having online courses opens up several other discussions. Instructors may fear the more technology is used, and the more students learn using technology, the more likely administrators will be to start challenging the number of instructors it takes to adequately address the learning needs in the classroom (Burbules & Callister, 2000). In fact, it may even be possible that some day a corporate business can hire a professor for each subject and then sell lectures to universities (Burbules & Callister, 2000). Maryam (2001) discusses the possibility of using technology-mediated learning (TML) not only in the education realm but also the business world, arguing there needs to be more research done in this area to find out in what ways it is beneficial and in what ways it is not.

It is reasonable that some instructors shy away from technology usage in their classroom. Maryam (2001) points out instructors using TML generally integrate it fully, not incorporating a hybrid-style course. The technology itself takes time to learn, and if the instructor is concerned about job security once the technology is implemented, spending the time to learn the software and prepare the lesson may seem counterproductive.

Not only must the instructors be on board with the purchase and usage of technology, but the school/district must also be able to handle the technology. One of the many reasons why Hope (1997) stated technology is not being integrated into the classroom has to do with money. The district, school or department must have the funds to purchase all of the needed hardware and software. In addition to the funding, the physical plant housing both the hardware and the software must be able to handle its usage (Hope, 1997). In addition to the hardware and software costs, there are costs to
maintain the technology, costs for additional supplies, and costs for human resources (Kinnaman, 1994). Are these costs feasibly met? In today's economy, do schools have the money to try new technology they are not positive will aid their teaching or aid their students' learning?

Students also find some non-beneficial aspects of technology usage in the classroom. It is important to think about the cognitive level of the students in the course. Students are in the course trying to learn the content. If/when the content is difficult for them to understand, integrating technology may conceivably make the learning atmosphere worse.

From an instructor's perspective, when technology is integrated, the technology is new, but the material is familiar and well understood. However, from a student's perspective, both the technology and the content are unfamiliar, possibly causing stress.

If the software program is not user-friendly, and the students struggle to understand how to use it, the content can become almost irrelevant. In this case, students would rather use a paper and pencil approach and work to understand the material instead of spending time trying to also learn how to use and understand the software (D'Souza & Wood, 2003).

Many of the studies involving technology usage and the opinions of teachers and/or students focus on one kind of technology and its appropriateness in the classroom (Buteau et al., 2010; Dogan-Dunlap, 2003; Schmidt, 2010). The authors chose one specific technology or software program and discussed the strengths and or weaknesses of the software, many times based on a study done in their classroom with their students. For instance, Buteau et al. (2010) and Schmidt (2010), both specifically discuss computer
algebra systems (CAS) and their usage in the classroom.

The focus of this study is not giving the pros and cons of one particular software program in one particular setting. In this study, the perceptions of both college instructors and college students on technology usage in the classroom will be explored to see if they align or are skewed; and, also to test the existing findings in the literature.

**Purpose of the Study**

In an age when educators are encouraged to incorporate technology as a part of the curriculum, the voices of the students are (unintentionally) ignored. The aim of this study was to research online technology integration in the classroom from both the perspective of the college instructor and student. The goal of the data collected was to provide an avenue for both further discussion on technology integration and also provide a means for finding the most beneficial avenue for integration from dual perspectives.

**List of Research Questions**

1. What is the appropriate usage of distance learning in the college mathematics classroom from both the student and instructor perspective?

2. What are the similarities and differences found among the mathematics education students and the mathematics instructors’ perspectives?

3. What might these differences, if they exist, mean?

4. Where is there a disconnect or gap (either real or perceived) when comparing student and instructor perspectives?

5. How can the disconnect or gap be addressed?

**Limitations/Delimitations**

**Limitations/delimitations of my perspective as an instructor.** As an instructor, I have very little experience teaching mathematics online. While I do have opinions and
perspective on this type of teaching, they are based more on my experiences as a student
taking online courses and also my experiences as a teacher along with my philosophy of
teaching as a whole. While I do believe not having this experience is a limitation, it also
helped me keep an open mind when analyzing the data gathered.

Limitations/delimitations of my perspective as a student. I had a fairly
negative experience taking an online mathematics course. The online course integrated a
software program. Learning the program proved difficult, leading to several hours spent
in a computer lab on campus laboring through the software instead of spending time
learning the mathematics. While I do believe online courses can be very effective, my
personal experience was not a positive one. This may have skewed my view of how
online courses function.

Limitations/delimitations to instructor participants. The instructor
participants changed from proposal stage to implementation stage. Originally, only
mathematics instructors were going to be asked to take the survey and also potentially be
interviewed. Finding willing participants proved to be difficult. There were many
instructors who did not respond to the emails inviting their participation. Overall, I was
hoping to get more instructors who had a lot of online experience. However, the
instructors who did take the survey and participate in the interview had varying amounts
of experience along with varying perspectives on online learning in the mathematics
classroom. For this study, perspective was the key. I wanted to know how instructors
really feel about teaching this way. I do believe I obtained the information I set out to
obtain, just with a smaller amount of participants.

Limitations/delimitations to student participants. The original study was going
to discuss the perspectives of students from two universities with close proximity. After
discussion with my committee members, the pool of participants changed from just
mathematics education majors from two universities, to mathematics education majors
from any university. In addition, the stipulation that the student had to be a mathematics
education major was lifted. Finding willing college students was difficult. While faculty
emails are displayed on department websites, finding students’ contact information is
more difficult, as it should be. Because of the difficulty in finding student participants,
any college student was welcome to take part in both the survey and the interview. This
changed the dynamics of the study. The findings pertained to a more general college
student, as the participants were not major-specific. The students may or may not have
had experience taking online courses.

At first I was disappointed I was not able to get the student participation I was
aiming to find, but after the study was finished I realized the data collected was
unexpectedly rich. I was able to gain perspectives of students in all points of their college
career with varying online experiences. Some students had no online experience at all.
Some students had some online experience, but no online mathematics experience. Other
students had a lot of online mathematics experience. All of these experiences are useful in
answering the research questions.

Limitations/delimitations to the survey. Having students disclose their major
would have allowed analysis within this group of students. Using SurveyMonkey®
allowed me to describe my data quantitatively and also analyze it qualitatively. This tool
proved to aid greatly in the organization of my data. While SurveyMonkey® provides an
excellent tool to use in data collection, I believe instructors and students are still leery of
giving out information online. Clicking on a link within an email from someone you do not know is generally not encouraged.

This may have been detrimental to this study. More students and instructors may have responded if they were sent paper surveys.

Limitations/delimitations to the interviews. The interviews provided me with the richest data. I was able to discuss at length instructors’ and students’ perspectives as well as ask probing questions in order to clarify or deepen a response. There were limitations however, to the interviews as well. Having different modes to interview the participants was effective because I was able to interview more instructors than if I could only interview face-to-face, however, the results may have looked different had I used the same interview mode for all participants.

The ever changing literature. Research involving technology is ever-changing as new and different studies rapidly emerge. Additions to the literature base are thus occurring on a continual basis. I found this exciting, as new work was continually showing up in the scholarly literature base that added richness to my work. But, this meant the continual act of adding to my Chapter 2: Literature. This felt very disjointed. A more natural feel involved using the literature as I was analyzing the data and developing my discussion and results. Thus, literature relevant to the findings and emergent themes is incorporated into the discussion found in Chapter Five. This is not typical of many dissertations, but was necessary for me to lucidly connect my developing analysis to the evolving literature.
Chapter Two

Preliminary Literature Review

Lack of Research at the College Level

There is a lack of research focusing on technology integration, specifically distance learning at the tertiary level (Buteau et al., 2010; Shuell & Farber, 2001), specifically looking at both the perspectives of students and instructors. The NCTM encourages the usage of technology in all grades, starting prior to kindergarten. Technology integration is seen as a concept so important there is even a standard designated in aiding teachers to find the appropriate ways to incorporate technology into their classroom (NCTM, 2000). The research continues to grow finding ways and reasons to (or not to) use technology at this level, however perspectives from college students and instructors are not as prevalent.

According to Handler (1993), public schools are way ahead of universities in the attempt to integrate technology. Perhaps this is because of the encouragement from entities such as NCTM to encourage technology at the elementary and secondary levels. There are schools trying to follow the encouraged technological guidelines, however, research looking at perspectives from instructors and students at the college level is not as common. Questions such as: Is it working? What does it mean if the technology is working? Is it possible that universities can use some of the suggestions being made to elementary and secondary schools as guidelines for them as well? Even if universities are behind public schools in technology usage and integration, is this a bad thing? Even though the question seems to be “When will universities catch up?” perhaps there is a viable reason they have/have not decided to integrate technology.
Hope (1997) gives several potential reasons why technology usage has not become common place in schools. One reason includes the change in organization already in place in the school. Schools have a certain structure, a way in which the school “works”. The introduction of technology, or anything foreign to the normal structure can cause disarray within its fluid motion. Hope (1997) likens this structural change to an organ transplant within the human body. As a foreign object or organ is introduced into the body, the body as a whole must accept the new organ. If the body does not accept it, the organ is rejected. Technology can also be rejected within the school body, much like an organ can be rejected by the human body. Technology, too, can either be embraced or rejected in the environment of a school. Instructors not viewing technology integration as valuable will reject its utilization. For this reason, its positive impact must be sold to teachers in order for them to embrace its implementation. Rejection of technology integration may be done overtly, as instructors outwardly discuss their decision not to integrate it, or covertly as they decide more quietly they will not integrate it. Either form of rejection ends with a negative attempt at integrating technology into a school.

While there are several different kinds of technology usage, for this study, technology integration is thought of as implementing technology by almost submerging the students into its usage. It is not using technology to write a paper or search the internet, which Ertmer (2005) describes as low level usage, but making technology an integral part of the approach to learning, seeing the proper implementation of technology as the best way to teach a concept and the most effective way for a student to learn a concept.

A true integration, making technology a major instrument used in teaching,
requires implementing at least a partial constructivist classroom. Traditional lecture-style teaching and technology integration at a high level must allow students to use activities to explore and discuss. If students are truly going to use technology at a high level above word processing and simple internet searches, the atmosphere must be conducive for this to happen. Thus if the instructor is not in agreement with this style of teaching or willing to change, integration will prove to be difficult.

If technology integration is going to take place, instructors’ attitudes are extremely important. Placing technological tools into the classroom will not ensure correct usage, if usage at all. Instructors must be the ones who implement the technology (AL-Bataineh & Brooks, 2003; Callister & Dunn, 1992; Earle, 2002; Solomon, 1992). All components must be in place, but instructors hold the key. Depending on the kind of attitudes, the instructor’s feelings might be seen as an obstacle to learning, or the instructor’s attitudes might be seen as an optimistic opportunity. The instructors must want to integrate the technology and be willing to make some sacrifices to do so.

Providing professional development for instructors can be a financial burden. In addition to providing money for staff development, it is unreasonable to believe all instructors want to integrate technology and are willing to put in the time and effort to integrate it effectively. Because of this, Hope (1997) argued teachers must have an outside incentive to be willing to try new technology.

Keeping up with the fast-paced technological world is not an easy task. Teachers must learn the technology, decide if it is relevant for their classroom, and then implement it. This implementation can change the entire atmosphere of the classroom. For true integration to take place, teachers must implement a constructivist-style classroom, thus
if this is not already the case, the entire pedagogical belief system is overturned.

For a moment assume that in a perfect technology world, all of the participants are on board: administration, instructors, students and community all support an entire overhaul of a school and support the full integration of computers in the school possibly causing a pedagogical overhaul which may or may not be “needed”. The school must decide what technology would be most beneficial and decide whether or not the school can physically and financially stand such a drastic change.

There are positive and negative aspects to offering coursework online. The positive aspects include allowing students from many walks of life into the same classroom, but at different times. Many college students are not traditional in the sense they are only college students. Some are parents, some work other jobs and some live hours from campus. Online classes give students with varying schedules the opportunity to take college courses.

**Basis for Mixed Methodology**

According to Johnson and Onwuegbuzie (2004), the beauty of using a mixed method approach is being able to implement the strengths of both methods into one study.

**Participants.** Participants were gained by contacting mathematics department chairs and also mathematics instructors who then passed on a solicitation email asking for student participation in an online survey. The solicitation email can be found in Appendix A. In addition, some participants were found when a participating instructor asked her students if they would volunteer for the study.

Students who took the survey were then prompted to give voluntary contact information if they were interested in being interviewed. A full description of the
demographics of the participants can be found in Chapter Three.

**Survey.** The survey was administered online via SurveyMonkey® (found at surveymonkey.com). Copies of the instructor and student surveys can be found in Appendices B and C.

**Interviews.** Interviews were conducted with the participants who gave contact information within their surveys. In addition, to gain more student participation in the interviews, one of the instructor participants asked her students if they would be willing to participate in the interview process. At this point of research, the surveys were finished, so these students were not surveyed. Due to proximity only some interviews were done face-to-face. Other interviews were done via Skype, telephone, or email. There are positive and negative aspects to all of these means of data collection. Personal interviews and Skype interviews provided me with facial expressions as well as candid responses from the participants. Telephone interviews provided immediate responses, but without facial expression. Email responses lacked both immediacy and facial expression. Lacking these two aspects, however, is not necessarily a bad thing. Participants who provided feedback in this way were able to think clearly about the question and answer at their leisure, without feeling the unnecessary pressure of someone waiting for an answer.

**Analysis of the data.** The data was analyzed and described using both quantitative and qualitative means. A full description of the analysis is described in Chapter 3. While not exclusive, the main mode of quantitative data was gathered via the survey, while most of the qualitative data was gathered from the interviews.

**Quantitative.** Johnson and Onwuegbuzie (2004) list several strengths to incorporating quantitative research into a study. They discussed the value of the *number.*
Some of the data from my study, specifically the surveys, is quantified, such that a numerical value is placed on it.

For instance, one of the questions on the survey asked the instructors how important technology usage was to them, based on a numerical rating system. Another question asked how often they used technology in their classroom. The data produced from these questions was numerical.

This kind of data is quickly gathered, even when the group of participants is large (Johnson & Onwuegbuzie, 2004). Not only can the data be gathered quickly, but in some cases “numbers talk”. Numbers are seen as concrete data and they “speak louder” to people in power such as administrators and politicians (Johnson & Onwuegbuzie, 2004). A number is not subjective. No one interpreted the number. It came straight from the data set, so it is sometimes more powerful than an interpretation of a non-numerical piece of data.

Qualitative. “Qualitative researchers, seek to understand and interpret how the various participants in a social setting construct the world around them. To make their interpretations the researchers must gain access to the multiple perspectives of the participants” (Glesne, 2006, p. 4). Interviews of several different instructors and students in an effort to gain their perspective(s) on the usage of technology in the classroom were completed. Based on the research questions and survey responses, the goal was to interview instructors and students with varying experience.

The interviews allow for deeper understanding of the perspectives touched upon in the surveys. The participants' voice and perceptions are the data used to interpret and describe the differing perspectives.
Denzin and Lincoln (2003) emphasize the importance of keeping study conditions the same as the normal setting conditions. This was a pillar to my study. The goal of gaining student and instructor perspectives on online learning in the college mathematics classroom, requires the voices of these individuals while they are in the midst of taking or teaching mathematics classes. In this study I used a descriptive narrative approach, giving all participants a voice explaining and analyzing the perspectives of the instructor and student participants.

**Literature review continued in Chapter Five.** Chapter Five includes a richer literature review based on the modifications to the scope of this research study and the evolving scholarly literature connected to this study. The original proposal incorporated a literature review reflecting literature supporting general technology research at the college level. The goal was to gain perspectives from both instructors and students, but on technology integration as a whole. This would include any kind of integration such as calculators, SmartBoards®, software programs and online components. Because the scope of this research was deemed too large, it was scaled down to perspectives from instructors and students of online learning in the mathematics classroom only. To compensate for the lack of focus on distance learning education in the original literature review, Chapter Five includes a more elaborate literature component in conjunction with the discussion of the analysis of the study and scope of this research.
Chapter Three

Methods

Description of General Research Design

The first step in the research process was to survey the instructors and students. The surveys provided a foundation and general perspective of how the participants felt about the implementation of online mathematics classes. After reviewing and analyzing the surveys, the participants who disclosed contact information were contacted for an interview. Interviews were completed and an additional analysis was done on the interview data collected. Detailed descriptions of the research methodology and analysis process are found in this chapter.

Much of the quantitative data gathered was via a Likert Scale. Questions five, six, seven and eight are examples of questions gathering quantitative data (see Appendices B and C). These questions included asking instructors and students to rate characteristics found in online mathematics courses as to how attractive the characteristic is from their perspective. Another question with quantitative data asked instructors and students to describe the percentage of material provided in particular mathematics classes via distance learning methods.

Both the quantitative and qualitative data gathered through the surveys were used to decide whether or not it was necessary to administer interviews and also to use different ways to answer the research questions. Based on the responses from the surveys, it became apparent interviews would add richness and depth to the survey data set. I did not feel comfortable with the amount of data gathered from the surveys alone, leading me to want to ask the instructors and students more questions. I felt the interviews would
provide a clearer yet richer voice from both the instructors and students.

Instructors and students were asked more specific questions as to how the technology could be integrated (or was already being integrated) to enhance student learning. Instructor and student interview templates are included in Appendices D and E respectively.

**Rationale for Mixed Methodology**

It is difficult to stay up to date with an ever-changing world of technology, however universities have a unique quality other kinds of institutions and businesses lack. The student body is just as ever-changing as the technology. Instead of fearing a seemingly inevitable technology gap between the students and the faculty, perhaps embracing it will in the end aid students in understanding the intended curriculum via technological means familiar to them.

As previously stated, using a mixed methodological approach for this kind of study was appropriate. I asked why students and instructors find these technologies appropriate via surveys and during interviews. Instructors implementing technology into their curriculum were able to elaborate as to why and how they use technology during their interviews. Additionally, instructors not using technology were able to voice reasons for the lack of integration.

According to Johnson and Onwuegbuzie (2004), this mixed method approach allowed the use of positive aspects from both kinds of research, quantitative and qualitative, to best answer my research questions. This makes sense as the surveys gained insight of a large group of instructors and students while the interviews brought a voice to a more intimate group of instructors and students, gaining more detailed, personal insight.
Selection of Participants

My student and instructor participants changed. In Chapter 5 I discuss how the actual participants are different from intended participants discussed in the preliminary proposal.

Intended student participants. To gain the perspectives of student participants, the intent was to survey students taking an introductory education class taken by a large volume of students at two local universities. Based on the responses to the surveys, students who volunteered would then be interviewed.

In addition, I wanted to take a closer look at students majoring in Adolescent/Young Adult (AYA) mathematics education. The intent was to include and focus on one AYA mathematics class.

Actual student participants. After the proposal of this study the student participants changed. The modification is described here. The intent was to solicit students majoring in mathematics education at the secondary level (Adolescent Young Adult (AYA) majors) and students majoring in middle childhood education with a concentration in mathematics. Instead of focusing on two universities with close proximity, it was decided to broaden the scope of participants to several universities across the nation. Rationale behind this change was because it was thought that the students attending two universities so close together with similar demographics would possibly share the same perspectives, thus not gaining insight from instructors and students in other parts of the country.

There was also going to be a focus on students majoring in mathematics education for several reasons. First, these students have to take a wide variety of classes to complete their coursework. Within their coursework, they will have to take several different
mathematics classes. These students have a framework from which to compare their mathematics’ distance learning classes with other classes which they have taken. In addition, these students are future teachers. Because these students are the future education workforce, I felt their perspective was important. I also thought they might carry perspectives on both mathematical procedure and pedagogy, a dual perspective other students with differing majors may not have.

The actual student participants ended up being any college student willing to take the survey or willing to be interviewed. At first this was disappointing as I felt my data would be worth less than intended, however I do not feel this is the case. Because I was able to survey and/or interview students with varying backgrounds, the gained perspective is more general, instead of focused. The analysis holds valuable data for university math departments as the perspectives reflect an eclectic group of students.

**Intended instructor participants.** The instructor survey was to be sent out to all instructors at two local universities. From the respondents, five professors were to selected to interview. Selection was to depend on the survey responses, with respect to the respondents disclosing contact information. Respondents with differing perspectives were to be chosen.

All instructors who teach mathematics education courses to AYA majors were to be contacted to complete the survey. It was hoped that all mathematics education majors could be interviewed.

**Actual instructor participation.** After the proposal, the intended set of instructor participants were modified. Instead of focusing on two local universities, a wide variety of mathematics instructors from all over the region, if not the country were contacted via
email through internet searches of university mathematics departments. Again based on the responses on the survey, the necessity of follow-up interviews was determined. Instructors were also be given the opportunity to declare their willingness to be interviewed on the survey.

Unlike the student participants, only mathematics instructors and not mathematics education instructors ended up being the intended participants. Mathematics instructors’ perspectives are more relevant for this study because they teach mathematical content, not necessarily pedagogy.

Demographics

A total of 82 instructor surveys and a total of 148 student surveys were returned through SurveyMonkey® (via surveymonkey.com). Instructors were contacted at 98 colleges and universities in several states. Appendix F includes a table summarizing the participants in both the surveys and the interviews. In addition I conducted thirteen instructor and fourteen student interviews. Most interviewees were survey participants indicating interest via the survey in being interviewed. Five student interview participants volunteered after their instructor, who was interviewed, solicited interested students.

Instructor survey demographics. There were 82 instructors who completed the online survey. The instructors held a varying number of years of service teaching mathematics, with 35 (42.7%) instructors having greater than 25 years of experience in the mathematics classroom (See Appendix F).

Approximately half of the instructors had experience teaching mathematics online. Experience teaching online includes both completely online courses and also partially online courses. There were 43 (52.4%) instructors who had experience teaching
The instructors had a wide variety of course experience, with Calculus (86.6%), PreCalculus (65.9%), and College Algebra (64.6%) being the top three most-taught, while the most popular courses taught online were College Algebra (34.9%), Introductory Statistics (30.2%), and Other (30.2%). The first percentage in the last column of the table represents the percentage of instructors who have taught the particular course out of the total number of instructors who have taught mathematics online, while the second percentage represents the percentage of instructors who have taught the particular course out of the total number of instructors surveyed.

**Instructor interview demographics.** Out of the 82 instructors who participated in the surveys, 13 were interviewed. Interview participants had different lengths of years of experience with five instructors (38.5%) having greater than 25 years of experience, and a total of nine (69.3%) having more than 20 years of experience. Experience teaching online included both completely online courses and also partially online courses. There were 10 (76.9%) instructors who had some experience teaching mathematics online.

Instructors interviewed had experience teaching several different courses, with the most having taught College Algebra I (13, 100%), College Algebra II (12, 92.3%), and Calculus (11, 84.6%) (See Appendix F). The most popular classes taught online were College Algebra I (5, 50.5%), Calculus (6, 60.0%), and Introductory Statistics (4, 40.0%). The first percentage in this column represents the percentage of instructors who have taught the particular course out of the total number of instructors interviewed who have taught mathematics online (10), while the second percentage represents the percentage of instructors who have taught the particular course out of the total number of instructors
Student survey demographics. There were 148 students who completed the online survey. The students were in different places within their college careers. There were 21 freshmen (14.9%), 20 sophomores (13.5%), 20 juniors (13.5%), 25 seniors (16.9%), eight fifth-year seniors (5.4%), and 54 graduate students (36.5%). Approximately one quarter (26.2%) of the students had experience taking college courses either entirely or partially online (see Appendix F).

The students had a wide variety of course experience, with Introductory Statistics (57.9%), Calculus (33.8%), and College Algebra (63.9%) having been taken most often. The most popular courses taken online were College Algebra (36.4%), Introductory Statistics (29.5%), and Math Education courses (27.6%). The first percentage in the last column represents the percentage of students who have taken the particular course out of the total number of students who have taken mathematics online, while the second percentage represents the percentage of students who have taken the particular course out of the total number of students surveyed.

Student interview demographics. Fourteen students were interviewed. Interview participants were in various years of their college career. Most student interviews were generated from participants volunteering via the online survey, however a few interviews were generated through other means. Instructors who had taught online were asked if they would send or post a message to their students seeing if they, too would want to participate in the interview process. These students did not take the survey first, they were only a part of the interview process. For this reason, a complete summary of the student interview demographic is unavailable.
Analysis of Methodology

The methodology used proved beneficial in answering my research questions. Based on the surveys and interviews, the data obtained and analyzed served the purpose, however; if I were to do this study again, there are a few things I would change. First I would change the participants. Prior to gathering data, I incorrectly assumed anyone I attempted to contact would be happy and willing to take the survey and be interviewed. This was a false presumption, as finding participants was difficult. Not having the participants I originally desired, I changed the focus. While I believe the new focus is both worthwhile and appropriate to study, it was not what I originally intended. For this reason, I would need to rethink my method of gathering participants.

Secondly, I would rethink the survey questions. I asked a lot of questions which I thought would prove to be valid, providing me with rich data to analyze and report. While this is true, the data was almost too broad. If I were to do this study again I would refocus the survey questions. Even though the questions aided in answering the research questions, I could have asked the research questions to my participants directly. Instead, many of the research questions needed to by deciphered from within the responses given to related questions.

Third, I would also rethink the interview questions. I do believe the questions were effective in getting the desired perspectives, in turn I felt as if I was sifting through data to analyze the research questions when I could have simplified the process by asking the participants the exact questions to which I wanted answers.

Lastly, to analyze the data I read and reread interview quotations and then placed them into appropriate themes. The process proved to be effective, however, I need to
work on my efficiency. I looked at themes that were most likely irrelevant instead of focusing on the most popular themes. This was a learning experience.

I do believe the mixed methodology approach was effective. While much of my discussion is regarding the interviews, the surveys were needed to 1) find the interview participants and 2) know from where I should start asking questions in the interviews.

Survey and interview implementation. The survey was made available through SurveyMonkey® (surveymonkey.com) (see Appendices B and C). Instructors and students were able to provide anonymous feedback through the website. Participants were given a link providing direct access to the survey. The SurveyMonkey® software tallied, collaborated, and summarized responses using tables or charts. Responses to open ended questions were also available for analysis. The researcher can only see the date and time the of the participant’s responses. The only time a name may have been linked to a response was if the participant volunteered to be an interviewee. In addition, responses can be organized to see a summary of a particular question, or raw data from each participant can be analyzed separately. Filtering options are also available through the software. For instance, a filter can be set so only the participants who responded “Yes” to a particular question are summarized/analyzed. These types of filters can be applied or unapplied at the researcher’s discretion.

Instructors and students who voluntarily gave contact information were contacted via either telephone or email. The last survey question asked if they would be interested in being contacted for an interview. Only interested participants disclosed contact information. To preserve anonymity, participants could have been asked to contact the researcher if interested in an interview, however it was thought students would be more
willing to disclose contact information than actually contact the researcher, which could make the student feel uncomfortable.

It is important to note, however if the participant gave contact information then their survey was attached to their name, losing anonymity. While not ideal, survey information was analyzed more cumulatively than the interview information, thus having names attached to data was not as relevant. When analyzing the survey data, disclosed contact information was not linked to responses. For instance, if participant #63 had a response quoted in the analysis, the quotation was not linked to the student’s name in the written discussion. Great effort was taken to use the name and contact information for only contact purposes. The information gathered from interviews was analyzed separately from the survey information.

Interview participants were given a pseudonym within the analysis and discussion. For clarity, instructor associated pseudonyms start with a letter from the first half of the alphabet, while student associated pseudonyms start with a letter from the second half of the alphabet (see Appendix F). Pseudonyms were used so as a participant’s different responses were quoted, readers would be able to link responses to their participants gaining a better relationship with each participant.

One instructor participant (Barb) aided in finding interview participants. These students did not take the survey. I did not ask them to take the survey for a couple reasons. The survey data had already been analyzed and I had used the survey data to determine it was necessary to interview instructors and students, which was one of my main goals of the survey. Many of the participants who volunteered to be interviewed based on taking the surveys did not have experience taking online mathematics classes.
Because Barb was actually teaching online mathematics courses, I knew she had access to students who had taken online mathematics courses specifically. I felt as if my interview data would have been lacking had I not gotten at least a couple students who had online mathematics experience. Her students were able to provide me with this insight.

Survey results would have been slightly different if these interview participants would have taken the survey. Survey responses from these students would most likely have been biased towards online courses. They had experience with online courses and volunteered to participate in the interview process via their instructor’s solicitation. Passionate students are more likely to respond to such a call for volunteers. These students were not asked to participate in the survey because the surveys had been completed and the researcher had proceeded to the interviewing stage. Some students who had volunteered via the survey to be interviewed did not respond to emails asking for their preferred interview protocol. More interviews were needed from students having online experience. Barb was asked to seek volunteers from her classes, gaining an additional five student interviewees.

Interview participants chose the method through which they were interviewed. Interviews were done face-to-face, via Skype, over the telephone or by email. Instructor interviews consisted of one face-to-face, three Skype, five telephone, and four email. Student interviews consisted of one face-to-face, six telephone, and seven email. Because the goal of the interview was to gain unbiased perspectives from the instructors and students, the researcher attempted to keep personal opinions and perspectives undisclosed. The outline of the interview questions can be found in Appendices D and E.
The questions included here serve as the template used during the interviews. In many cases the questions only served as a guideline of the discussion that took place during the interview; and not all questions were always asked. In other cases several extra questions were asked in addition to the set questions. These extra probing questions were participant-dependent. As a rule, face-to-face, Skype, and phone interviews were kept to twenty minutes unless the participant agreed to discuss perspectives longer. Participants were asked if they could be contacted with further questions. While all participants agreed to this, few were contacted. The main reason for contacting them was for clarification on a written response.

All interviews except for interviews done via email were audio recorded and then transcribed by an outside source. These interviews included face-to-face interviews, Skype interviews, and telephone interviews. Audio recording files were too large to email, so they were sent via yousendit.com (which later transferred names to hightailit.com) to a transcriptionist from TranscriptionInternational.com, a site found by doing an internet search for transcriptionists.

Once an audio file was sent, a written file was emailed back from the transcriptionist within a couple days. Transcriptions were then analyzed. Audio recordings of the interviews and the written transcriptions were compared for accuracy, while making necessary corrections/modifications if the transcriptionist was unable to understand a word or phrase.

To analyze the interview data, the interviews were then read through at least three times. During each reading a different color highlighter was used to emphasize relevant responses potentially needed for future use. In addition, a quick-reference notecard for
each participant was made (see Appendix H). The notecard was used to give me quick reference to the overall perspective(s) the participant portrayed.

Several different themes emerged from the interviews. The themes were written down and the transcription data was then read through again. During this reading the themes were written in the open spaces near the response(s) regarding each particular theme. For instance, if a response to a question discussed the motivation of an online student, “MOTIVATION” was written in the margin/blank area. These notes made skimming the data easier when looking for a particular type of response later during additional analysis. Both survey and interview results were used to answer research questions. Interview questions were not finalized until the surveys were complete. The data gathered from the interviews was much deeper than the data from the surveys. Open ended response from the surveys provided some complex responses, however even those were generally limited to a sentence or two.
Chapter Four

Results

Initial analysis of the data began by examining the findings to the electronic survey. Included in Appendix F are both the demographic information for the instructors and students who participated in the surveys. In addition, a table of demographic information is included for the instructors and students who were involved in the interviews including their pseudonyms (see Appendix F).

Data Collection and Preliminary Results

The purpose of this study was to understand a) how college mathematics instructors perceive online learning in the college mathematics classroom b) how college students perceive online learning in the college mathematics classroom c) where there are gaps and overlaps within these perceptions d) what these gaps and overlaps mean and e) what can be done about these gaps and overlaps.

What is the appropriate usage of distance learning in the college mathematics classroom from both the student and instructor perspective?

Both the electronic survey and interviews were analyzed to answer this question. Instructor and student analysis for this question is based on question 23 from the survey along with question 1 from the interview.

Instructor survey themes. Question 23 in the survey asked instructors specifically about their perspectives on the appropriate amount of distance learning utilized in the mathematics classroom, based on their experiences (see Appendix B). The following themes emerged from the analysis of the data: Student type, Course dependency, Hybrid format, Student demographic, Instructor preference, Lack of
incorporation, and Other non-categorized themes. Table 1 gives the frequency counts for the previously mentioned themes (see Table 1). There were 60 participants who responded to this question. Some participants’ response touched on more than one theme, making the frequency total 66. A more complete description of the themes is provided. Because there were so many instructor and student responses for the surveys, pseudonyms were not used. A sequential delimitation was used for respondents (e.g., Instructor A, B, C). If an instructor was quoted for more than one response the letter was repeated. The same system was used for student responses.

Limited discussion is provided in this chapter. Chapter 5 looks more closely at the data gathered from interviews, discussing these themes more deeply.

Table 1
*Research Question One: Instructor Themes regarding Level of Distance Learning Incorporation in the Collegiate Mathematics Classroom*

<table>
<thead>
<tr>
<th>Theme</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student Type</td>
<td>14</td>
</tr>
<tr>
<td>Course dependency</td>
<td>12</td>
</tr>
<tr>
<td>Hybrid model</td>
<td>10</td>
</tr>
<tr>
<td>Student demographic</td>
<td>10</td>
</tr>
<tr>
<td>Instructor preference</td>
<td>3</td>
</tr>
<tr>
<td>None/very little incorporation</td>
<td>3</td>
</tr>
<tr>
<td>Other</td>
<td>14</td>
</tr>
</tbody>
</table>

*Student type.* The most commonly cited theme, Student Type, refers to the type of students instructors felt are most successful in a distance learning environment.

Instructors felt some student types are suited to be successful in face-to-face settings, whereas other types of students would be more successful in the DL environment.
Instructor A:

Many students utilize DL courses when their schedules do not allow for seated courses. A motivated student can be quite successful. Therefore, this option should be made available, but through advisement, perhaps students who would not benefit from DL courses can be encouraged to take seated ones.

Instructor A believes motivated students can be successful in DL courses, while students who are not as self-motivated may fare better in a face-to-face course. In addition, Instructor A believes advisors may even play a role in aiding students find their best course fit.

Instructor B said, “Students that are motivated, independent learners tend to excel in these types of courses.”

These two instructors believe motivated students are suited to be more successful in a DL setting. In addition, in some cases it is believed some students need to be steered clear of this environment though, if they are not necessarily motivated or if they struggle learning independently.

Instructor C said,

The appropriate use of DL is directly related to the student’s learning style. Some students need to be in a classroom; others are independent learners; most are in between. DL components for practicing skills are useful for most students; posting lectures – especially videos- is very helpful for all students. Many textbooks come with excellent assignment options that allow for hints, complete solutions, extra problems, etc. that really help the dedicated student. The instructor must be willing to really develop and/or monitor all DL use for it to be effective… and it has to counted in the grade for the course for most students to use it.

In addition to motivation, this instructor discusses the importance of student learning style. All students learn differently, making the classroom atmosphere better for some and online learning better for others.
**Course dependency.** The second most commonly cited theme regarded Course Dependency. Course dependency refers to responses indicating instructors believed the appropriateness of incorporating DL components into a mathematics course depends on the course itself. Instructor D said:

> For some students, it can provide wonderful flexibility but it is not for everyone. My experience is that students are far more successful in developmental math or liberal arts math DL courses. They have much more difficulty with higher level math DL courses.

Instructor D believed online learning in a developmental math course or a liberal arts math course was more appropriate than higher level mathematics courses.

Instructor E said,

> I think courses that focus on mathematical processes (problem solving, reasoning) are fine online. The same is true for courses that use software (Geogebra, etc.) as a primary tool. Some procedural courses (pre-calculus?) are not easy to transition to distance format.

Instructor E did not categorized all lower level courses as DL appropriate, but felt courses with an emphasis on processes or software were suitable for DL, but other developmental courses were not.

These instructors felt the lower level mathematics courses would be best suited for the distance learning format, using terminology such as “developmental math”, “prerequisite knowledge”, and “procedural courses” when describing where DL implementation would best fit.

Instructor F felt DL integration depends on the course style, describing a discussion-heavy course, as the best environment, stating,

> DL works well when the goal is building shared understanding of a concept through discussions. It is easier for me to use DL in courses for practicing teachers, where their discussions can focus on applications of the mathematics in the classroom.
Instructor F viewed a course teaching preservice teachers, where discussion is an important component, as a suitable setting for DL use. He did not mention procedural knowledge.

Instructor G was not specific as to where or how DL components should be used, but instead stated, “All math courses should be taught with varying percentages of DL components. This includes no DL component, blended, and fully DL.” This perspective alluded there are appropriate and inappropriate formats in which to incorporate such technology, but is non-specific as to what these settings were.

**Hybrid model.** Ten instructors felt the hybrid model, one where there are both face-to-face and online components, was the appropriate way to use distance learning. Some responses described a hybrid course where it has a face-to-face base class with the distance learning as an added component, while other responses posed the opposite course make-up, one where it has a distance learning base with a face-to-face added component.

One response where face-to-face is the base of the course was, “DL should be used to enhance the instructor’s lesson. They can also use DL to give feedback to students between classes.” Instructor H saw the DL component as an enhancement to the lessons in the face-to-face class, and also a mode of communication between class meeting times. Another response was,

DL simply provides more “tools” for an instructor’s toolbox. For example, students can view an online tutorial as many times as needed. Or, an online homework system may be able to provide them with instant feedback besides helping the instructor with the burden of grading.

Instructor I described having the DL component as one of the many tools an
instructor can use to teach her students. Students are able to watch lessons or tutorials as many times as needed. In addition, there are homework programs capable of providing students with instant procedural feedback.

While more instructors viewed DL as the added component to the already established face-to-face class, two responses viewed the classroom in the opposite manner, the DL component as the base of the class, adding face-to-face elements to it. One response showing this perspective was, “blended learning…maintain a classroom component, although minimal.” Instructor J felt although the face-to-face classroom component has value, it should not play a large role. Another response with a similar view was, “Supplement online component with some face-to-face lecture/review sessions or recorded sessions for playback and reinforcement.” Instructor K felt the face-to-face role is for lecture or review, although even these instances could be replaced with online equivalences.

**Student demographic.** Some instructors believe the change in student demographic plays a role in the appropriate usage of distance learning. Reasons such as family and career responsibility along with travel time are reasons some students choose to take DL courses. Distance learning provides an opportunity for students who could not otherwise take college courses making these courses a necessity for such students.

One response showing demographics as an appropriate argument for DL courses includes, “when necessitated by outside factors such as time, location, student availability, etc.” Instructor L felt logistical reasons may make online learning more appropriate for some students. Similarly, “in a DL course, one can easily teach students that cannot attend courses on campus physically,” voiced Instructor M. For various
reasons some students are unable to physically come to campus for a class. Online courses allow for students in this situation to still take college courses. Some of these students’ only option in earning a college degree is through DL courses.

The following two responses show support for distance learning courses, however only as a last resort. One response was, “DL courses could help a student who has no other means of learning mathematics.” Instructor N believes if students are able to learn mathematics in some other manner they should however, in some cases this is not possible. Only in these cases should students take online courses. Another similar response was, “It is useful for those students that have an issue with getting to the classroom (job, family,…) If a student can get to the classroom it is usually better for them.” Instructor O felt it is usually better for students to take face-to-face classes, but sometimes this is not a possibility, and in these cases DL learning is an appropriate option.

_Instructor preference._ Three instructors believed the appropriate use of DL is not just up to the student, but also the instructor. The amount of DL incorporated into a class would be the instructor’s preference.

Although I teach 100% online, I think that if it is possible, most students should take math in a classroom. If that is not possible, DL is a good choice if the courses are carefully designed and the instructor is active in the course.

From Instructor P’s perspective the instructor plays a large role in the design and success in a DL course. The instructor should play an active role in the course set-up and implementation.

Instructor Q said,

This is going to vary based on individuals and how comfortable they are
with DL and other technology. Starting out slow and gradually adding things each successive semester as the instructor is more comfortable with the DL components is probably the best approach.

Instructor Q felt the comfort level of the instructor plays an important role in the potential integration of distance learning components. Gradually adding DL components to an already established face-to-face course would allow instructors to maintain a level of comfort and confidence.

No/Very little integration. Some instructors feel DL has no (or very little) place in the college mathematics classroom. The three participants responding in this way did not give details as to why they feel this way. Responses included, “None whatsoever,” “very limited,” and “I think DL is a fraud.” These responses clearly show there is some resistance to the incorporation of DL into college mathematics courses.

Other. Unrelated responses either not fitting into any of the previously stated categories or not clearly answering the question fell into this category. While lacking frequency, these responses have merit. Instructor R says,

> There would have to be significant opportunities for interaction between student to student as well as student and instructor. Instructors would have to construct the learning environment very carefully and realize that more time will be needed than originally anticipated. Instructors will have to be willing to provide extensive feedback to students (through e-mail, chats, video conference, or phone call) as there will not be the opportunity for interaction in class. Synchronous meeting time for a content course would be especially important and that does not just mean watching a lecture.

This instructor gives many changes an instructor must be willing to make in order to have a successful online class, making a clear argument that transitioning a face-to-face class into an online class is not a simple feat.

Instructor S said, “The use of blended and distance-learning courses will increase in the next several years. Universities should start experimenting with those sorts of
delivery, to see which ones work for various audiences.” The increase in DL components seems inevitable in the near future. However, Instructor S believed universities need to be ahead of the curve determining how, when and where to best incorporate DL components.

Financial strain on a university may nudge them to implement more DL courses or components. Instructor I felt DL may be less expensive than face-to-face instruction, and for this reason using it is appropriate.

I think the traditional classroom instruction is more expensive than DL. I believe that there is room for alternate models of education which involve providing a different type of instruction with a smaller financial investment. DL is an example of such a model. I don’t know whether the different types of instruction could be more or less effective, but I am confident they could be more cost effective and for some applications, that seems to be a perfectly good reason to use them.

Possibly disregarding the best means of instruction for the students, sometimes financial obligations aid in decision making. This instructor feels because online courses may be more cost effective, a college or university may choose to teach courses via DL methods.

**Instructor interview themes.** Question 1 in the interview asked instructors specifically about their perspectives on the appropriate amount of distance learning utilized in the mathematics classroom, based on their experiences. For comparison purposes Table 2 summarizes the same themes found in the surveys using the frequencies found in the interviews.
<table>
<thead>
<tr>
<th>Theme</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student Type</td>
<td>1</td>
</tr>
<tr>
<td>Course dependency</td>
<td>6</td>
</tr>
<tr>
<td>Hybrid model</td>
<td>4</td>
</tr>
<tr>
<td>Student demographic</td>
<td>0</td>
</tr>
<tr>
<td>Instructor preference</td>
<td>0</td>
</tr>
<tr>
<td>None/very little incorporation</td>
<td>1</td>
</tr>
<tr>
<td>Other</td>
<td>1</td>
</tr>
</tbody>
</table>

**Student type.** Instructor responses shared appropriate DL usage depends on certain student types. One instructor cited the appropriate amount of distance learning depended on the student-type.

Well, I think it, in my experience, it takes kind of a special student to be a completely online or a completely asynchronous class, you know because a lot of our students now seem to have issues with time management, so without having those skills, I think it makes it a little bit more difficult. I think that math can be taught online really well and there’s definitely room for improvement in what I’m doing, but I think that math can be done and that it can be done successfully.

This instructor felt the students who are successful at managing their time are more likely to be successful in the online course, making these courses appropriate for those types of students. He also made it clear an online mathematics course can be taught well, and students can be successful.

**Course dependency.** Course Dependency was the most popular theme among the instructors interviewed. Six instructors believed the appropriateness of a mathematics course being taught online depended on the course itself.
Obviously, Learning Management Systems (Blackboard, Angel, etc.) can provide benefits to any course. But in my opinion not all mathematics courses are well served in a completely online format. It is most beneficial in a course without extensive computational needs (i.e. where traditional blackboard work is a large part of the course). For the course that I have put online (Elementary Statistics), I have used live online lectures as the foundation of the course (and a way to best emulate traditional classroom settings). So this component would be most important in my view, and yes, I have provided this to my online students.

Denny did not specifically name courses, other than Elementary Statistics, as being appropriate online candidates, but he did feel there were definitely courses more conducive to the online format. Courses where the traditional blackboard is not a necessity made the course more online appropriate.

Henry portrays his disgust for online mathematics courses as a whole, but finds they may be appropriate for some remedial courses.

…I am very ill disposed towards distance learning in mathematics. Perhaps remedial courses might be done via distance learning, using a computer-based system, such as Alex, because there, we don’t have much face-to-face contact anyway, and Alex tends to work pretty well in terms of helping students develop rote computational skills…So rote practice, I think is fine, with a computer based system and that would probably carry over to distance learning, but any course of substance, I think, is greatly compromised, by the very entity of distance learning itself.

He felt it is conceivable to believe computational skills can be learned using online format, but courses asking for conceptual understanding are more appropriate in the face-to-face setting.

**Hybrid model.** Four out of the 13 instructors believed the hybrid classroom is the most appropriate place for online mathematics learning. A classroom where there are both online and face-to-face components is the appropriate kind of online integration, according to these instructors.

The perfect course would have some face-to-face time as well as online
time. The face-to-face time would be used for such activities as explanation of complicated topics, testing, and opportunities for group work. The online time would be used for things such as lecture materials, self quizzes to help student access their understand questions from students and discussion. I would prefer a class with slightly more face-to-face time over online time.

Francine found value in both types of teaching mediums, giving specific criteria for when it is more beneficial to use the face-to-face medium as opposed to the components more appropriate for online use. Although calling them “web enhanced,” Carla (below) also believes hybrid courses are excellent.

A number of mathematics face-to-face classes at my college are what we call web-enhanced, where students do their homework online with MyMathLab. I feel that this is a great tool for students in the traditional classroom because they can get help while they are doing their homework by pressing “Help Me Solve This” or “View an Example” buttons. If problems still exist, students can click on “ask my Instructor” to get further clarification. Also, if a student misses class, there are videos available on the material that was presented.

The extra help MyMathLab (MML) provides students while doing homework played a large role in her positive perspective of a hybrid course.

**Instructor perspective on student demographic.** There were no instructors who mentioned student demographics, meaning online courses are appropriate for students who can not get to a face-to-face class because of reasons such as having another career and/or having a family, in a response to this question in the interview sessions.

**Instructor preference to teach online.** There were no instructors who mentioned instructor preference in response to this question as an appropriate reason to incorporate distance learning.

**No/Very little integration.** There was one instructor who felt there should be no online integration, if possible. Interestingly, Barb is an online instructor.
Well, I think although I teach math online, I really think that students probably would do better in a face-to-face classroom for most people with mathematics. However, I think if you’re going to teach math online, I really highly suggest that some program is used like, I don’t know if you’re familiar with MyMathLab software from Pearson?

While she taught online, she felt the face-to-face classroom is the best place for students to learn mathematics. However, she felt sometimes teaching online is the only option, so when this is the case using a prepared software program such as MML is an acceptable solution.

**Other.** Aaron’s response did not fit well within the other themes, so was categorized as Other. He finds great value in having student discussion as part of the mathematics classroom, and feels the online medium is an effective tool to advocate discussion. He said, “…I think that discussion part of it is important that sometimes students might not say things within the classroom that they’re first to say things when they’re grouped in a distance learning environment.”

He believed discussion is an important part of the mathematics classroom and felt the online component may allow students who would normally not have the confidence to verbalize their perspectives in the face-to-face classroom to use the online format to discuss their opinions.

**Student survey themes.** Question 23 in the survey asked students specifically about their perspectives on the appropriate amount of distance learning which should be utilized in the mathematics classroom, based on their experiences. The following themes emerged from the analysis of the data: Student type, Course dependency, Hybrid format, Student demographic, 100% DL incorporation, Lack of incorporation, and Other non-categorized themes. Table 3 gives the frequency counts for the previously mentioned
themes. There were 104 students who responded, while 43 students skipped this question.

A more complete description of the themes is provided.

Table 3
Research Question One: Student Themes Regarding Level of Distance Learning Incorporation in the Collegiate Mathematics Classroom (from surveys)

<table>
<thead>
<tr>
<th>Theme</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student Type</td>
<td>11</td>
</tr>
<tr>
<td>Course dependency</td>
<td>8</td>
</tr>
<tr>
<td>Hybrid model</td>
<td>41</td>
</tr>
<tr>
<td>Student demographic</td>
<td>11</td>
</tr>
<tr>
<td>100% online</td>
<td>3</td>
</tr>
<tr>
<td>No/very little incorporation</td>
<td>15</td>
</tr>
<tr>
<td>Other</td>
<td>17</td>
</tr>
</tbody>
</table>

Student perceptions on appropriate type of student in DL course. Student Type, refers to the type of students the participants felt are most successful in a distance learning environment. Some student types are suited to be successful in face-to-face settings, whereas others would be successful in the DL environment. Students who are strong mathematically or more motivated would be more successful than other students was one perception. Student A said, “Great for use with mathematically inclined students, but not good at all for those who struggle with math concepts.” A similar response was

Distance learning math courses are better suited for students who are better at math because they are free to move as quickly as they’d like. Students who are not as strong in math should take an in class math course so they can get as much face-to-face help as they require.

Student B felt while strong mathematics students would be better suited for an online mathematics course allowing the student to move through the material more
quickly. This instructor felt struggling students need face-to-face interaction to help them. Student C responded more generally, “I think it should be an option so that those who learn well with this type of education have the flexibility they like. However, I did not like being forced into it.” This student while feeling there are students who are suited for online courses, did not enjoy being forced to attempt learning in this manner.

**Appropriateness of DL course implementation is course dependent.** Course dependency refers to responses where students who believed incorporating DL components into a mathematics course depends on the course itself. Eight students felt the appropriateness of online incorporation depended on the course. A couple students were specific, stating lower level, computational course would work better in an online format than an upper level course. Student D said,

> Much of this depends on the ways in which students engage in the DL. If this is restricted to self-guided modules that the student can work through themselves focused mainly on computational accuracy, then the role of the DL course is to increase computational accuracy and should be used in courses focused primarily on computation. However, if the course is intended to deepen students’ critical thinking and problem solving skills. This should most likely be a mixture of self-directed work, streamed lectures, and virtual face-to-face meetings.

This student felt courses focused on computational accuracy are DL appropriate, while courses focusing on critical thinking or problem solving should have a more hybrid approach utilizing other kinds of class models.

**Hybrid model is more appropriate.** Hybrid model refers to the responses where students refer to having courses where a part of the course is held face-to-face, and another part utilizes DL tools. Hybrid model was the most cited theme, with 41 out of the 106 students feeling the most appropriate way to incorporate distance learning in a mathematics course is in a hybrid format.
Some students chose hybrid courses as their preference, but also made it clear there should be more time spent face-to-face while others felt the bulk of the course should be online with smaller face-to-face components. Student E said, “DL should be used to supplement on-site instruction.” Student E felt the online component should supplement the face-to-face instruction, allowing the face-to-face instruction to be the main source of instruction. “The appropriate use is for homework only.” Student F made it clear the actual instruction should be done face-to-face, leaving the online component for homework only.

Some students chose a hybrid courses as their preference, but made it clear there should be more time spent online, instead of face-to-face. Student G answered the question by saying, “75% DL 25% on campus.” This response did not include any more information or clarification, but made DL the main component in the course makeup. Another response was similar, but gave more specific details. Student H said,

I think that if used well, DL learning could account for almost 75% of the class. I would say that the other 25% of the class would obviously be tests on site and perhaps a weekly meeting so that students can meet other students to help form study groups and talk to the instructor face-to-face if needed.

Student H felt the tests should be administered face-to-face, and there should be other student-student, and student-instructor, face-to-face interactions, including weekly meetings along with the possible integration of study groups.

Finally some students chose hybrid courses as their preference, but were either non-specific with the way the course should be broken, or said the course should be 50% online and 50% face-to-face. One such response was, “I feel that the components in DL are useful for teaching and learning mathematics, but I think that being able to sit down
face-to-face with classmates and the instructor are very important.” Student I found beneficial components to both online and also face-to-face courses. Student J said, “hybrid courses are the most appropriate use in college mathematics courses. I like face-to-face but want the practice that the online modules can give without slowing down or waiting on the instructor to provide feedback.” The immediate feedback online courses can provide was an important characteristic for this student, while he also enjoys the face-to-face component.

**Distance learning course participation related to student demographic.** There are students who would not otherwise be able to take college courses were it not for online classes. Physically attending a class is difficult for individuals for many reasons, some being non-traditional students who have a career and/or family, along with students who physically live too far to drive to campus on a regular basis, or students who work during normal school hours. There were 11 students who cited student demographics as an appropriate reason to implement an online course.

One reason a student may not be able to attend class is because of traveling obligations or studying abroad. Student K said, “I think the appropriate usage of distance learning is to help out the students who cannot attend a class in person or who may be traveling for work or studying abroad.” In these instances, a student is unable to physically attend the class, but having an online component would allow this student to stay current with the class. Student L gave a similar response, “I think it could be very helpful for those unable to commute to campus regularly or are working full time and have multiple other obligations.

**Students feel 100% online mathematics can be successful.** There were three
students who felt a successful college mathematics course could be taught 100% online without having any face-to-face components.

I think MyMathLab was the best way to learn math. You had the opportunity to really learn the material. It told you when you were right when you were wrong and have the option to fix your mistakes, as opposed to in a classroom setting its either it’s right or it’s wrong.

Student M chose MML as the best way to learn math over having an instructor teach him the material. According to student M the instructor does not play a vital role in learning mathematics.

Students feel there should be no/very little integration. Fifteen students felt DL has no (or very little) place in the college mathematics classroom. Some students gave very little detail saying things such as, “Little to none. I feel that students need to be in class,” and “I think math classes should not be taught via DL courses.”

Other responses went into detail as to why the courses should not be offered in this manner.

I think that for a math course, it is very helpful to be in an actual classroom with a professor that provides explanations and examples that you can work through as a class, as well as being able to ask questions and get an immediate explanation. I do not see this possible in a DL course.

Student N valued the explanations and examples provided in the face-to-face setting, along with the immediacy he felt the atmosphere provided. However, these are components he felt are unachievable in a DL setting.

Other responses. Unrelated responses either not fitting into any of the previously stated categories or not clearly answering the question fell into this category. There were 17 Other responses.

I believe that DL has its place in a mathematics class, as stated above. It can be helpful in providing students with a “virtual teacher.” However,
sometimes DL can lead students to lose focus and ambition for the class. They feel disconnected from it so they do not seek help.

While Student O did not directly answer the question, the response has value as this student believes not having a human teacher, calling this a “virtual teacher,” makes maintaining focus and ambition difficult.

Another response not falling categorically into one of the other themes was,

If Skype was properly implemented then 100% DL courses would be more viable than they currently are. As it stands, it is hard to gain a proper level of conceptual understanding without student/instructor interaction. That combined with MyMathLab would be it [SIC] affordable and easier to schedule taking math classes at home.

This student did not see the current DL course as adequate in teaching concepts, only procedures, but believed with MyMathLab and an additional Skype component, a DL course would be appropriate for students.

**Student interview themes.** Question 1 in the interview asked students specifically about their perspectives on the appropriate amount of distance learning which should be utilized in the mathematics classroom, based on their experiences. For comparison purposes, Table 4 summarizes the same themes found in the surveys using the frequencies found in the interviews.
Table 4
Research Question One: Student Themes Regarding Level of Distance Learning Incorporation in the Collegiate Mathematics Classroom (from interviews)

<table>
<thead>
<tr>
<th>Theme</th>
<th>Frequency</th>
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</thead>
<tbody>
<tr>
<td>Student Type</td>
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<tr>
<td>Course dependency</td>
<td>0</td>
</tr>
<tr>
<td>Hybrid model</td>
<td>6</td>
</tr>
<tr>
<td>Student demographic</td>
<td>0</td>
</tr>
<tr>
<td>100% online</td>
<td>5</td>
</tr>
<tr>
<td>No/very little incorporation</td>
<td>1</td>
</tr>
</tbody>
</table>

Distance learning integration depends on student type. There were two students who discussed Student Type in their response to question 1 of the interview. When asked about the appropriate use of distance learning in the college mathematics classroom one student responded, “I would say that when it comes to distance learning in the college mathematics classroom it depends on the student. Is the student a visual learner or more of a hands-on learner?”

Pam viewed the appropriateness of DL depends on the student, where a hands-on learner may not be well-suited for an online class.

Another student believed students who are strong in math should take hybrid courses, while students who struggle should take face-to-face courses.

I have found that Math classes can be more difficult when they are 100% online. You have to diligently work on the new material and make sure that you completely understand each type of problem and how to solve it. If you do not understand something, you need to ask questions or make time to get tutoring in the Math Center. I think that a hybrid Math class would be the best choice for students who generally do well in Math and completely face-to-face classes are better for students who sometimes struggle with the material.
Yara is not specific on what kinds of things should be taught using DL or face-to-face methods, but is specific about who should take the courses. Struggling students would be better-suited having more face-to-face time with the instructor, while students who are stronger mathematically could take a hybrid course.

**Incorporating distance learning is course dependent.** There were no students who mentioned course dependency for question one of the interview.

**Hybrid model is the best course of integration.** Five of the 12 students viewed hybrid as the most appropriate use of DL in the mathematics classroom. The amount of DL incorporated into a course varied from response to response. Rachel said,

I think that math courses need to do them with face-to-face interaction but I think the computer distance can be utilized to give back formative data, make sure your students are on track and to also help keep track of the progress…I think you could even utilize it for quizzes. I don’t think some of the data should be done through the computer because you can’t verify credibility.

She sees the DL component mainly as a way for the instructor to communicate with the student and give the student feedback, rather than a mode of actually teaching and learning. The reason documented for not wanting more components online is because student credibility or integrity may be compromised in the online atmosphere.

Thelma said,

I definitely feel like there is a need for a recitation at least twice a week. I think it would be very helpful for the time to be used for practice problems and reviewing. The DL piece could come in with a lecture and sample problems done, so that students can listen to it more than once if needed. Also I think DL could be used in an online-chatting system that allows students to post questions or chat with other students or teaching assistants. Lastly, DL learning could be used in posting problems and having a recording of the professor working on the answers to the sample problems, so that students can review their own pace.
She felt a face-to-face component is a necessity, but DL could be used for the actual lecture, allowing students to re-watch lecture if needed. In addition, online could be used for chatting or discussion with the instructor or other students. This response was not specific about the role the face-to-face component would play.

**Student demographic plays a role in distance learning success.** While there were students who mentioned issues with student demographics as making 100% online courses desired, there were no students who put this as a priority in a response to the question.

**Students feel 100% online mathematics can be successful.** There were five students who said mathematics courses offered 100% DL were the best. Wayne said,

> The ideal situation for me (i.e. full time employment, family commitments, etc.) would be the online course and some type of ability to verbally speak to the instructor/professor and classmates. …maybe to at least have the option of some type of video conference or “ReadyTalk” conference call situation or even Skype as an available tool… Careers today are so time management focused and I literally will not make the time for more than one class a semester.

This was an example of a student who would truly like to take a course 100% online, but to do so and feel confident he would want a component tied in so he could communicate with the instructor in real time.

Zane said,

> I mean I think for a math class it does just fine to do the work online. It’s more based on numbers and things like that and not necessarily about communication skills. So I don’t really feel the necessity for there to be a face-to-face interaction with that. As long as the student has access to the instructor for questions on something he or she might not understand or a concept that they’re not getting, which in all the math classes I’ve taken, it’s been the case if we had a problem, we could always ask about it. But it gives you a little more freedom to learn and teach yourself, I think which helps you remember things better.
Zane felt there is no need for a face-to-face component, as long as the student has access to the instructor for questions. He enjoyed teaching himself believing he gained a better understanding when from his perspective, he was the teacher.

*Students feeling there should be no/ very little integration*. One student was adamantlly against having any DL components in a college mathematics classroom. Ryan said,

None. Mathematics tends to be a subject that the majority of college students do not like, but they do not realize how much they need it. Online learning in my opinion fosters cheating. I have heard of people who have had others take their online classes on their behalf and no one is the wiser…in a classroom setting this is much more difficult to do and people tend to learn better and retain the knowledge longer.

Rhett valued mathematics and felt students who take it online are likely to cheat because the subject is difficult for many students. He also believed students retain information longer if they learn it in a classroom setting.

**What are the similarities and differences found among the mathematics education students and the mathematics instructors’ perspectives?**

This research question was answered by comparing the themes which emerged from question four from the survey and questions two and three of the interview.

Demographically, the instructors and students are the same as the participants from research question one. However, it should be noted the instructors were all mathematics and/or mathematics education instructors, but the students were not all majoring in mathematics education as the question states. They were all college students in varying places in their college career at the time of the interview. In addition instructors’ experience teaching face-to-face, hybrid, and/or online varied, as some instructors had experience teaching in using all three methods, while others only had
experience using one method. Likewise, the students’ taking courses face-to-face, hybrid and/or online also varied, as some students had experience taking courses taught by all three different methods, while other students only had experience taking courses of one type. In addition, some students had experience taking online courses, but not online mathematics courses.

**Survey question four.** Survey question four asked the instructors and students whether or not they would be interested in teaching/taking a DL mathematics course. Results are summarized in Table 5 below.

Table 5
*Percentage of Instructors and Students Willing to Teach or Take Distance learning Mathematics Courses (from survey)*

<table>
<thead>
<tr>
<th>Willingness to teach/take online</th>
<th>Percentage of survey respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>37.3%</td>
</tr>
<tr>
<td>No</td>
<td>33.3%</td>
</tr>
<tr>
<td>Maybe</td>
<td>41.5%</td>
</tr>
</tbody>
</table>

When asked about their interest in teaching or taking DL courses, a total of 51 instructors answered the question with 32 instructors skipping the question. Nineteen (37.3%) of the instructors would be interested, 17 (33.3%) would not be interested, and 15 (29.4%) may be interested. There were 123 students who answered the same question, with 25 students skipping the question. There were 29 students (23.6%) who responded they would be interested, 51 (41.5%) would not be interested, and 43 (35.0%) would
possibly be interested.

**Interview question 2.** Question two of the interview asked the instructors and students their teaching/taking course preference: face-to-face, online, or hybrid. There were 13 instructor and 14 students interviewed. Table 6 summarizes the responses.

Table 6  
*Instructor/Student Preference in Teaching/Taking Courses*

![Bar chart showing preferences for teaching/taking courses among instructors and students.]

Of the 13 instructors interview six (46.2%) said they would prefer to teach a course in the traditional face-to-face format. Of the 14 students interviewed six (42.8%) would prefer to take the course in the traditional face-to-face format. One instructor (7.7%) and two students (15.4%) would prefer to take a course online, and six instructors (46.2%) and six students (38.5%) would prefer to take a course with both face-to-face components and online components (hybrid). This section is organized by Face-to-face, Distance Learning, and Hybrid as themes. Each section is then split into instructor and student responses. These responses are based on interviews responses.
**Face-to-face.**

*Instructors.* Instructors chose face-to-face as their preference for reasons such as working with people, communication issues, and delivering the material. There were several reasons instructors gave as to why they would prefer to teach a mathematics course online. Dal enjoyed teaching face-to-face because he likes working with people.

I would probably choose an in-class one because I like working with people and there’s more contact when I get to see the students, than contact with the online students is maybe some verbal, but a lot it’s over the internet and things, so it is not as personal.

His perspective was more personal preference, as he simply likes working with other people.

Another instructor felt the communication is superior in a face-to-face course, thus making this his preference. Jim said, “…in terms of delivering the material, doing it face-to-face is clearly the best way…in terms of communicating with the student, that’s what I would choose first.” While he went on to say he was very interested in seeing online teaching work in the future, he was content (and prefers) teaching face-to-face.

*Students.* Students also had various reasons for wanting to take courses face-to-face. The communication aspect was important for students as they desire immediate feedback from an instructor. Sarah responded, ”I have to be able to physically see my instructor in person and be able to interact with them while they are teaching and be able to ask questions right on the spot if needed.” She liked being able to see the instructor while the instructor is teaching, being able to ask a question and receive a personal response from the instructor in real time.

Paul had a similar response, “I would choose face-to-face, I think, because…I’m visual, so I have to see it done first and then do it myself and if I have questions next day,
I can come to class and get those questions answered.” He valued not only having the lesson taught in a face-to-face, personal format, but he felt comfortable knowing he could return to the class a day or two later, ask questions and get answers.

**Distance learning.**

**Instructors.** The one instructor who chose DL as her preference for teaching college mathematics courses enjoyed the flexibility teaching online provides. Carla said,

I definitely would choose teaching online over the other possibilities. In fact, I have taught completely online for many years. The major reason that I prefer online teaching is that it gives my personal schedule some flexibility. I do not have to be in the classroom at 8 a.m. every Monday, Wednesday, and Friday.

Her preference to teach online allowed her to teach mathematics without sacrificing the personal schedule she desired.

**Students.** The two students who chose DL as their preference for taking college mathematics courses both felt they were successful at teaching material to themselves, and also enjoyed having some freedom in their education, thus the online format suits them well.

As a student I’d rather have it completely online. Mostly because it really depends on the student himself. I, personally, am extremely good at teaching myself…people don’t work quite as well that way. Some people are more visual. They have to have an instructor in front of them to show what’s going on. For me personally, and for people who can pace themselves, I prefer 100% online because then I can stay home and teach it to myself when I don’t feel like going anywhere.

He both enjoyed learning on his own and in his own environment. However, he did realize this learning style is not the best style for everyone sharing some students are visual learners.

Zane felt the online atmosphere allows students to learn on their own. This
preference aids in learning and understanding the material more clearly.

…I think for a math class it does just fine to do the work online. It’s more based on numbers and things like that and not necessarily about communication skills. So I don’t really feel the necessity for there to be a face-to-face interaction with that. As long as the student has access to the instructor for questions on something he or she might not understand, or a concept that they’re not getting which in all the math classes I’ve taken, it’s been the case if we had a problem, we could always ask about it. But it gives you a little more freedom to learn, and teach yourself, I think which helps you remember things better.

While he mentioned communication as not being necessary, he did feel having the option of asking the instructor questions is a positive aspect. He enjoyed having freedom and felt he remembered things “better” if he taught them to himself.

**Hybrid.**

*Instructor.* Instructors preferring to teach hybrid courses had several different reasons for wanting a hybrid course, including level of the course while being able to also provide the face-to-face components students desire.

Aaron said,

I would choose a hybrid because…I like some of the off line things that distance gives you, but I also like that everybody comes together and everybody gets kind of a more holistic view as the entire class discusses.

He went on to discuss the level of the students plays a role in the kind of course being taught.

…it really depends on the level of the student in which I’m working with, as to what would be the most appropriate for them…a lot of people have developed procedural tools and those are great, but there’s got to be more conceptual tools developed that I don’t think people have really thought too much about.

Lower level procedural courses have more online tools created, thus making it easier to incorporate online components in these courses. Aaron saw value in getting all
students together and having a class discussion, which may be difficult in the online setting, at least the way it is configured today.

Jim believed “… for any class below calc 2 [SIC] I try personally to do combination, or some kind of online component.” He felt there is a lack of material for upper level mathematics classes above Calculus II. Students in these lower level classes are able to go online and find supplemental material to help them should they need it.

Students. Students had various reasons for making hybrid their preference. Students liked having the online component allowing them to re-watch lectures whenever they want. In addition students liked to have the face-to-face component, allowing them to ask questions and receive immediate feedback.

Walter responded, “Definitely the hybrid course would be the absolute best.” He went on to say he spent a lot of time trying to work backwards to figure out how to answer a question, when “so much time could have been cut off if I’d had the face-to-face time.” While having experience with 100% DL courses, Walter would have liked to have the face-to-face time to clear up misconceptions instead of trying to contact the instructor, only to get a response five or six days later leaving him wondering what he had asked days earlier.

Wayne responded,

I would take some sort of online and face-to-face course if time was not a factor. You cannot replace the interaction of folks in a face-to-face environment. I, personally, like to study in seclusion but do learn also in group settings when I am an active listener and am participating in discussions.

Taking a hybrid course would allow him to learn in a setting he prefers. He would rather study in seclusion, but valued the group setting where he could learn by
participating in discussions with the entire class.

**Interview question three.** Interview question three asked instructors and students how they would perceive success in an online course and how they would think their counterpart (how students would perceive teachers, and how teachers would perceive students) would perceive success. The themes emerging from the data were Grade, Emulate Face-to-Face, Maturity/Communication, and Other. Descriptions are included below.

Not only were instructors asked how they perceive success, but students were also asked how they believe instructors view success as well. Table 7 below summarizes the responses given showing how both participants view instructor success. Instructors had several different ways to measure success in the online classroom. While there were only 13 instructors and 14 students who answered this question, some instructors and students gave responses spanning across more than one theme, thus the frequency total does not equal the total number interviewed.
Instructors’ Perceptions of Success, from Both Instructor and Student Perspectives

**Success is based on grade.**

Instructors believe success is based on grade. Six out of 13 instructors and three out of 14 students felt instructors view success of an online course based at least in part by the grades students earn in the course. Grades considered satisfactory are different for different students, some simply wanting to pass and some wanting to earn an A. Benny said,

…while that’s (grade) one of the measures I would use too, when looking at whether an online course is a success, it’s not the only one. I think that you know, they are [SIC], there are other things that kind of play into that whether it’s the amount of interaction between students whether it’s you know the students feel comfortable asking me questions and I think that really plays a little bit of a role in determining online success as well.

While giving several sources of perceived success, Ernie definitely believed grade was one of them. He felt communication was a source of success as well.

Students perceive instructors to believe success is based on grade. Five out of the 14...
students felt instructors perceive success based on the grade the students earned. Sandy felt instructors would perceive grade to be a measure of success according to instructors, but he also felt instructors’ credit is misplaced. He said, “The instructor, I mean the goal is to have all your kids pass the class, or all your students pass the class… I mean you’re taking credit for people who pass the class that they taught themselves, it seems.” He felt the students are teaching themselves, so an instructor should not necessarily feel a sense of success for something the student themselves earned without the instructor ever teaching.

**Success is based on the emulation of learning objectives.**

Instructors believe success is based on the emulations of learning objectives. Instructors and students whose responses fell within this theme were the ones who viewed instructors as finding success when their online lessons emulate their face-to-face lessons or responses emphasizing meeting learning objectives as a way to measure success. If an online class can obtain the same learning objectives as a face-to-face one, it can be deemed successful. Four instructors and two students perceived instructors to believe online courses are successful if they emulate face-to-face courses or they fulfill the same appropriate learning objectives.

My initial goal for the online course was that it completely emulate the integrity of traditional course. In this sense, I’ve insisted on proctored pencil-and-paper exams (at campus or testing centers) for online courses. I use the same exams as in the traditional courses, and hence (hopefully) keep intact the integrity of the online course. I’d then measure success of the course in terms of student success…

While Denny measured the success of the course based on the grades achieved, he made a point to discuss the effort he put forth to make the online course as similar to the face-to-face course as possible.
Students perceive instructors to believe success is based on the emulations of learning objectives. Rhett’s response stated instructors’ view of success was based on the amount of material retained by the student.

...Instructors tend to believe a course’s success, whether online or not, based on the material students retain, thus the idea of a final exam to gauge the retention. With the online environment instructors have no idea who is on the other end actually taking the exams including the final examination.

He believed instructors, both online and face-to-face, look at the final exam scores to reflect upon student retention and understanding of the material presented in the course. He believed, however, this is not an accurate measure as the instructor truly does not know who took any exam, including the final. (See discussion on Integrity in Chapter 5.)

Success is based on maturity and the need to prepare students for future.

Instructors believe success is based on maturity and need to prepare students for future. There were three instructors and no students whose responses were categorized within this theme. Responses indicating student maturation and/or the student understanding as preparation for future mathematics courses as a perception of success were placed in this section.

I think the biggest thing is a philosophical point of view of getting the students to explore and think and reflect and potentially, well certainly communicate and problem solve. But they’re forced to do it in an environment that they’re not used to. They’re used to facial expression of the teacher, giving them clues as to if they’re on the right path or not, where they don’t have that in an online setting. So the teacher may think that ‘I’m getting them to stand up on their feet’, and the students are thinking ‘this is way too hard.’...

Aaron believed a successful online course should engage a student to explore, think, reflect, communicate and problem solve, however in attempting to do so may make the
course more difficult than a course implementing the same strategies with a face-to-face format.

Dal felt both grades and future mathematical success for the students were predictors of the success of an online course.

...obviously grading is a part of that both teacher and a student would agree on the same as if they pass the course or if they get their As or their Bs. I think an extra thing that as teachers we maybe consider a little bit more than the students do in their short run is how they are going to succeed in their next course after...

Again grades play an important role, but Dal also believed it was important the student is well-prepared for the next course. A passing grade, or even an excellent grade needs to indicate the student understands the material well enough to take the succeeding course.

Success is based on communication. Communication refers to the responses where communication played a role in the perceived success of an online course. Three out of the thirteen instructors felt success of an online course could be perceived through the communication occurring throughout the course, while five out of the fourteen students felt instructors perceive online success based on communication throughout the course.

Instructors believe success is based on communication. Benny discussed communication in two different ways.

I think there are other things that kind of play into that, whether it’s the amount of interaction between students whether it’s the students feel comfortable asking me questions and I think that that really plays a little bit of a role in determining online success as well...the interaction and the communication between students and teachers and all the students in class that to me is also a valuable piece of online learning, I think.

First he believed the students need to feel comfortable asking him questions. This leads me to believe the success of the course could be hindered if the
students do not feel comfortable asking him questions. In addition he felt the student-to-student communication along with the students (as a whole) and the teacher was also an important measure of success. It is important to note here, his response seemed to answer a slightly different question. The question’s intent was to find out how an instructor would determine whether or not a course was successful. His response explained how communication was necessary to make a successful course.

*Students perceive instructors to believe success is based on communication.* Zane believed both students and instructors measure success through communication. He said, “And so my measure of success was not just perfect performance to understanding the concepts…but because you have to show you understand concepts through weekly discussion and questions and things like that.” While he also said grades were important, Zane felt the instructors and students perceived success in the same way, basing perceived success on more than just grades, but weekly discussions as well. Communication is discussed in depth in Chapter Five.

*Other/no response.* There were two instructors and four students whose responses did not fall into one of the above categories, or they did not respond to the question at all.

Instructors have the responsibility to look at the class as a whole instead of individual success. While a student generally looks only at how he is doing as the student, the instructor must look more broadly at the success of the class as a whole.

One student felt instructors may not want to put forth the necessary effort to make a successful online course.

I think that the more sources that are posted and in depth instructions, the better. And I feel like an instructor may not feel the same in wanting to put
forth more information because it would take up more time and effort for them.

Pam felt the work needed to make an online course may be too much effort for an instructor to want to put forth.

**Interview question three regarding students’ perception.** Students were asked how they perceive success in an online course, and instructors were also asked how *they* believe students perceive success in an online course. Table 8 below summarizes the responses given showing how both participants view student success. Much like the previous section, while there were only 13 instructors and 14 students interviewed, the frequencies are higher than the number of participants if a response disclosed more than one success perception.

Table 8
*Students’ Perceptions of Success, from Both Student and Instructor Perspectives*

<table>
<thead>
<tr>
<th>Perception of Success</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade</td>
<td>7</td>
</tr>
<tr>
<td>emulate face-to-face/Learning Objectives</td>
<td>4</td>
</tr>
<tr>
<td>Maturity/Future Prep.</td>
<td>3</td>
</tr>
<tr>
<td>Communication</td>
<td>3</td>
</tr>
<tr>
<td>Other/No response</td>
<td>5</td>
</tr>
</tbody>
</table>

**Success is based on grade.** Four out of 14 students felt grade was how students perceive success in an online mathematics course, while seven out of 13 instructors view a student’s grade as the method students use to measure success in an online course.

*Students believe success is based on grade.* Pam said her grade is the way she
measures success, more specifically, if she earned an A, emphasizing she must earn the grade.

…A student would probably claim an online course is successful if they received an A. I would claim an online course to be successful if I receive an A, but I worked for it and learned from it. Why pay money if you are merely getting a grade but didn’t do anything to deserve the grade? I want to go to college to learn about my profession so I can be a better educator, but often times I learn what not to do as a teacher instead of the right way to teach.

Her goals as a college student went beyond getting good grades. Earning good grades, while learning important material was important to her. Unfortunately, she felt while being a student she has learned what not to do in the profession instead of learning how to be an effective teacher.

Thelma’s response was similar. She said, “In general, students think a successful class means that they earned a good grade and put the least amount of time and effort in it as possible.” She believed some of her peers desire good grades, but do not want to put forth effort to achieve them.

*Instructors perceive students to believe success is based on grade.* Seven instructors thought students perceive success based on the grade they earn in the course. Barb’s views mirrored what some of the students voiced.

Well I think the students’ perception is it’s successful if they pass it. If they get an A or B, then they think “Oh it’s great!” –and they’ll say a course is great even if it isn’t great if they got an A or B. If it is the worst course in the world, the least amount of work they have to do, if they get an A or B, it’s fine.

She believed students are so grade-focused they really do not care about the content they are trying to learn. They only care about getting a good grade in the course. Carla’s response was similar.
As a teacher, I feel that my online math classes are successful if my students are successful. If my students are successful, then they will consider my online math course to be successful. However, if students are not successful, then the fault in their mind lies with the course and not with themselves.

She felt students want to earn passing grades in order to be successful, however they do not take responsibility for their failures should they not pass the course. A non-successful student was then likely to blame the course, not themselves for not passing.

**Success is based on the emulation of learning objectives.**

Instructors and students whose responses fell within this theme were the ones who viewed instructors as finding success when their online lessons emulate their face-to-face lessons or responses emphasizing meeting learning objectives as a way to measure success. In short, responses discussing learning material instead of earning a grade, in addition to the responses directly parallelizing online and face-to-face courses fell into this category.

**Students believe success is based on emulation of learning objectives.** Three students believed online courses are successful if they emulate face-to-face courses or they fulfil the same appropriate learning objectives with students gaining understanding.

Paul’s view was opposite some instructors’ view stating he felt the instructor based success on grade, but he based success on content learned.

An instructor would say it was successful by the grade or the results that the students produce…I took an online course over the summer and I got a B, but didn’t really learn anything. The instructor would say okay, that’s good…

While several instructors believed students base success on grades, Paul believed the instructors perceive success based on the grades earned, when in reality the student may not have learned anything.
Instructors perceive students to believe success is based on the emulation of learning objectives. Three instructors thought students perceived success based on the amount they learned or how well the online course emulated the face-to-face course. Denny believed grades were important, however he also believed the students in the online course should receive the same quality education as the students in the face-to-face course.

My initial goal for the online course was that it completely emulate the integrity of a traditional course. In this sense, I’ve insisted on proctored pencil-and-paper exams (at campus or testing centers) for the online course. I use the same exams as in the traditional course, and hence (hopefully) keep intact the integrity of the online course. I’d then measure success of the course in teams of student success, While I cannot say for sure what the students perceptions are, I would guess that their online experiences have been mostly successful in their view and I don’t see any substantial differences in their perceptions from mine.

He spoke mainly about his role as a teacher and his perceptions of success, but then stated he felt students most likely felt the same way. He strived to provide his online students the same kind of education as the face-to face students, specifically by using the same exams in both classes.

Success is based on maturity and need to prepare students for future. There was only one instructor (and no students) who felt students would base success on whether or not a student was well-prepared for future mathematics courses. This category was kept as a sub-heading in order to parallel the subheadings in the previous section reporting instructors’ perceptions.

Instructors perceive students to believe success is based on maturity and need to prepare students for future. Francine said, “Yes, I think both would describe success as a grade of C or more in the current course, and the appropriate level of preparation for subsequent course…” She believed both grade and preparation for future courses were
ways students (and instructors) measure success.

**Success is based on communication.** Communication refers to the responses in which communication played a role in the perceived success of an online course. Five out of 14 students believed communication played a large role in course success while one out of 13 instructors believed students felt this way.

**Students believe success is based on communication.** Wayne explained his regiment in being successful. He did not base success on earning an ‘A’, but if he put in the effort described below.

I thought it was success in a couple of ways. One, I vigorously followed the syllabus for each class along with communicating with the instructor when I needed to. This was key to me being successful. Two, the discussion boards helped also when other students brought up questions and talked about current chapter contents. Three, I felt I had to put in quite a bit of time and effort, especially during the first few weeks of each class, to be successful. If I thought this was easy and simple to do, I cannot say I was successful even if I received an A for the courses I took.

This response strayed slightly from the intention of the question. The intent was to gain what criteria deemed a course successful to a student. While somewhat answering this question, he more accurately answered his perceptions to how he was successful in the course. It is still notable however, that to him communication played a large role in course success, just in a different way.

**Instructors perceive students to believe success is based on communication.** One instructor placed emphasis on the feedback students receive from the teacher.

He or she expects a certain level of communication and the like…I mean, the classroom environment provides feedback. The quicker the feedback there is, the better it is for a student, so there’s the promise of that in the internet class. And broadening the group of people with whom the professor can have contact...(a student would think) “As long as I can understand him or her and I can ask questions, get answers just the same way.” I don’t think there’s any difference in the perception….
Freddie believed students value communication regardless of the mode of teaching. If a student can ask the questions and receive helpful responses, a student would deem the course successful.

**Other/No response.** There were three students and five instructors who either did not answer the question or whose response did not fall into one of the above categories.

**Students’ Other responses.** Rachel said she felt students in online courses did not actually feel like they were learning the content, instead they were just going through the motions to get credit for the course.

I think students actually don’t feel like they’re learning, that they’re just kind of jumping through hoops...I think students right now are kind of put off by any time you expect them to just sit in front of a computer and learn.

She felt students had a negative connotation towards online courses as they believed they were simply going to sit in front of a computer and try to learn mathematical concepts on their own.

**Instructors’ Other responses.** Instructors’ responses falling in this category varied greatly. Aaron addressed the issue mentioned by a student in an earlier section. He believed students think they are working hard in an online course, while the instructor is not putting in the same level of effort.

I think a lot of students perceive an online class as one that they’re doing all the work and that the instructor is doing, I don’t want to say diddly, but yeah, that may be a perception on that it’s all in incumbent upon them.

Benny interpreted the question differently than intended, but gave a response worth discussing.

I really think the students are more open to it, but the professors may be a new professor who’s coming out and used to it would be open to it, but you get somebody who’s been teaching for 20 years, you know,
discussion, lecture, now it’s new work to go out and unless somebody’s already handed it to them and said just do this, you know, it’s a bit of work to change your teaching methods. So I think the students would perceive it as just another way to get instruction, and the teachers are probably more, ‘Oh great, I gotta learn more!’

Because there are several different ways teachers can present material, this professor believed students would take this mode of instruction in stride, while the instructor would perceive this mode of instruction to be a lot more work.

**Where is there a disconnect or gap (either real or perceived) when comparing student and instructor perspectives?**

This research question was answered by comparing the themes which emerged from survey question 26 and interview question nine. Some participant responses answering this question as a response to another question are also included here.

Demographically, the instructors and students are the same as the participants from research question one and two.

**Survey question 26.** Survey question 26 asked the instructors and students to share their perspectives of mathematics courses offered 100% online and also what tools are needed for these courses to be successful. Results are summarized in Table 9 below.
When asked about their perspectives on college mathematics courses offered 100% online and subsequently asked what tools are needed to make such a course successful, a total of 56 instructors answered the question and 26 instructors skipped the question. There were 104 students who answered the same question, and 44 students skipped the question. The emergent themes were Supplemental material, Student discipline, Integrity, Communication, Effective Instructor, Improved technological resources, Computer/software, and Other non-categorized responses. A more complete description for each theme is provided. Quotations from the top three most popular instructor and top three most popular student themes are also provided. The most popular instructor themes were: Communication, Improved technology resources, and Supplemental material. The three most popular student themes were: Communication,
Computer access, and Effective instructor (tied with Other).

**Supplemental material.** Supplemental material refers to items such as textbooks, publisher-provided material, and interactive student practice. Sixteen instructors (28.6%) and 16 students (15.4%) believed supplemental materials were essential tools for an online mathematics course to be successful. Supplemental material was the third most popular theme for instructors, but was not part of the top three most popular themes among the students.

Instructor P responded, “A good online tutorial system like MyMathLab is essential. I would NOT teach online without that tool.” For this instructor, the publisher-provided software program was essential to the success of the online mathematics course. Instructor U responded, “Appropriate software for the subject matter use. In mathematics GeoGebra and the TI-Nspire PublishView are good tools.” This instructor felt, depending on the course, there is appropriate easy-to-use software. Both GeoGebra and TI-Nspire are free online software tools. Instructor V who believed the online homework feature was key wrote,

Online homework problems where immediate feedback is given as the student answers each question are very valuable to making sure the student understands newly acquired knowledge and practices correctly. Online problems are even better if the students are able to see similar examples explained if they miss a question on the first attempt.

The need for immediate feedback for the students makes online homework an essential tool for this instructor. In addition software providing students with similar examples was an even more valuable resource.

**Student motivation/discipline.** Student motivation/discipline refers to the need for students to have self-motivation and self-discipline in order for them to be successful in
an online course. Five instructors (8.9%) and nine students (8.7%) viewed students’ motivation as an essential component for the success of an online mathematics course. This theme was not part of the top three most frequently mentioned themes for either instructors or students. However, it was an extremely popular theme among instructors interviewed. (See discussion of Motivation in Chapter Five.)

**Integrity.** Integrity refers to the need to have an effective tool used to curb dishonesty and promote student integrity. Responses emphasizing the need to have a tool in place policing the students taking the course, assuring the student responsible for the work is the student registered for the class. There were five instructors (8.9%) and no students who mentioned integrity as an important tool in making an online mathematics course successful. This theme was not part of the top three most frequently mentioned themes for either instructor or students in the surveys, however this too, was an important theme in the interviews and is discussed in detail in Chapter 5.

**Communication.** Communication refers to responses viewing communication as a key element in making an online mathematics course successful. Communication tools included a potential “Skype-type” classroom with the students and instructors able to communicate in real time, emails between students and instructors, video conferencing between students and instructors, office hours (possibly virtual), and discussion boards. Nineteen instructors (33.9%) and 34 students (32.7%) mentioned communication as being an essential tool for maintaining a successful online mathematics course. Communication was the most popular theme in both the instructor and student responses.

**Instructors view on communication.** Many instructors agreed communication was essential, putting the students’ needs as a priority and viewing students’ desire for
communication and feedback as a necessity. Instructor W said,

Lots of instructor communication to students. My students appreciate hand written responses to exams so I will continue to make use of PDFs for grading written work. Videos are important for some students so I will continue to use them as well. Organization is key to student success.

Based on the response, this instructor already provided some of this much needed communication, and based on the positive feedback he has received from the students he intends to continue his method of communication.

Instructor X’s response touched on three themes (Communication, Effective teaching, and Improved technology). Regarding communication, this instructor did not feel the current modes of communication were adequate in an online course.

Online learning would need to become more person-to-person than it presently is. Students cannot learn mathematics from reading. It just doesn’t work that way. They need more vibrant presentation, the Socratic method, and the ability to have a teacher who can present the material dynamically, by pacing the presentation and choosing what details to present in response to observing student reactions. It is possible that in the future some sort of “Skype classroom” will exist that will allow for that, though I’m still not sure how you could make it work asynchronously, you could make it work with requiring students to be physically present in the same location. Until then, though, math just does not work online.

This instructor was so adamant about mathematics needing a quality instructor demonstrating effective communication skills he did not feel mathematics courses should be offered without them. Online courses can not be achieved without improved technology.

Students’ view on communication. Approximately one third of the students also believed communication was crucial. Student Q said, “Clear and decisive instructions from your instructor. Frequent communication with multiple options for communication, such as email, Skype, and face to face meetings.” This response also encompassed a few
different themes (Communication, Effective teaching, Other-face-to-face meetings). Not only did this student see the need for communication, he felt there should be several different modes of communication. Student R said, “I think some kind of online forum or instant messaging would be important for students to be successful and feel supported in a DL classroom.” This student used the term “supported” alluding effective communication from the instructor encourages students, ensuring students instructors are supporting their efforts and are available to help.

**Effective instructor.** Responses indicating having an effective instructor makes an online mathematics course successful fell into this category. An effective instructor is one who was able to clearly instruct students providing relevant opportunities allowing students to achieve the course’s objectives. Three instructors (5.3%) and 20 students (19.2%) felt an effective instructor is a necessity. This theme was not one of the top three most popular themes emerging from instructor responses, however it was the third most popular emergent theme from student responses.

Approximately 1/5 of the students surveyed felt the instructor is an important tool for obtaining online course success. One student said,

I think it is necessary for students to be self-motivated and willing to set aside time for the course. They can’t just blow it off and procrastinate. I think MyMathLabs plus is good; it keeps you on track because homework assignments are due every other day. (I somehow still am able to procrastinate). Additionally, my professor for this course is very helpful. I haven’t had any questions about material but she is very prompt with returning emails and reminders. So, the instructor is valuable part of DL as well.

This student’s response spanned several themes, however focusing here on the role an effective instructor plays, she felt the instructor played a large role in the successful nature of the course, using communication as a key component to the
instructor’s helpful nature.

Another student also felt the instructor plays a large role in obtaining a successful online course, also linking the instructor’s effective teaching ability with the effective communication with the students. Student Q said, “Clear and decisive instructions from your instructor. Frequent communication with multiple options for communication such as email, Skype and face-to-face meetings.” This two-fold response linked the instructor’s ability not only to provide effective directions or lessons for the students, but also communicate these instructions and then support the directives with several different modes of communication.

**Improved technology resources.** This theme encompasses responses where instructors or students felt technology was a barrier to learning material successfully in an online course. The technology needed to make these courses successful is either not available yet, or is unfamiliar to students and/or instructors making these courses less effective than their potential. Fifteen instructors (26.7%) and 19 students (18.3%) believed technology needs to improve for online mathematics courses to reach their potential success. This theme was the second most popular instructor theme, but was not one of the top three student themes.

As noted earlier Instructor X’s response spanned several themes, including improved technology.

Online learning would need to become more person-to-person than it presently is. Students cannot learn mathematics from reading. It just doesn’t work that way. They need more vibrant presentation, the Socratic method, and the ability to have a teacher who can present the material dynamically, by pacing the presentation and choosing what details to present in response to observing student reactions. It is possible that in the future some sort of “Skype classroom” will exist that will allow for that, though I’m still not sure how you could make it work asynchronously, you
could make it work with requiring students to be physically present in the same location. Until then, though, math just does not work online.

Instructor X was skeptical about online mathematics courses in general, but focused on the need for a way for students to view the material dynamically while being able to present the material in real time. He was not against online learning, but did not believe it is currently as effective as face-to-face courses.

Instructor Y also saw a void in the technology available to teach online mathematics courses.

Video conferencing with simulated whiteboards is a must for discussion sessions and office hours. I also feel that with DL, computer-graded homework is not acceptable...so one would need some way to get students’ handwritten answers to graders. Tablet PCs would help here, I suppose.

Instructor Y needed to see what the students were doing, along with their thought processes. For this to happen, instructors need to be linked to the students’ work through modes such as simulated whiteboards. Many current textbook publisher-generated supplemental material have software-graded homework. While some instructors find this feature a must, Instructor Y needed to see the work of the student, and felt homework should not be graded by a computer or software.

**Computer/internet.** This theme is similar to the Improved Technology Resources theme, but is different enough, it needs to be its own theme. Responses simply stating a successful online course needs a computer, or the internet, or a free open-source software program fell into this theme, contrasted with the ways technology needs to improve to sustain effective DL courses as seen in the previous theme.

Three instructors (5.4%) and 21 (20.1%) students gave responses falling under
this theme. This was not a popular theme for instructors, but was the second most popular student response. Several student responses falling into this theme were very short, simply stating students need computers. A few responses were, “internet access computer/laptop/Ipad access,” “a computer,” and “computers with internet access.” These students stated the only thing necessary to have an effective DL course is a computer or internet. While not enough evidence is here to make a clear argument, this may reinforce what an instructor said earlier regarding DL being simply a different mode of instruction, but not one posing extra problems for students already familiar with technology.

**Other/would not do.** This category refers to responses not falling into any of the more popular themes. Or, the instructor/student simply stated she did not want to be a part of online learning in the mathematics classroom. There were eight (14.3%) instructor and 20 (19.2%) student responses falling into this theme. These frequencies make this theme tied for the third most popular theme within the student responses. It is not in the top three themes in the instructor response.

Student responses falling into this category varied greatly, but there were some emphasizing the need to have some classroom time, making DL only a part of the class. Student T said, “It needs to be used side by side with classroom instruction.” While the student did not answer the question as intended, he felt strongly there needed to be a classroom component to the course. Only a student who felt strongly about having this setup would veer from answering the question in order to make sure his perspective was made clear.

Student U said, “I think a combination of exclusively DL activities as well as exercises that connect DL to classroom time would be effective.”
Another student felt so strongly DL courses are not appropriate, he called them “anti-humanistic” and went on to describe the need to have face-to-face courses available for students, stating he “hates” online courses.

**Interview question 9.** Interview question nine asked both instructors and students their thoughts regarding courses offered 100% online. A follow-up question asked what is needed for such courses to be successful. Table 10 summarizes the instructors’ and students’ perspectives on the potential success of 100% online mathematics courses.

Table 10
*Instructor/Student interview question nine: a.) What is your perspective of mathematics courses that are offered 100% online? Can these be successful? If so, what is needed for them to be successful?*

<table>
<thead>
<tr>
<th>Responses</th>
<th>Instructor Frequency</th>
<th>Student Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>9</td>
<td>4</td>
</tr>
<tr>
<td>No</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Other/Did not answer</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>

Thirteen instructors and 14 students were interviewed. Two instructors and four students either did not answer the question at all or their response did not directly answer whether or not they felt a 100% online course can be successful. Nine instructors said online courses can be successful, several giving criteria determining their success. Two instructors said 100% online mathematics courses cannot be successful. Four students said online courses can be successful, several giving criteria determining their success.
Six students said 100% online mathematics courses cannot be successful. Each category from the table is discussed further.

Based on interview question nine, nine out of the thirteen instructors and four out of the 14 students interviewed felt online mathematics courses can be successful. With these responses, some instructors and students gave success stipulations such as having disciplined students, a caring instructor, appropriate course level, video conferencing and a course upholding high integrity.

**Disciplined students.** Disciplined students are defined as students who work diligently in order to ensure they fulfill their desired potential success. Both instructors and students discussed the importance of students’ discipline.

**Instructor responses on disciplined students.** Carla stated, “My classes are 100% online. These courses can be successful but it is a lot of work for all involved.” Benny, an instructor with at least six years of online mathematics experience said,

…a lot of it really does depend on how the student’s going to view the class, how much work and how much effort they’re willing to put in and if you have a highly motivated student or somebody who’s willing to sit here and ask you questions and willing to get on the discussion boards and say ‘Hey classmates, I’m having trouble with factoring trinomials. Can you help me out?’

Benny’s response continued with him explaining the amount of time and effort he, as the instructor had put in to trying to motivate his students, however his efforts failed unless the students themselves were already self-motivated. He felt outside motivation seemed to be wasted effort on the his part.

**Student responses on disciplined students.** Student participants also felt student motivation and/or discipline played a large role in online success. Pam’s response,

Mathematic courses that are offered 100% online can be a challenge
because students really need to keep up on the daily work. What is needed in order to be successful? Ultimately, I feel that a good professor is needed. It takes a hard working student to be successful in 100% online courses.

Pam believed it takes both a hard-working student and an effective instructor.

Wayne’s response mimics Pam’s, sharing the importance of student dedication and instructor efficacy.

It totally depends on the goals and desires of the students. More and more adults are entering college deep into their careers or after getting laid off with trying to start another career. It makes sense to save some time to do online courses. For the courses to be successful, you have to have good content to start with like *Smith College (name changed) has. But if you don’t hire the right instructor or professor who desires to do well and add value to the class, it won’t matter what type of content there is. In the end, the student is also part of the success. Bottom line, it starts with leadership at the top that has a vision for something to add value to folks.

He believed the success of online courses is multi-faceted. Students must be motivated, the instructor must be effective, and the content must be relative.

**Effective instructor.** Both instructors and students discussed the importance of an effective instructor.

**Instructor responses.** Instructor participants feel their role, or the role of any online instructor is important.

I think a really good teacher is adaptive to the students I think a fully online course that is just set up in the beginning of a semester and everybody rolls through it, it feels more like a machine…that adaptation is more difficult to deliver in an online environment because you have to create a bunch of different new resources and I think that resource creation takes so much time…

Aaron felt the instructor plays a large role in the success of the course. It is possible for an instructor to load a course and essentially let it ride the entire semester, making the instructor’s role nearly non-existent during the academic semester, however,
Aaron felt this adaptation of instruction is based on the needs of the students. Because online activities take a lot of time to create it is more difficult for an instructor of an online course to adapt a course or lesson to the needs of the current students.

Barb felt instructors play a large role in the success of online courses, not only viewing the instructor’s concern for the students as pertinent, but feeling there needs to be some sort of quality control in place so the instructors who do teach online meet certain criteria and/or are specifically trained. She said, “…you’ve got to have an instructor who cares and the course has to be designed well. It can’t be a mess where the students can’t figure out what’s going on.” A sound course is the instructor’s responsibility. The implementation of these responsibilities allows a course to be a potential success for the students. In addition, she felt a pedagogically-based quality control element should be in place. She stated, “…It’s got to be quality control where there’s somebody who knows something, not necessarily about your subject area, but about the pedagogy, to look at it.” Having someone aid instructors in making a sound course for their students makes an instructor and the course more successful.

Haley felt she is a better teacher when she teaches online courses. One of her responses, not as a direct answer to an interview question, portrayed herself as a better online instructor than a face-to-face instructor.

Another point I want to make is I think that in the last three years I have ventured into this online environment of my own choosing, I have become a better teacher. And I thought I was a pretty good teacher before…I think I’ve become a better teacher because I’ve ventured into the online environment because now I’m stopping and thinking about as the student looks, reads through this, if I’m not in the room, what is it that I really want to be saying and focusing on, and focusing their eye on in the slide presentation, and how do I structure my slide presentation to maximize their learning? And I never used to worry about that when I was in the face-to-face environment.
Not only are effective instructors important, she felt she is a better instructor when she is teaching online courses. Her preparation for online class was different and more well-thought-out, than the face-to-face courses she has taught. She gave deep thought to how she could portray the information so her students would have the greatest likelihood to understand the material.

Student responses. Pam believed having an effective instructor is imperative to student and course success.

Mathematics courses that are offered 100% online can be a challenge because students really need to keep up on the daily work. What is needed in order to be successful? Ultimately, I feel that a good professor is needed. It takes a hard working student to be successful in 100% online courses.

Even though she felt students are part of the course success, she used the word “Ultimately” when describing the vital role instructors play in the course.

Appropriate course level. Some instructors felt lower-level service courses are more prone to online success than upper level courses, while some instructors felt the opposite. However, for this particular question in the interview the instructors who addressed Appropriate Course Level made it clear lower-level service courses were more appropriate online than upper level mathematics courses. One reason they felt this way was because of the resources already made for this level, whereas upper level courses do not have this component as readily available.

Students did not discuss the course level in response to this question, except for stating the content needs to be “good”.

Instructor Responses. Henry, an instructor adamantly against teaching mathematics online at the college level stated,
I think a course that is basically aimed at developing computational skills using reliable software to assess and implement the instruction, such as Alex, which is, we find to be pretty effective at this level. That I think can work fine, and you know how far you can carry that, I don’t know. There’s a point of transition where mathematics ceases to be computational and starts to be conceptual, and as that point of transition is reached, I think distance learning format becomes less successful.

He did not describe the points where online learning becomes less successful, but definitely believed there was a fine line indicating which courses are taught successfully online.

Without giving as much discussion, Cal, a retired instructor having the same mentality stated, “I suppose that some lower level courses could be successful this way, but I don’t really know what would be needed there. But I don’t think upper level courses would be at all successful that way.”

*Student responses.* Sandy discussed Appropriate Course Level in response to question 5. He believed if a student was interested in simply completing a course, online would be an appropriate avenue, while if learning the concepts is of importance, students should not take online courses.

It depends. Me, personally, my degree is going to be a checkbox and some interview where it says, “do you have it?” --and that’s pretty much all it’s there for. I don’t see myself using Calculus I or Calculus II down the road so anything I might not have been able to pick up from the classes, I don’t see affecting me later down the road. Now if you get into people taking algebra or more common math classes that are using in everyday life for jobs and stuff, there’s certain stuff you can’t pick up online that you can get by not knowing, compared to class. So I think it’s detrimental as far as learning all the material in that class, as far as tests and courses are concerned, and it’s a positive for getting through the course.

While he enjoyed teaching himself the material in the online class he divulged his lack of deep understanding for the material, and additionally he truly did not think it
matters in this situation. He realized his understanding of the material taught was less than adequate, however, he also believed he will not need the material in his future, thus the class became a simple hurdle over which he had to jump.

**Technology resources.** Technology Resources refer to the extra resources instructors need to make an online course successful. Many times this means more than just a computer and internet access. Instructors and students alike recognize the need for these extra needed resources.

**Instructor responses.** Instructors need technology to deliver online courses. In some instances instructors felt the technology currently available to them was adequate, while others felt in order to provide the best atmosphere in a 100% online course there are some missing resources.

I put the following two things as imperative for a completely online mathematics course to be successful: - live online lectures. (I use videoconferencing and an online whiteboard to as-best-as possible emulate a live classroom). Also, live online office hours as well. Proctored exams to preserve the integrity of the course. Other than these two items, there are certainly huge benefits that the myriad of available online tools can provide to both the teacher and student, and such a course can in theory be just as good or better than a traditional course.

Denny believed live online lectures and live online office hours in addition to proctored exams were imperative believing online courses can be just as good if not better than face-to-face courses. Aaron wanted more. He stated (in response to a different question),

Well, I think that one of the things that can be done is literally [SIC], but it would require technology to catch up and that everybody would have access to the technology. But literally a kind of meeting, electronic meeting in which everybody connects in an electronic environment where all the students come together at one particular time of the day and you have these conversations, so you could potentially do a classroom meeting, but that classroom meeting being in a distance mode…and that
there would be a community whiteboard or something like that. But I don’t think we’re there yet. I don’t think we have the technology to be able to do that that everybody in the classroom would have that, especially from home….It would be worthwhile to try to see how that would run.

While there are several resources available to instructors, some instructors felt the lack of resources made it inadequate for them to deliver a successful online course. These resources would allow instructors to “emulate a live classroom” to the best of their ability. Denny on the other hand believed what he was currently using seemed to be sufficient.

Student responses. Students, who are likely at least as technologically savvy as the instructor, recognize the need for such resources. Many of the resources fit hand in hand with communication resources. Students were looking for video conferencing and live chats. They wanted to communicate with instructors in an almost face-to-face format.

One example came from Tierni. She talked about an “interactive Skype class”.

I think that you could do an interactive Skype class where you could raise your hand or you know where the students watch the professor do problems, and they could write it, watch her write it out even, I’m sure there’s technology that could do that.

In addition to feeling a Skype-type classroom would be beneficial, she also said it would be helpful for the student to see what the instructor is writing and went on to say, “I’m sure there’s technology that could do that.” Even though she was sure of its existence, she had not experienced the technology she describes.

Instead of having a Skype-type classroom, Yara wanted to simply see video conferencing, presumably instructor-student conferencing. She said “I think that setting up video conferencing would help many students.” While technology may not be ready for a Skype-type classroom, it is possible to Skype one-on-one with students.
**Integrity.** Online courses may make it easier to be less than honest in an online mathematics course than in a face-to-face mathematics course. Because much of the course work is done from home, monitoring who is actually doing the work is difficult. For this reason, some instructors and students worry about upholding the integrity of the course and the honesty of the students.

**Instructor view.** Some instructors worry about who is actually taking a course. If a course is completely online it is feasible a dishonest student could pass the class without ever doing the work for the class. Besides live online lectures, Denny felt he must have “proctored exams to preserve the integrity of the course.”

Francine felt the same making the proctored exam a must-have.

100% on-line courses certainly can be successful if there are some important criteria for grading included. Proctored exams are a must to maintain any level of course integrity. Please note that proctored exams may be taken in any testing site - at a college, a testing center such as Sylvan, or at the instructor’s campus. If proctored exams make the course not 100% on-line, then I would say that the courses that are entirely on-line including exam are basically worthless. There is no way as yet to verify who is submitting the exams and papers. The integrity of such courses is compromised if only the final is proctored, there is still some danger of the courses integrity being compromised.

Francine believed the proctored final exams either makes or breaks the online course. With the proctored exam the course upholds a level of integrity which is lost without it. For her, an online course could be successful with a proctored final, but without the final the course results would not be valid.

**Student view.** Ryan, a student against online mathematics courses mainly because of the potentially dishonest student said,

I do not like them, nor do I think they can be successful. The only way they could be somewhat successful would be to make students take all of their exams in a secure testing facility or in class with the instructor. But,
that is not 100% online then.

The reason Ryan believes online courses are not effective is because of the integrity issue. Requiring students to take proctored exams is his proposed solution, however he realizes this type of exam would perhaps deem the course hybrid instead of 100% online.
Chapter Five

Discussion

Discussion of Emergent Themes

There were several emergent themes within the interviews. Chapter five looks at the three overlapping instructor and student themes: Integrity, Future Prevalence, and Communication. Motivation was a theme most often discussed with instructors while Deep Understanding was a theme most often discussed with students. Each theme is discussed below in detail including quotations from the instructors and students involved in the interviews.

Integrity

Dishonest behavior in the classroom is not a new phenomenon. Instructors of traditional face-to-face courses are aware of the potential dishonest student. Because there can be a lack of student integrity in face-to-face courses, it makes sense to ask instructors and students their perspectives on the honesty and integrity of students who take online mathematics courses, where it may be even easier to cheat.

Originally termed “student reliability” meaning the instructor could rely on the student to be honest about his/her work, after interviewing several instructors and students it became apparent student reliability was not the best phrase to use to describe the honesty and integrity of online learners. Instructors and students had different interpretations giving their perspectives on a wide variety of issues, not all related to the academic honesty and integrity of students taking online courses. The phrase was changed to student integrity, at the suggestion of one of the participating instructors, to better reflect the interpretations of participants.
The original question read, “Do you think student reliability is a problem in distance learning mathematics courses? What can/should be done about this?” The intent of the question was to find out if the participants (both instructors and students) felt students taking online (mathematics) courses, or any courses for that matter, were being honest (See definitions in preface). I was looking to find out if the perspective was that students were doing the work themselves and earning the grade they deserved. After asking the question a few times, I realized instructors and students did not interpret the question the way I intended. One of the instructors suggested I change the term to “integrity” instead of “reliability”. This question was extremely important to me as there were students and instructors who responded to the survey indicating they were skeptical students were being honest. It was suggested there were students who would find other students stronger in mathematics to take a course for them. Other responses indicated it was unclear as to what actions would be deemed “cheating”. For these reasons, I found it important to change the wording in order to gain the perspective I wished to gain.

Students valuing integrity submit their own work without soliciting aid from unauthorized sources. The grade earned by these students reflects work done by the student enrolled in the course.

There are two particular ways students can be dishonest about their work. The first is using unauthorized sources at inappropriate times. During an assessment, it may be forbidden to use online calculators as an aid. An online calculator could be simply a traditional calculator, or a device used to calculate derivatives, integrals, volumes, or any preloaded mathematical calculation. If a student is taking an online course and taking the exam from home, it is essentially impossible for an instructor to monitor the resources the student is using during any particular assessment.

The second way students can be dishonest is by having someone else take a course or specific assessment for them. In this case, a student may sign up for a course, a
grade is assigned to the student, but the work is actually done by someone else. Reasons for having someone else take a course for the enrolled student could be because the student does not have time to take the course, or because they are not confident they can successfully earn a desired grade.

Both students and instructors discussed the issue of student integrity Not only did they give their perspectives on whether or not they felt it was a problem, they also gave several remedies to the problem, citing many different ways instructors can try to ensure the student earning the grade in the course is truly deserving.

Maintaining student integrity in the tertiary classroom is not a new phenomenon, however offering online courses which are believed to make cheating even easier is worrisome. It is logical to believe a course where students are not monitored in a face-to-face setting would be more likely to cheat than those in a traditional class. Research on student integrity issues in online courses is quite limited, (Grijalva, Nowell, & Kerkvliet, 2006; Watson & Sottile 2010) thus making the findings in this study relevant.

In a survey done by Grijalva, Nowell, & Kerkvliet, (2006) results showed students were no more likely to cheat in an online course than in a traditional face-to-face course. In an online course, the geographic distance between students makes collaboration difficult, thus finding someone to cheat with becomes more burdensome. In addition, they found students surrounded by a culture where cheating is thought to be acceptable are more likely to succumb to this atmosphere and participate in less than honest activities (Grijalva, Nowell, & Kerkvliet, 2006). Students in an online class, therefore are not physically surrounded by this atmosphere. It is likely the student knows no one in the course. Results from a survey given by Watson and Sottile (2010), showed students in
face-to-face class were actually more likely to cheat than students in an online class.

Other studies found lack of integrity to be a problem. In an Australian study, Maslen (2003) found approximately 80% of undergraduate students admitted to cheating sometime in their college career, while an alarming 54% of post-graduates claimed the same behavior. King et al. (2009) also believe it is a large problem which has been minimized by other researchers, including Grijalva, Nowell, and Kerkvliet, (2006). Based on findings from their study, one reason students are more dishonest is because they do not know what constitutes cheating. For instance, in an online course, is it acceptable to work with another student on any assignment? Some assignments? Is it acceptable to use online resources to aid in understanding a concept or procedure? Is text or instant messaging a student to help with a problem acceptable? What about getting personal help during an online assessment? Questions such as these were asked of participants in their study. Several students did not find such behavior as inappropriate, especially if the instructor was not clear as to the rules for the online course (King, Guyette, & Piotrowski, 2009). Scanlon (2003) described the saturated resource space found online as “fair use,” claiming students believe if they can find it online they are free to use the information. Correcting dishonest behavior when it is thought to be permissible is difficult.

Tertiary students feel stress and pressure to perform well. This burden can feel even stronger as a student is isolated in the online classroom, lacking the instructor-student interaction they may crave which is available in a face-to-face class (Gibbons et al., 2002). In addition, some students choose to take a course again after a failed attempt in the face-to-face classroom, now in the online environment. Gibbons et al. (2006) see this scenario as leading to disaster as the weaker students are possibly attempting to
remove the instructor from the course in an attempt to aid in understanding, believing they could be more successful with less involvement from the instructor.

Bunn et al. (1992) described two types of cheating: planned cheating and panic cheating (Bunn, Caudill, & Gropper, 1992; Grijalva, Nowell, & Kerkvliet, 2006). Cheating using premeditated means constitutes planned cheating. Planned cheating includes copying homework, making a cheat sheet or plagiarizing someone else’s work, with full knowledge of the inappropriateness of the behavior (Grijalva, Nowell, & Kerkvliet, 2006). Panic cheating occurs in the heat of an assessment when a student does not know how to answer a question, and thus copies off a paper in view. According to Bunn, Caudill, and Gropper (1992), more students are believed to participate in panic cheating than planned cheating which may be a positive aspect of online courses, as would-be panic cheaters do not have anyone from whom to cheat off.

Assessments in online mathematics courses may lend themselves to dishonest behavior. In courses where term papers are the basis for assessment, instructors have resources available to check the legitimacy of the student’s work (Heberling, 2002), however in a mathematics or science class where assessing a student may be an objective correct or incorrect response, cheating can be more difficult to detect (Watson & Sottile, 2010). Students not only have online resources available to them, but also human resources in friends or acquaintances who may help the student complete the assignment.

In an effort to monitor students taking assessments, some institutions have implemented proctored examinations, a potentially cumbersome, time-consuming task. In addition, the flexibility claimed by online courses is compromised if students are asked to take an assessment at a certain time/place (Watson & Sottile, 2010). Based on the
research, mixed results from the research, it was necessary to find out what perspective instructors and students have on the topic.

**Instructors’ perspectives.** Many instructors interviewed felt student integrity was a problem. One said, “This is the biggest worry.” Denny stated, “Integrity and honesty will always be an issue in online settings.”

Others saw the problem but did not see it as being any more of an issue in distance learning courses than it is in traditional face-to-face courses, with one instructor wondering if perhaps student integrity issues are simply ignored in more traditional settings. Haley responded by saying, “I think student reliability with distance learning could be an issue but I think it’s an issue now [in traditional face-to-face courses] and we just ignore it.” Additionally, Denny stated, “I’ve struggled with the notion that I’m still not completely sure that students taking my online quizzes are who they say they are. I don’t see this as any more of a problem, than it is in the traditional classroom (where it is still a problem as well!)” (Denny, personal communication, Sept. 19, 2012).

Many instructors did not specify what kinds of courses seemed to be conducive to cheating, but some said more students in lower level courses are likely to be dishonest. The possible reasons for this were resources and interest.

The sheer volume of resources for lower level courses makes it easier for students taking these courses to cheat. Not only are there resources online and in books, but there are also thousands of other students who have taken the same course, whereas there are not as many resources available for upper level mathematics courses. Additionally there are not as many students who have already taken the course.

Students in lower level math courses may not have the vested interest the students
in upper level mathematics (or mathematics education) courses do. Degree requirements in these lower level courses drive enrollment rather than interest in the subject or course content, whereas students in upper level mathematics (or mathematics education) courses may have a vision as to how or why they will need the content in the future.

Regardless of which level of students are lacking integrity, many of the instructors had either implemented methods to deter college students from cheating or had ideas on how the less honest student might be thwarted, including implementing proctored exams, weighting the grade of the course so a face-to-face assessment bears a higher percentage, providing the students with a workload that only an enrolled student would be willing to complete, and utilizing an oral assessment. Each of these possible methods are described in the following sections.

*Proctored exams to promote integrity.* By far the most prevalently discussed deterrent by instructors interviewed was proctored exams. Barb who taught at a college where proctored exams were implemented and another where they were not said, “I feel more sure of student knowledge and the success of my course when they do take a proctored final.” Even courses considered to be 100% online can utilize proctored exams, which can be administered in several different ways. First, students can be asked to drive to campus to take the exam at the same time and in the same place as their peers, providing picture identification to the instructor, however because of physical proximity, scheduling problems, or other reasons some students are not able to attend a proctored exam at the university. In this case, students may take the proctored exam at an approved location during an approved time overseen by an approved proctor. Locations such as libraries or other universities can be used as testing locations. Conceivably, one instructor
could have students living hundreds of miles away from the university from where the course is being taught, thus having to schedule several proctored exams. This effort to maintain academic honesty can be quite time consuming. Barb voiced this concern saying, “I’ll tell you,” she said, “teaching at the two colleges, it’s a bigger pain for me to deal with proctored exams than straight online exams.” By using proctored exams instructors can be more confident the student taking the exam is truly who he says he is, even if he was not honest throughout the semester. Because of the confidence instructors gain in giving a face-to-face assessment, many times these proctored exams and/or finals bear more value than the other portions of the course.

Weights proctored assessments. An additional practice instructors implement to deter students from being dishonest is weighting the proctored final exam. Many times weighting grades goes hand in hand with the proctored exam or final. The instructors implement several methods to do this.

Benny said, when discussing integrity,

I think it is an issue. To combat that a little bit, I make students come onto campus. I mean they have to come on campus for the final exam, and they have to bring photo ID so I know from that standpoint that that’s the student. This semester I’m actually having them come on campus during three unit tests as well and how I combat that is I make it so that anything that they’re doing off campus, all that stuff adds up to less than 50% of their overall grade.

Barb made the final worth 60% of the grade stating, “We don’t care if they have a 100 in everything. If they don’t get at least a 60 on the final, they automatically fail the course.”

The rationale behind a weighted final exam is students who are not doing their own work during the semester will flounder during a final they are taking themselves,
making it more difficult to pass the course. While students who were doing the work themselves throughout the semester should understand the material, making their grade on the final most likely similar to the grades earned throughout the semester, giving a more accurate representation of the students’ work and understanding. Carla, voiced while the distance learning office at her university did not particularly like the math department forcing students to take proctored exams in a 100% online course, they did support this decision.

My department requires that there be a proctored final and that you have to pass the final in order to pass the course. This helps us with the validity of course results. If we were not allowed to do this, we would NOT offer online math courses. My college’s distance learning office isn’t thrilled with us for mandating this but they do support us in our decision to do so.

Stricter yet, Carla believed not only should the student have to pass the final to pass the course, she will “award no final grade more than 20 points higher than the grade received on a proctored final exam.” This means if a student earns a 55% on a final exam, it would be impossible for the student to earn more than a 75% in the course. This feature is intended to discourage students from having someone else take the course at home behind closed doors inflating the student’s grade, and then have the enrolled student take the proctored exams.

*Student workload used as deterrent.* Another method of promoting student integrity is by increasing the regularly scheduled workload. Student integrity is Dal’s “biggest worry”. In order to try to combat this issue he says,

I try to increase the volume of their responsibilities so that even the things that they’re doing online or on the computer, there are so many of them that I can see, that they’re responsible for, that if they were trying of find somebody to cheat for them, it would almost be ridiculous because the person would have to do their work every day, as opposed to if I just put four tests online, then you can find somebody to take four tests, no
problem.

The volume of work needed for Dal’s course was purposefully overwhelming. For this reason, finding someone to stand in for the registered student would prove difficult.

*Proctored oral exam as deterrent.* Finally, the last method of deterrence is requiring students to perform an oral assessment in addition to written assessments. In this way the instructor is able to find an amount of continuity between the students’ written work and his oral assessment. Dane did not say that he implemented oral exams as part of an online course, but he said he implemented them when teaching high school calculus. He stated,

…our method of making sure the student was doing the work, we had a conference with the student as a part of their test. In other words, they would actually have to answer some questions verbally and that’s kind of expensive…it’s pretty hard for them to be able to answer questions and then you can compare that with the written part of the test and we do pretty much know if the student’s trying to cheat.

Realizing the expense involved in implementing such a procedure, this instructor said oral exams aided in linking continuity between students’ written and verbal understanding of a concept. It should be noted while he implemented oral exams in the traditional face-to-face classroom, he suggested this might be a way to preserve integrity in online courses as well.

When trying to ensure student integrity, but yet be true to the distance learning concept Barb felt she is in somewhat of a catch 22 phenomenon.

I’ve spoken at conferences where people always say ‘Oh, it’s an online course, they should never, ever, ever have to take a proctored anything. It should be totally online.’ But then when you start giving your results, they’ll start saying, ‘well, are you sure the person did it?’ And then we turn around and say well, they took a proctored final, so we know.

She feared she gives up integrity if she allowed the assessment to be online however, if
the assessment is not online she sacrificed the online nature of the course.

*Students.* Students’ views of integrity in the online classroom can be placed into three (overlapping) categories. The first category is “Not a Problem”. There were some students who felt that integrity in the online classroom was not a problem at all. The second category classifies responses as viewing integrity as problem, but not necessarily any more of a problem in an online class than in a regular face-to-face class. The third category looks at responses of students who believe student integrity is a much larger problem in distance learning courses than it is in face-to-face courses. Within this category, remedies suggested by students to increase student integrity will also be discussed.

*Not a problem.* Some students did not view student integrity as a problem in online course, Sandy responded saying,

> No, I really don’t. For the math classes I’ve taking, those weren’t proctored or anything, but at the same time, it was, I mean, you had to write down on paper and do your work and stuff, and this makes it extremely difficult to cheat on them and my university was certainly laid back on the testing policy. Most people I know that are taking online classes, they’re required to go do their midterms and their finals in like a proctored setting. So, no I don’t see cheating as a big deal in classes.

He recognizes other universities have processes in place to try to keep students from cheating, however, he feels that it really is not necessary. To him having to show work on the problems is enough proof that a student is being honest. Walter seemed to have the same feelings as he stated,

> I have never met anybody online in a student field that sent an email or said here’s the answers or anything like that. Never came across it whatsoever...Never saw anybody breach integrity, who I even thought was even close to breaching integrity.

It is admirable these two students are honest. However, the issue here is larger
than these two students. A college or university is graduating students with degrees, making them certified, licensed, or trained in a number of fields. Their diploma serves as proof they have successfully completed the appropriate coursework or experience to be successful in a specific field of work. There are arguably careers where college mathematics may not be of great importance. However, there are degrees where it is of utmost importance. While past the scope of this research, it would be worthwhile to continue researching how large a problem dishonesty in online mathematics courses truly is in the tertiary classroom.

*Not more of a problem.* As previously discussed, traditional face-to-face courses are not free from dishonest students. While students recognized the online environment as one that could foster dishonesty, they believed this dishonesty is not a bigger problem in online courses than in traditional ones. Zane said,

I think somebody’s going to go through the trouble of signing up for online classes is probably going to do most of the work themselves. I don’t feel like there’d be any more integrity violation in an online class than there would be in a normal class.

Wayne viewed compromising integrity as a temptation saying, “I think the temptation of compromising your integrity is the same in both online and classroom venues.” The students’ responses that fell in this category viewed student integrity as a real problem. But they do not see the problem being heightened solely because a course is online.

*Students see integrity as a problem in online courses.* Within the responses students discussed who is most likely to be dishonest, why they are dishonest, the lack of clarity regarding student regulations regarding integrity, and remedies for the situation. Some students viewed student integrity as more of a problem in online classes than face-
to-face classes. Rachel reported lack of integrity as a problem, and viewed while using online components for some aspects of a course is effective, face-to-face components are also necessary. Rhett has a completely negative view of online learning as a whole because of the temptation for students to compromise integrity by having someone else take a course in his place.

Online learning in my opinion fosters cheating. I have heard of people who have had others take their online classes on their behalf and no one is the wiser. The person gets the degree, but has not earned it. In a classroom setting this is much more difficult to do and people tend to learn better and retain knowledge longer.

Not only did Rhett believe that students are getting undeserved credit for courses, he also believed the face-to-face traditional classroom is more conducive for students to learn anyway.

Wayne viewed student integrity as a more global issue by saying, “That problem would be the lack of moral leadership in the United States and around the world.” He continued saying the problem is one that should be addressed at home well before students even attend school. He voiced, “If parents were more involved in their children’s education and lives from the start and led their kids down the right road of honesty and integrity, this problem and many others would be a heck of a lot less.”

Who are the culprits? Some students who believed student integrity is a problem also disclosed their perspective on who is being dishonest. Rachel believed that students in lower level classes were more likely to cheat.

I think as you get to upper level, especially more like a math ed, you usually and this is kind of stereotyping, have students that are interested in that subject and are driven to actually master the materials they use. You don’t have the issues that you have with lower level mathematics that I’m only doing this because it’s required for my degree.
Students taking courses they see as relevant to their future success will want to learn the material while students who are taking a course to fulfill requirements, will not have the vested interest and are thus more likely to cheat to avoid the difficult task.

*Why do these students resort to cheating?* In addition to students discussing the guilty, they also disclosed reasons why they felt cheating was more prevalent in online courses than in traditional face-to-face courses. For instance, students believed online students are more dishonest in an online course than in a regular face-to-face course because dishonest students are able to hide behind a computer screen. Tierni said,

> It takes an increased level of bravery to do it in person. I could have *Joshua (name changed) take my biology classes because he’s a genius, but I’m not going to do that, but that would take a lot more bravery from both people than to sit at the computer and not be seen by anybody…*

Knowing that she would never meet the instructor face-to-face and knowing there was almost no way to know who is sitting at the computer doing the work, gives the less-than-honest student an open door to dishonesty, most likely without immediate repercussion. Tierni even knew who she could ask who could help her in Biology. Her own integrity and moral beliefs kept her from being dishonest. But she recognized not all students share her beliefs.

Another reason suggested is that students are dishonest in any class because of the monetary value of the grade. Paul stated, “…school costs a lot, so you want to get an A.” The expense of school may tempt students to have someone else aid them in getting the desired grade, so they do not need to pay for the course twice. Students give monetary value to the courses they take, not wanting to waste their (or someone else’s) money.

*The rules for online courses are unclear.* On the other hand students do not always knowingly break the rules. Zane who has taken more than one online mathematics class
stated one reason students may breach integrity is because they do not know where the integrity line actually lands. There are several different means to getting help out there, many on the internet, consisting of several different kinds of “calculators”.

There’s a lot of tools and stuff available on line to help you, especially with calculus, and it’s never really made clear, on the tests, says you can use calculators, but there’s so many things available on line that are technically calculators that if you want to, you could have those pulled up, and the policy never really said anything about if that’s a valid calculator or not. [SIC]

Zane believed students may not know what is allowed and what is not. When this line is not specifically stated, students will most likely use any resources—calculators in this case—allowing them to perform better in the course.

*Proctored exams may help with integrity.* Some students believed a course that is 100% online will not have any face-to-face component, including a proctored exam. Others believed a course can be considered 100% online and implement proctored exams. Xavier could not fathom a 100% online course without proctored exams, responding, “I don’t believe any math course is 100% online. Exams need to be proctored for the grade to be fool proof…”

Yara agreed, recalling what she had to do in at least one of her classes, “You have to show a picture ID to take exams at the math learning center and if you are having someone else complete online work for you, then that will be reflected in your exam grade.” She realizes if someone did the work during the semester, the grade on the proctored final would most likely advise the instructor of a student’s dishonest ways.

*Oral assessment may aid in maintaining integrity.* One remedy to preserve integrity is having some sort of face-to-face oral assessment as the one that makes up a large percentage of the final grade.
Rachel said, “I think if you can then limit the use of the online component to only formative or have a large percentage of the grade determined by some kind of face-to-face interaction, I think you could reduce the problem.”

Assessing a student in a face-to-face setting allows the instructor to ensure the student on record for the class is truly taking the exam. Adding an oral assessment also adds dimension to an instructor’s assessments, gaining a more wider-scoped view of a student’s knowledge.

_Instructor responsibility to check parallel work._ While students choose how honest they want to be in a course, some students also believe the instructor plays a part in the overall integrity of the course and should be aware of the students in the course, and their ability. Instructors should check for continuity within and between a student’s work(s). One student said, “…as a professor I would be looking to see if the assignments and the discussion—the thought process—does it match what the student was providing….”

Both students and instructors viewed integrity as an important aspect in education. Some viewed student integrity as a problem, while others do not. The view on the level of integrity upheld in an online course varied from instructor to instructor and from student to student, with participants’ perspectives ranging from believing, upholding integrity is not a current problem to views believing it is a huge problem. Both groups gave remedies that could be implemented in order to maintain a degree of integrity.

**Future prevalence of online (mathematics) courses**

_Instructors’ perspectives._ All but one instructor interviewed agreed distance learning components will increase in collegiate mathematics courses in the next 10-25
years. Some described the increase as extreme; others described it as large enough to outcompete face-to-face courses; and, still others felt the increase is inevitable, yet face-to-face courses will not disappear entirely.

Aaron suggested distance learning advancement is necessary on an international level stating, “We need to keep up with the world.” While Benny described the advancement in distance learning as “…an explosion happening in the next 25 years.” Denny suggested online courses will be more prevalent than face-to-face courses stating, “I would suspect online education will become the norm in the near future.”

Yet other instructors, although agreeing distance learning options will increase, believed there is and will be a place for face-to-face courses. Jim stated, “I still think there’s a push for the traditional campus, but there’s going to be a bigger component of online learning and distance education, I think.” Unlike other instructors interviewed, Dal felt the number and level of online mathematics courses is at the highest level it can and should reach.

I don’t think it should grow much larger than it is now, because as students try these courses, I think a lot of them have the appearance that, “Oh it’s going to be that much nicer and that much easier because I don’t have to go to class,” and for some it is and for others they should realize that it’s not for them. So I think we’re getting to an almost like saturation point of where it should go. I know there’s some people that fear in 20 years all classes will be online and we won’t need the in-class teacher, but at least at my campus, I know that is ridiculous because most of my students that I have in class, they need, they need to be in there. They need to hear me, they need to ask questions regularly, or they’ll never make it and so I guess I hope there’s a balance and in my mind, I think we’re almost there at the peak.

He believed many students need to experience the face-to-face component of class. Once students realize they need this component they will shy away from taking
online courses in order to be more successful. Because all students learn differently, online mathematics courses are not a good fit for some students. Unfortunately, students are drawn to the stigma online courses are “nice” and “easier” because they do not physically attend class. Dal believed once some students realize online courses are not for everyone and they can be more successful in face-to-face courses, the number of online students will plateau.

*What will happen?* The potential increase in online courses could be a huge change for many instructors. Three of the changes discussed by instructors interviewed included instructors having to change their entire philosophy of teaching, instructors having to rely upon technology that may or may not be reliable, and instructors having to change their supplemental materials as traditional textbooks may become a thing of the past.

Teaching an online course may make instructors uncomfortable. This change may even cause instructors to change their philosophy or teaching. Aaron described this potential change as a paradigm shift.

I think that for most people that are even contemplating teaching on line, they need a lot of help and hand holding. They need structure. Um or they need models, as to how to do it. It’s changing the[philosophy of teaching] and interaction dynamic that they’re used to…So there’s a good portion of current teachers that would have to experience a paradigm shift.

While a paradigm shift changes an instructor’s way of thinking completely, it is more practical that instructors would keep their philosophy of teaching, but change the way they present material to their students.

Giving up some of the control normally available to them, may cause some instructors to feel uneasy. Benny felt the success of online courses could be based
partially on the success of the technology, not the instructor or the student. The technology must be reliable. He believed the “Effectiveness will be based on the reliability of the technology.” Benny felt the technology holds some weight as to the success of the course. An online course relies on dependable technology. In a face-to-face course, generally instructors need to rely upon themselves to be prepared. However in an online class, the instructor must also rely upon technology, something that can be unpredictable. This too can make instructors uneasy. It can be difficult to rely on technology if you have only had to rely on yourself to be prepared. It may feel like a loss of control. A technology failure can bring frustration to a teacher, especially if technology is not their strong suit. Learning the technology can be a struggle for instructors, and troubleshooting the problems which arise can be even more difficult. These are problems they did not have to deal with in a face-to-face course.

Not only could instructors have to change their way of teaching and thinking, the supplemental material they are familiar with may not be available as they are today. Carla believed traditional textbooks will be a thing of the past. “I think textbooks may become a thing of the past as the prices continue to skyrocket and they are available as e-texts. This also may lead to more of open educational resources being used.” Carla believes not only will paper textbooks disappear, the format of having to buy a textbook could also change. Open educational resources would provide resources to all teachers.

*Why will this happen?* The demographics of the college student today are changing. More students are becoming “non-traditional.” Many students already have careers or want to start a second or different career. These students cannot attend college courses offered at the normal times during the day. These students are looking to work on
their degree on their own time, when they are not working or perhaps taking care of a family. In addition to being more convenient to the students, some instructors felt it is also more convenient for them. Flexibility became a (less prominent) theme in this research. Instructors enjoy the flexibility online teaching provides them. They are able to travel, accessing the course from nearly anywhere. Even if the time spent on the preparation, communication and teaching for the course is the same or more than that of a traditional course, the flexibility in when an instructor or student completes the work is desirable.

Carla attributed the potential growth of online courses to the draw students feel towards the convenience of the course. She stated “I think online learning will continue to grow as it is a matter of convenience for many of our students.”

Henry who had strong feelings against online learning felt the increase in online courses will not be due to the effectiveness of the courses themselves, but instead will be based on the amount of money universities will save. He believed because online courses are generally cheaper for universities, they will want to make more online courses available to its students. “I see a rather significant expansion of distance learning in mathematics and in other courses as well, not because it’s effective, so much as because it’s cost effective.”

Where will the increase take place? There is a discrepancy as to where the increase in online courses can and should take place. Another less prominent theme found in this research was course level. Instructors believed lower level service courses will be the ones increasing in numbers because there are more students, making publishing companies more likely to produce online supplemental materials for a course servicing
several thousand students instead of a course servicing only a fraction of that.

In addition the procedural nature of lower level courses make supplemental material easier to grade and provide feedback. The conceptual nature of upper level courses can make it difficult to have supplemental online software. However, Dal believed lower level students are generally the ones who struggle the most. For this reason he believed the upper level mathematics would be more successful online. Barb agreed speaking from experience feeling the lower courses were “disasterous” when offered online.

Who will take the courses? Because online courses offer flexibility to the students allowing them to make a course fit nearly any schedule, some instructors felt non-traditional students will be the ones who will take advantage of online courses. Being able to take online courses may be the only way some non-traditional students are able to get a college degree. This is not to say traditional college students will all shy away.

Students’ perspectives. Students agree there will most likely be an increase in online courses. Pam said, “...in 25 years I feel that students will take most of their courses online.” In addition to courses taught entirely online an increase in the presences of online components in the face-to-face classroom, showing themselves as hybrid courses will also be prominent. Hybrid courses have both face-to-face components, and also online components, both having separate roles in the teaching and learning process. Even students who do not favor online courses feel they will increase in the near future. Paul, who does not have online experience in mathematics, but does have other online experience believed more education classes are going to be online. Based on his “I hate to say this” response, he did not feel this is a positive change. “From what I hear in
education classes and the educational field,” he said, “distance learning is becoming like this humongous thing and I hate to say this, but they might be all online, the way things are going with education.” This section will look at why students feel the prevalence of distance learning will increase in the future, what the future classes will look like, who will benefit from these online courses, how prevalent the online courses will be, along with a possible consequence to the increase of online courses.

Why the increase? Pam, a middle childhood education major saw incorporating technology in the college classroom as important. As technology continues to be a larger and larger part of life for nearly everyone, we can be confident technology will play a major role in the future of education.

Pam said, “I feel that it is important to incorporate DL because it helps students learn a new technology that they will see in their future. In the future it will be important for every student to know how to utilize a computer.” Because preservice teachers will soon be teaching in a potentially technology saturated career/classroom, she feels incorporating technology into the preservice teachers’ curriculum is a necessity. Although she defended the usage of technology, if given the choice she said she would choose a hybrid mathematics course.

Another reason universities may decide to increase the number of online courses is cost. As discussed in the above instructor section, universities can save money by offering online courses. In financially difficult times, universities may decide to offer more online courses in an effort to turn a negative financial trend around. Wayne said, I could conceive that more universities will pursue more online classes due to shear economics. As state and federal budgets are more and more squeezed, there will be a decline in funding to state universities. They will have to pursue other streams of revenue to be viable in the market place.
What will they look like? Many students discussed what future online courses may be like. Future online courses will be more in-depth, more interactive, and even more content intensive. One student, however, discusses her opinion on the backlash online courses will have in the future.

More in-depth. As technology as a whole continues to grow and develop, it is logical to assume so will the technology in the education system. Sandy described his own experience with MyMathLab ®.

…it’s getting more in depth now than probably when it started. … My Math Lab has a program we used and it’s really, it helps, it asks you where you are in homework and everything, and it asks you a problem, you can have them explain an example and it goes through and breaks down piece by piece how to solve it and why you’re doing what you’re doing. [SIC]

Interestingly Sandy discussed how MyMathLab ® breaks down problems and shows not only how to solve a problem, but why the steps work. It is difficult to say whether or not students are getting a procedural or conceptual understanding of the material based on responses to the questions in this interview, however it seems there may be room for integration of conceptuality.

More Interactive. While online courses have instructors, the role they play varies from course to course and instructor to instructor. Some students claimed they taught themselves, while others praised the role their instructor played. Future online math courses will become more interactive. The interactive component may be from the immediate feedback from the computer, or it may be more interactive on the instructor’s part. (See Communication.) Two students in particular discussed how the online course could become more interactive in the future.

Sandy felt he was teaching himself while taking online courses. He did not see
this trend continuing. Instead he saw the technology having more interactive components aiding a student like him understand difficult concepts. He stated, “I just see it getting more interactive with the person as far as instead of just submitting an answer, actually going through and teaching people…. I see a more interactive program down the road.” Strong mathematical students may enjoy the freedom of teaching themselves, but weaker students especially would welcome this interaction.

Another way students saw the interaction increase is via Skype-ish type classroom. Tierni suggested in the future, the online classroom will mimic the face-to-face classroom and students will have the opportunity to ask questions in real time and interact with the instructor. Originally she did not feel online math courses could be sufficiently taught. Throughout her interview she began contradicting herself and stated maybe she would be ok with online courses.

…with increasing technology, it would be more okay almost, because you know you could probably watch your professor on an iPad or something, like how to do the problem and listen to them talk at the same time which is pretty much the same thing, and I know there’s programs where you can almost Skype-ish type thing with your professor and probably watch them do the class and then… I know there’s a little button you can click so like ‘Raise your hand’ so I guess that would be at least more interactive.

Her tone changed from not wanting online math courses to saying they could work, giving ways such as this to make them successful. Yara described the Skype-ish setting as video conferencing.

I think that within the next 10-25 years, things will be done mostly online. Classes will actually be held either in an independent online atmosphere (as they are now) or by video conferencing. This will give students the access and feel of an actual classroom with an instructor and other students and allow the students to ask questions in real time.

Content intensive. In a face-to-face traditional classroom, instructors spend time
teaching content to the class, answering questions on demand. Thelma felt an online instructor would be able to concentrate on the material taught and focus on preparing relevant lessons instead of answering questions on demand. This way instructors would be able to give insightful answers and even make the responses available to all students. In addition, the instructor could put together relevant lessons. Class time could be used to teach instead of used to answer questions. Thelma said, “…teachers will be able to spend more time on the content that students really need help with versus trying to teach the material to a whole lecture.” Haley (instructor) agreed with this. As an online mathematics instructor she felt she was able to do just this!

**Backlash in online learning.** Rachel agreed the presence of online components in the mathematics classroom will increase in the future, but warned the increase will soon cause a major backlash. Believing students are unable to grasp a deep and meaningful understanding of the material being taught, she believed students will have problems understanding the content in the mathematics courses that follow. She continued, “…students aren’t conceptually mastering the information, which will catch up to them in later courses.” So while course participation may increase at first, she felt there will be a time when students and instructors realize online courses are not sufficient in teaching students mathematics. This argument was similar to Dal’s argument on the saturation point of online courses.

**A more teacher-friendly format than currently.** As students have grown up in the technology age, many times students are more technologically savvy than instructors. Because of this some students feel instructors are not prepared to teach using the online format. One student responded on how the format of online courses will change in the
future as instructors become more comfortable teaching in this way. Pam said,

I think that it will become easier for the teachers to use this format (students in my generation are already used to this kind of technology, and some teachers are struggling to keep up). When it’s easier for teachers, it will be easier for everyone.

An effective instructor must have among other things content knowledge, sound pedagogical methods, and effective communication skills. An effective online instructor must have the same qualities, but using unfamiliar communication skills may be difficult. Students on the other hand are generally at least as knowledgeable and in most cases more knowledgeable regarding technology. As a student in a class where the content may be difficult, having an instructor who struggles with the technology would be frustrating. As the future unfolds, instructors will become more comfortable with technology, making online classes more effective.

Who will benefit? While there could potentially be several groups of students who could benefit from having the option to take a course online, Rhett was adamant about what students will benefit from having online courses available. He believed the students who will get degrees from universities offering online courses are students who are undeserving because they may be dishonest about their coursework. He believed the prevalence of online courses will increase, stating “Only becoming more prevalent and providing people with degrees who have not really earned them.” (See Integrity for more discussion.)

Instructors and students alike agree technology will be prevalent in the future. Even instructors and students who did not believe teaching and learning in this format is a best practice believed the increase is almost inevitable. Instructors discussed when the increase would take place, what will happen, why the increase is inevitable, where (what
courses) the increase will take place, and who will take the online courses. Students discussed why there will be an increase, what the future classes will look like, who will benefit from the online courses, how prevalent online courses will be, and how teachers may have to change their teaching styles.

**Communication**

Communication was a very popular theme among both students and instructors. In this section, first literature regarding communication is discussed, followed by the instructors’ perspective on the relative importance of communication and the students’ perspective on the same theme.

**Literature on communication.** Universities feel compelled to offer online courses because they are becoming part of the cultural norm; they can aid in diminishing university financial burdens; and, they cater to individuals yearning to continue a life of learning (Volery & Lord 2000). Successful online courses, much like traditional face-to-face courses need effective modes of communication. The two types of online platforms are Learning Management Systems (LMS) and Interactive Learning Systems (ITS). LMSs serve as a platform to communicate with students, post grades and assignments along with important documents or links to videos. The system itself does not teach the student, but instead allows the instructor to use it as a medium to help with teaching the student. The instructor is in control of what is a part of the LMS. The ILS, on the other hand, plays a role in teaching the student (Volery & Lord, 2000). Interactive software programs such as ALEKS and MyMathLab (MML) fall into this category. The program allows instructors to pick and choose appropriate exercises for her students (Kennedy, Ellis, Oien, & Benoit, 2007). The instructor is in control of what is asked, but many of the
questions are generated by the textbook company and the instructor chooses the appropriate exercises. Students are then asked to complete assignments, while the software program gives the student immediate feedback on the correctness of his answer, allowing students to look at hints or similar problems.

In a study where several different modes of communication were implemented, such as online homework, PowerPoint presentations, lectures, and quizzes, Glass and Sue (2008) reported students both used online homework, which utilized the instant feedback provided by MML, more often and learned more material from online homework than the other learning objects researched.

In an effort to allow students to ask questions outside of class, many face-to-face instructors offer weekly office hours. Unfortunately office hours are rarely attended by large quantities of students (Hooper, Pollanen, & Teismann, 2009; Li & Pitts, 2009). Virtual office hours have been proposed as a potential solution in online settings, or as a supplemental opportunity in a face-to-face course (Hooper et al., 2009; Jeoung, 2007; Li & Pitts, 2009). Instant messaging services are used in both Jeoung (2007) and Hooper et al.’s (2009) research involving virtual office hours.

One positive aspect of instant messaging implemented as virtual office hours is students are granted the immediate feedback they desire (Jeong, 2007). Students value this feedback, however it is noteworthy Jeong reported being available online 12 hours a day making himself extremely accessible to students. Students appreciated the immediate feedback and availability Jeong provided them, however a controversial point may be whether or not the instant messaging process provided the instant message or if the instructor himself provided the instant feedback. In this case, students may feel email is
just as effective if the instructor is readily available. Being accessible 12 hours a day is a hefty time commitment, taking away from the flexibility many online instructors desire.

In Li’s research, students surveyed who had virtual office hours available to them throughout the entire term of a course, were more satisfied with the course than students who did not have this option. However results of the survey also showed the number of students attending virtual office hours was even less than the number of students attending face-to-face office hours (Li, 2009). Simply having the opportunity to utilize virtual office hours provided a sense of comfort for these students even though an extremely small number of students took advantage of this resource.

A different type of virtual office hour utilizes enVision, “enVision is a synchronous, real-time communication tool that resembles a whiteboard or chat-room but has added functionality to easily create mathematical equations” (Hooper et al, 2009). According to their research, several students are able to see what an instructor is doing via enVision, thus if one student asks a question, other students who may also be asking questions or simply “lurking” can watch as the instructor completes the problem. In addition to the whiteboard part of the technology, there is also a “Chat Window,” an instant messaging feature for the students and instructor to communicate.

In addition to valuing the feedback instructors are able to provide via this software, students also enjoyed the anonymity enVision provides. Students can ask a question without the instructor (or other students) knowing who asked the question (Glass & Sue, 2008). This gave them the confidence they may not have in a face-to-face class (McIntyre & Wolff, 1998). McIntyre & Wolff’s research predates enVision software, however they discussed interactive learning in the early stages of courses taught online.
They promoted the positive aspect of “rapid compelling interaction and feedback” when using the Web, a frequent desire today.

One discouraging aspect of online learning in the mathematics classroom was the difficulty representing symbols with technology. EnVision boasted this is no longer a problem with this free software (Hooper, et al., 2009). Instant messaging, using standard IM mediums could pose problems with communication.

Because communication is a very important component in the whole concept of teaching and learning, a miscommunication could be detrimental. In a face-to-face class students are able to read the instructor’s face aiding in the successful nature of the communication. In a text-based communication, it is impossible to read the instructor (or student’s) face (Jeoung, 2009). Text-only interaction lacks the feeling and emotion the sender intends, allowing the receiving party to interpret the message using only one mode of communication: text.

**Instructors’ perspectives.** Communication was discussed in several different formats. Instructors’ perspectives are broken up into the following categories: Online Communication, What Determines Success?, Discussion Boards, Course Level, Face-to-face feedback, and Immediate Feedback.

**Online communication.** When taking a face-to-face, lecture style mathematics course, students are generally permitted to ask questions of the instructor receiving immediate feedback. Students are able to watch and listen to the actions and reactions of the instructor as topics are discussed and questions are answered. In an online course the students lose some of this interaction. Depending on the style of the online course, they may be able to watch and listen to the instructor, but these senses will be observed as
actions, not reactions. If an instructor is able to video the lesson, students are able to watch and listen to the lesson observing how the instructor shows relevant materials to the students. However, the student is unable to see the instructor’s reactions to questions asked by the students. The student is unable to see that, “You got it!” look in the instructor’s eyes as positive reinforcement.

Aaron discussed how traditional and online students may be engaged in excellent activities allowing students to explore and reflect, but the online setting can become a barrier if the students need more guidance from the instructor.

…I think the biggest thing is a philosophical point of view of getting the student to explore and think and reflect and potentially, well certainly communicate and problem solve. But they’re being forced to do it in an environment that they’re not used to. They’re used to facial expression of the teacher, giving them clues as to if they’re on the right path or not, where they don’t have that.

Asking the students to be engaged in learning can be a difficult task in face-to-face settings let alone online, especially if students are used to a lecture-style mathematics course. Even if the same activities are used in the online course as the face-to-face course, the students are now asked to participate in an activity without the assuring feeling of the instructor perusing the class nodding in approval, or nudging misguided attempts back on track.

In addition to having different communication, online instructors claim in many cases they are communicating more frequently with online students.

…they don’t realize the investment of time in communication with the students. I spend a lot of time communicating with my students, much more communication with my students in the online environment than in the in class environment, because in the face-to-face my students rarely come to my office hours. When I have an online class, if they have a question that they can’t get answered by replaying the material, I get emails from them. I don’t get emails from them for the face-to-face
materials, so there’s a lot of communication…

Liz discussed the stigma online mathematics courses have where she teaches. Her colleagues did not understand the amount of time she spent communicating with her online students. Students who may not have the time outside of class nor the courage inside of class to ask a face-to-face question, are able to voice their questions in a less intimidating, online setting. Students in the online courses communicated with her and expected a response.

What Determines Success? Instructors determine success of courses in different ways. Some may feel the course grades determine success, while some may feel the lessons prepared determine the success. Benny feels communication can play a large role in determining success in a class. In a face-to-face class students are able to discuss concepts with other students, putting a face to a name in the class. Students are able to see the instructor and form an impression of her. Students are able to attend office hours, knowing who they are going in to meet. They can study together for quizzes and tests, or even work on homework together.

In an online course, it is more difficult to do some of these things. Students and instructors do not normally have a face-name association. They are not in the same proximity at the same time, so working together after class is not necessarily an option. The instructor may simply be a name on the page. While all of these things may be true, it is also true, Benny believed, if the lines of communication are open, students are able to achieve success.

I think there are other things that kind of play into that whether it’s the amount of interaction between students whether it’s you know, the students feel comfortable asking me questions and I think that that really plays a little bit of a role in determining online success as well…It’s the
interaction and the communication between students and the teacher and all the students in class, that to me is also a valuable piece of online learning, I think.

Benny believed when students feel comfortable asking him questions, they are more likely to do so making the course more successful. In addition, students must also be able and willing to communicate with each other. Even though this mode of communication is different from what they may be used to in a mathematics class, it is not necessarily a new mode of communication. Students growing up in this generation are familiar with communicating textually.

Discussion boards provide different perspectives. One mode of communication in online mathematics courses is discussion boards. On a discussion board instructors are able to place questions for discussion and leave it open for students to post responses to not only the question, but to other students’ responses. This allows for student-student and student-instructor dialogue. Instructors have both positive and negative perspectives on discussion boards.

On the positive side, discussion boards can be used to discuss concepts. Information can be dispersed to an entire class at one time. Students can ask questions of the instructor or one another and receive a response back, sharing it with the entire class. Students can post questions at any time of the day (or night), depending on their schedule. In addition, students are able to look back and review material previously discussed.

While Francine believed she would prefer more face-to-face contact time, she does feel there is a place for discussion boards.

The perfect course would have some face-to-face time as well as online time. The face-to-face time would be used for activities as explanation of
complicated topics, testing and opportunities for group work. The online time would be used for things such as lecture materials, self-quizzes to help students access their understanding, questions from students and discussions. I would prefer a class with slightly more face-to-face time over online time.

Francine divulged several different components of an online course, but specific to communication, she felt questions from students and also discussions are a positive characteristic in an online course. It is important to note she specifically said she would rather have more face-to-face time, and complicated materials should be reserved for this time.

Posting appropriate questions to a discussion board can be difficult. If an instructor posts a question with a solution, the discussion is over after the first student posts the correct answer. However, if the question is more thought-provoking having several different correct solutions, or different avenues to find the correct answer the discussion board may be more beneficial.

Carla, however, found it difficult to find this type of question.

The one component that should (not) be in a distance learning classroom is discussion boards. I have them in my course, but they are not effective other than in the beginning of the course when everyone is introducing themselves to their classmates. When I first started teaching online 10 years ago, I had what I thought were great discussion questions. I found the responses were poor and once someone posted the correct answer, how do you grade the posts that follow? I do not require discussion posting as part of the grade in my online class.

Her response indicated discussion boards serve no purpose if there is only one correct question. After realizing students shy away from posting after the correct answer is found, she tried to find questions appropriate for discussion purposes, however, finding questions where students can continue to post discussion even after one correct answer is posted proved to be difficult.
Communication is more/less appropriate at particular course levels. The appropriate course level in which online mathematics courses should be used is a discrepancy among teachers. Several instructors discussed the importance of immediate feedback. However, some enjoy the immediate feedback the students received from an online software program giving them feedback to homework-type problems. Others felt the immediate feedback students received through face-to-face communication was more beneficial.

Complex topics are difficult to discuss in any realm, but having to discuss them online may be even more difficult. For this reason some instructors found lower level service courses more appropriate for online courses than upper level mathematics courses.

Probably a lot of things, but two that we’ve kind of already touched on is the lower level kids need immediate feedback because they make a lot of mistakes and they need to know right away so they don’t practice wrong. That’s what makes math hard for them. The higher level kids, they don’t really need that, but to discuss more complex ideas, you kind of need to have a conversation setting rather than just one-way communication.

From Dane’s perspective, students in lower level courses fare better learning lower level material, as the software is available to give them immediate feedback to problems they are working through, allowing them to know right away whether or not they are doing the correct procedure. Higher level mathematics courses rely a lot on discussion with less procedural practice. According to Dane, these complex topics are more appropriate for face-to-face discussion.

Face-to-face feedback is desired. Face-to-face feedback gives students more feedback than just on the mathematical problem at hand. It allows instructors to ask probing questions to see how deeply a student understands, and from where the confusion
stems. It allows students to ask the instructor clarifying questions as he provides
guidance. As mentioned prior, instructors can read facial expression and body language,
along with voice intonation to make judgments as to how well a student is grasping a
concept. Likewise, students can also read facial expressions and body language, to read
whether or not they are on the right track.

Hybrid-style classrooms allow for the perks of online courses, while giving the
students the face-to-face time they desire.

I think the emporium is probably better than totally online, because they
do have a little more structure and they have the availability for actual
help from a professor that is definitely better than you can find on the
street.

The emporium style classroom, is a specific hybrid model. Denny believed this
method is better than online because the help students receive while taking an online
course may be from someone “you can find on the street.” This model allows students to
work on problems online, gaining immediate feedback alerting them to incorrect answers,
and allowing them to try multiple similar exercises. Students meet in a computer lab
during a predetermined time to either work on these types of exercises or ask questions of
the instructor(s) perusing the lab. This set-up allows students one-on-one time with the
instructor while also gaining immediate computer feedback.

Another argument lies within the actual art of verbal discussion. Mathematics has
its own language, and if not spoken it can be missed or misunderstood. Simply working
through and solving problems by looking at examples, without rich discussion leaves a
gaping hole in the students’ understanding.

It’s difficult for students to engage with other students, to discuss
homework assignments as a group. The instructor is less accessible in a
distance learning course than in the face-to-face environment. Much of the
student’s success in learning mathematics hinges on the ability of that student to actually use the language, more or less imitating how the instructors’ language and if you completely eliminate that face-to-face opportunity, I think it greatly cuts down on the effectiveness.

Henry felt this discussion was essential. He believed the effectiveness of a course was directly related to the ability of the student and instructor to engage in face-to-face communication.

Denny believed face-to-face communication and feedback was essential, however he also believes it is possible to emulate this scenario. Providing this atmosphere for students though, is time consuming and difficult.

As I indicated above, for all of the courses I teach I still feel it necessary to somehow emulate a traditional “lecture” format for delivery of content. Having face-to-face feedback and interaction in this process is essential in my view. While I believe this can be emulated with online lectures, at this time I don’t have the demand nor the time or resources to invest in migrating other courses to this format.

Regardless of the type or mode of communication, instructors felt communication was an extremely important part of a successful class, whether it is face-to-face or online. Communicating via online means can be difficult and time consuming, but gives students who may not speak up in class a voice. Having an online component along with a face-to-face component in a course allows students immediate feedback from the computer, while getting face-to-face explanations and encouragement from their instructor.

*Immediate feedback.* Immediate feedback is a coveted component to online learning. However, the immediacy comes in different formats, one being from the online software, and one being the instructor. While some instructors valued the face-to-face feedback in a traditional course, the online feedback is valued even more by others.

Student attendance in a traditional classroom, does not guarantee participation,
understanding, or communication. It is difficult for an instructor to know whether or not a student is engaged during a class or not, simply by observation. Having a group discussion does not always involve all students. Some students decline participation because speaking in front of others is uncomfortable, while other students decline participation because they may not care about the content or are not prepared for discussion. Aaron felt there is more an instructor can do to foster discussion and immediate feedback in an online course.

…I think there’s actually in a distance environment there’s actually more you can do to give them instant feedback that they’re not doing what they need to do than you can actual, than you typically might do in a face-to-face setting. Because it becomes blatantly clear you’re not participating

In a distance learning course, however, if participation in online communication is a part of the students’ grade, it is easier for an instructor to monitor what students are thinking, and understanding. It is also easier for the shy students to voice their opinions and perspectives as they no longer have to disclose them in front of the entire class.

Haley felt that she is able to also provide students with nearly immediate feedback. In many cases traditional college mathematics courses are not offered daily. The gap between classes can cause students to feel uneasy as they wait for the next class to ask questions and obtain desired responses. Online students are more likely to send their instructor a message as there is no class meeting to ask these questions. Haley spent a lot of time monitoring her email to communicate with students.

…I try to provide good experiences in online learning with my online math classes. I feel that the instructor needs to be on constantly providing instantaneous feedback. My students always feel that I am sitting in front of the computer 24/7 responding to them. This availability often prevents frustration on my students’ part as I can help them understand where they are going wrong with a math problem before they fret about it too long.
She felt this kind of feedback keeps students from feeling frustrated for too long. In addition to providing feedback to one student, an online instructor has the opportunity to communicate with several students at the same time. Freddie agreed quicker feedback is best. He, too, believed the classroom environment provides this rapid feedback, but the online classes can reach more students at one time, which is a positive aspect of an online class.

The classroom environment provides feedback. The quicker the feedback there is, the better it is for a student, so there’s the promise of that in the internet class. And broadening the group of people with whom the professor can have contact. Those are the pluses and everybody, I think, I’m being presumptuous, but I think everybody agrees that’s great if you can do it.

While a little uneasy about the success of online courses today, Freddie believed should the online classes be able to provide immediate feedback to a larger number of students in the online setting “everybody” believed this would be “great”.

*Students believe communication is important.* Communication was a very prominent theme among student interviews. There were three different types of communication discussed, Online Communication, Face-to-Face Communication, and Online Immediate Feedback. Discussion in this section is broken up into these three categories with descriptions included.

*Online communication.* Online communication includes any communication done online, such as email, instant message, discussion boards, etc. While some students value face-to-face contact, some students would rather not communicate in this manner. Zane, a student with online experience, did not feel face-to-face interaction is necessary. He values communication, but perceived communication online as acceptable.

I don’t really feel the necessity for there to be a face-to-face interaction
with that. As long as the student has access to the instructor for questions on something he or she might not understand, or a concept that they’re not getting which in all math classes I’ve taken it’s been the case if we have a problem we could always ask about it. But it gives you a little more freedom to learn, and teach yourself, I think which helps you remember things better.

Not only did he feel communicating online is acceptable, he felt it may even be better than face-to-face. Online formats vary from class to class and instructor to instructor. Students learn in different ways, but for him the online course was freeing, as he can try to learn concepts on his own, asking questions when necessary. In this setting, he would not have to listen to questions he does not deem necessary to his understanding. In addition, he felt he learns more when he teaches himself.

It is conceivable to believe online instructors would have differing views on this comment that online students teach themselves. While allowing students to take ownership in their learning, instructors who are spending several hours a day preparing lessons and/or communicating with students may feel students are not truly teaching themselves.

As discussed in the previous section, student/student communication can be difficult in the online classroom. Pam, however, suggested a way to remedy the situation. She discussed the format of an online class she took. A Facebook page was created where students were able to discuss problems and questions, along with sending messages back and forth to one another.

Establishing a good community will help students in their struggles. For example, we established a Facebook page where we could talk about the course, remind one another of what was due, discuss the struggles we were having etc. This made the course a lot easier to study with one another, etc. Often students go through an online course and never have the opportunity to talk with anyone else besides the professor.
While the course website most likely has similar communication features, Facebook may be a more familiar social media tool making communication more natural. It is necessary to note Pam did not divulge who set up the Facebook page. It seems as if the students did so on their own.

Being able to chat with one another is important. Discussing concepts with an instructor who already knows the solution to a problem does not always help a student think logically, or in a way that makes sense to them. However, when discussing concepts with other students who are taking the same course, and perhaps having some of the same struggles or the same successes, bouncing ideas off one another can help several learn the concepts more deeply.

Thelma felt this type of communication is important. “I think DL could be used in an online-chatting system that allows students to post questions or chat with other students or teaching assistants…” in addition to being able to ask questions of each other, students can ask the instructor questions. Walter believed this concept was “brilliant.” In his experience, once someone asked a question, his instructor proceeded to post the solutions for the entire class to see. “That was the brilliance of her being a professor for the class as she shared the questions with everybody…and that helps a lot of people.” Posting answers to student questions for all students to view saves both the instructor and student time. There is no wait time for students to obtain answers, and the instructor does not spend time answering the same question over and over again.

Instructors mentioned the ability they have to almost force participation, giving specific stipulations of communication value. Rachel, agreed with this stating, “…I think in certain courses, it actually creates more discussion and greater participation because
you can demand participation of every student on every question whereas in a classroom setting you can’t do that.” Attempting to have a class discussion in a face-to-face context expecting every student to respond not only to a prompt, but also to one another is unrealistic. However, in an online class instructors can do just that. They are able to give a prompt, ask for a response to the prompt and also responses to other students’ responses.

The future of education will definitely be different from the education of today. Communication will most likely be different as well. Outside of the education world, younger generations are already changing their style of communication from the styles of their parents, placing more emphasis and time communicating with text (using varying modes) rather than verbal means. When asked about his perspective on the future of mathematics classes, most likely having more distance learning components, Zane responded he did not think these technological changes would compromise learning. It would change the way students learn, and perhaps enhance the way material is taught.

I think that the learning will be more up to the students with the advance of technology. So the teaching style, I don’t think it’ll be compromised, I just think it will be changed, to suit a different need, to where a teacher might be used to face-to-face contact and we’re going to have to get used to electronic contact, knowing that communicating more through email effectively so I don’t think it’ll be compromised, just changed or even enhanced because of that.

*Face-to-face and immediate feedback*. In the instructor section above, these were two separate subheadings, but for students they merge into one. All students who commented on the need for immediate feedback in a course linked this feedback to face-to-face feedback. For this reason, discussion in this section covers both comments regarding face-to-face components of an online (or hybrid) course and the necessity for
Students felt online courses should have an avenue for communication with the instructor and with other students. For some students having the option to communicate with the instructor face-to-face was preferred. Pam valued an instructor who is available for her students and has the time to answer questions.

I also feel that the professor must have an adequate amount of time. They need to keep up with grades, posts, etc. and be able to provide students with the same knowledge they would receive if they were at the campus learning. The professor must be available to meet if needed and respond to students’ emails on a regular basis in order to be successful.

She did not feel meeting with an instructor is always necessary, but should a student need this one-on-one time, it could be granted. Thelma agreed with this mentality, but said live chats may also be acceptable.

If they are 100% online, I think there should be at least office hours for the teacher so that students can speak with them if needed. Also, the students should have access to a student roster so that they can meet up with other students in the classes if needed. It would also be really helpful if the professor was very accessible through email and live chat if possible.

In addition to wanting the instructor to be available she felt being able to communicate with others in the class is also beneficial.

As discussed earlier, immediate feedback is a coveted commodity in an online course. One big difference is the instructors feel the students need the immediate feedback provided by the software programs. This immediate feedback allows students to have more practice. Students however, seem to yearn for the immediate feedback given through face-to-face communication. Rhett is not impressed with the time lag it takes for instructors to respond to questions asked online.

Face-to-face is the best method because as you are learning the material when questions arise they can be answered immediately with examples.
provided if needed. Online there is a time lag between when a question is asked and answered.

Interestingly, instructors believed students want the freedom and flexibility to take online courses, however students yearned for the face-to-face communication traditional classes provide, asking for at least a fraction of a class to be offered face-to-face.

Both instructors and students felt communication plays an important role in the success of any class. Class discussions were important to many instructors and students, however one instructor felt they were useless because once one student answered a question correctly the others’ posts were basically pointless. Some instructors and students were in favor of having some components of a course online, but still felt there needed to be at least some sort of face-to-face communication, or at least the potential for face-to-face communication, if needed. The biggest discrepancy, however, was with the immediate feedback component of communication. While everyone agreed immediate feedback is important, the setting where the feedback is best implemented was disputed. Some felt the online atmosphere where the computer gave the immediate feedback in a procedural fashion was best, some felt instructors were able to give immediate feedback successfully in an online course, and still others felt the time lapse between question and answer in an online course is a major flaw, making communication in the face-to-face course the most effective.

Despite the potential downfalls of communication, it was clear both students and instructors alike valued the presence of positive communication features in any course.

Motivation. Motivation refers to the kind of things pushing or urging students to do well in a course. Do students with more internal motivation fare better in an online class than their not-so-motivated classmates? Or, is the motivated student simply more
successful in any class regardless the type of course?

**Instructors’ perspectives.** In order to be successful in any college course, a student must have some level of motivation. Most instructors interviewed believed motivation plays a large role in the success a student achieves in an online course. However, instructors’ perceptions on the origin of the motivation differed, with some instructors believing students must possess internal motivation while other instructors believe it is their role as the instructor to motivate students. Motivation did not emerge as an overall theme for both instructors and students, thus motivation is not discussed from the students’ point of view in this section. Discussion in the sub-themes are described below.

“Who motivates?” is the first sub-theme and discusses whose responsibility it is to motivate the students. “Why are students motivated?” is the second sub-theme discussing what motivates the students. “How are students motivated?” is the third sub-theme discussing how some students are motivated. “Who’s more motivated?” is the next sub-theme discussing which students are more motivated, online or face-to-face (or both/neither). Lastly, “Success based on motivation” discusses how motivation plays a role in the students’ success in a course.

**Who motivates?** There was a discrepancy as to whose responsibility it is to motivate students to become and/or stay motivated in the classroom. Some instructors felt it is the students’ responsibility to become and stay motivated, while other instructors felt the responsibility fell partially on the instructors’ shoulders as well.

**Motivation is the instructor’s responsibility.** Instructor responsibility places the role of motivator on the instructor, providing lessons that motivate in a positive environment. “I believe it is the instructor’s responsibility-at least in part-to motivate
students.” Francine said. “Not all instructors feel this way.” Instructors are trained professionals. A large part of earning an education degree is learning and understanding pedagogy beyond the content being taught. There are different ways to teach the same material. Teachers are trained to teach. However, many instructors at the college level do not have an education degree. They are not trained to teach, but are instead experts in their field, in this case mathematics. The ability to understand material and the ability to teach students the material do not necessarily go hand in hand. Instructors with teaching degrees may feel differently towards motivating their students than instructors without teaching degrees. This argument is not to categorize instructors without teaching degrees as ineffective. It only serves as a point of discussion as to why some instructors view motivation differently than others. While Francine believed it is her responsibility to motivate, she also understands that not all instructors share her perspective.

Unfortunately Benny commented that he spends a lot of time trying to motivate his online students, but did not feel his efforts made any difference on the passing rate of the class as a whole. He stated, “I tried everything to get the students motivated...it never really improved my success rate...” He seemed to feel defeated as he tried to get his students motivated, but felt he fell short as nothing seemed to “work”. An instructor placing motivation as their responsibility can only feel frustration when his efforts are not reciprocated by the students. This situation would seem less frustrating to the instructor feeling it is the students’ responsibility to be motivated.

*Motivation is the students’ responsibility.* Some instructors placed the motivation responsibility on the student, although perhaps not necessarily stating from where or how the student should become or be motivated. Jim placed all motivation on the student
stating, “…you’re in college, you should stay motivated. If you’re not-leave. You’re taking up space for somebody else.” He did not discriminate between online and traditional classes. He made it clear college students should be self-motivated in every sense. Benny agreed, feeling the motivation definitely had to come from within the student stating,

A lot of it really does depends on how the student’s going to view the class, how much work and how much effort they’re willing to put in and if you have a highly motivated student or somebody who’s willing to sit there and ask you questions and willing to get on the discussion boards…

When asked whether a student must be motivated in an online course, Dane said, “That is absolutely true for a totally online course and I’ve taught these, and the ones that aren’t motivated, they just drop off, they quit.” When asked if online students have to be highly motivated, Barb answered, “Absolutely 100% agree. Has to be highly motivated, self-directed, you know what I mean? If they’re not motivated online, it’s a disaster.”

On the contrary, Carla believed while it is usually important for a student to be motivated, success in an online course is not always directly related to the amount of motivation a student possesses.

…just because a student is highly motivated does NOT mean that they can learn mathematics online…All the motivation in the world may not be enough for them to be successful in the course….I also think there are some students who are not highly motivated but who will do fine in an online course…I do think that for most students, if they are not motivated they will not succeed in an online course. If students are procrastinators, they will not be successful.

Carla continued discussing how being motivated does not necessarily ensure being successful in a course.

The best thing you can do is offer a pedagogically sound course and let the students do their part. The online teacher should be available to students to assist them where they may be having trouble, but it boils down to the
student has to take responsibility for his/her own learning and not blame the teacher if they get behind or don’t pass the course.

Carla did not explicitly say motivation is the instructor’s responsibility. However, she did say it is the instructor’s responsibility to provide a course with potential, should the student put forth the necessary effort, to be successful. She does say the student needs to “do their part” but not before the instructor provides a “sound” course.

*Why are students motivated?* Is there a set of students who are more motivated than others? Some instructors seem to think so. Because online classes can be desirable for the non-traditional student, classes can be saturated with this group. According to some instructors, however, this is not a bad thing as these students are many times more motivated to complete work and learn the material than the traditional college-aged student. The students coming back to school to obtain a degree may only be able to do so because the course(s) are offered online. These students have no option, thus are happy and thankful to work on their own time to obtain their degree. Barb and Denny commented on these types of students. “I think it’s so much better for returning adults, but 18-year olds -not unless they’re very, very motivated,” Barb believed. Denny’s response was similar.

The majority of the students I have taught online have been non-traditional students. I have certainly found that adults returning to school are VERY much more motivated than traditional teenagers, and I believe strongly that this motivation on the part of the students has been an integral component to the success of my online courses.

In these cases students have been motivated and successful, but the reason for the success and motivation is difficult to decipher. These students may have been successful in any type of course simply based on the fact that they are non-traditional students with different perspectives and priorities in their lives. Determining whether the students are
more motivated in an online course because successful online students are highly motivated students, or if non-traditional students are more likely to take online courses for outside reasons and they are in general more motivated than the traditional student is unknown.

*Online courses have the opposite motivational effect.* The question regarding motivation was intended to grasp the perspectives of the instructors and students regarding whether or not online students need to be more motivated than face-to-face students, and what motivates such students. However, one instructor made a point that was slightly different than the others, but worth mentioning. Jim suggested perhaps online courses “generate interest and motivation” and went on to say,

> There is an argument to be made that online activities and information can generate interest and motivation. So if you’ve got students going online and getting help and doing things you know outside of class, then they’re motivated and they’ll do better. So it can help the not-so-sharp and the unmotivated student by actually becoming a little bit more motivated.

A strong student may be motivated to learn and may be successful no matter the venue through which he or she is taught, however, a weaker student taking an online course, may be good at finding help online. She may find help sites and may motivate her even more because she enjoys learning in this manner.

*Stay motivated.* Students are uniquely motivated. Finding the hidden student and motivating participation were discussed as part of “How to Motivate?” This section looks at how instructors felt students become and/or stay motivated to do well in college courses, specifically online courses.

Students in online courses can hide from the instructor. The structure of the student-teacher relationship in a face-to-face course is different than the structure of the
relationship between student and teacher in an online course. In many cases the teacher never sees the student’s face and vice versa. Hiding from someone who is able to call a student by name and look the student in the eye is more difficult than not responding to an email linked to nothing more than a name. Barb commented on this situati

…they don’t have to come look at you, so they can just put it on the back burner.” Haley agreed stating, “Oh, I would say probably the mere fact that you’re not in the same room with them probably yeah, there’s some degree a person has to be a little bit more motivated in an online environment than in a face-to-face environment.” While it may be easier to hide in a class where the instructor does not have a face to put with the name, Aaron agreed while students can hide in an online class, students are also able to hide in a face-to-face course as well.

…if you want to hide in an online discussion and not participate you can do that. And your grade will be impacted because of that. But if you want to hide in a face-to-face class you can do that just as well.

Aaron implied, however, that there are ways to be as visible (or invisible) in both online and face-to-face courses.

Students taking face-to-face courses who attend class allow the instructor to connect a face to their name. This connection makes it difficult for some students to miss class because the teacher will know they are gone. An online course where an instructor only has a name and an identification number lacks the face recognition and the relationship formed through personal communication.

Participation. Aaron also made a contrary point. In addition to using the lack of name-to-face recognition, hiding can also give some students confidence, a power they may not have in the traditional classroom. He said, “I think that discussion part of it is, is
important that sometimes students might not say things within the classroom but they’re first to say things when they’re grouped in a distance learning environment." While not having a name-to-face connection can cause some students to be a little less honest or a little less motivated to do the work for a class (as discussed in the integrity section), this lack of connectivity may give some students the confidence to act positively, allowing them to voice an opinion or perspective where in other situations they may not have been voiced.

In addition to giving students the courage to voice their opinions and perspectives via discussions, the online format also gives the instructor the ability to make discussions a more concrete part of instruction, requiring posts of different kinds from the students. In a face-to-face classroom, grading participation and discussion can be difficult and subjective, but having stipulations via online posts/discussions can be more specific and objective.

First off you have to respond to engage in the discussion, but secondly, when I normally do it, I also have it that you have to respond to at least two other people, so that is a requirement of an expectant discussion board or a forum that the students might be involved in. So I tend to force the thing. I actually, think you get more out of it.

Aaron was able to force participation, making the posts required and a graded portion of the students’ overall performance and believed by teaching in this manner it allows students to learn even more. It is difficult to force participation in a face-to-face setting.

Who is more motivated? While many instructors agree online students must be motivated, it is difficult to decipher whether they must be more motivated than the traditional student or if the “normal level” of motivation will suffice for either type of
student in either type of class. Some instructors say all students must be motivated to be successful, while others say online students must be more motivated. There were no instructors who said face-to-face students must be more motivated than online students.

Dal placed the motivation responsibility on the student, however his belief holds true in any environment, face-to-face or online. Freddie agreed. Dal said, “If you want to succeed, the bigger part is up to you. It’s not really up to me and so that must makes sense for anybody that’s learning.” Freddie said, “They have to be highly motivated to be successful in other courses, too,” implying motivation is needed in all courses. Success can be a result of motivation. Dal and Freddie believed the way the class is taught does not determine the success of the class. A student must be motivated regardless.

There were instructors who felt online students must be more motivated than the traditional face-to-face student. Barb said, “I agree that motivation to succeed is crucial for success in any course, but especially in an online course.” She agrees students need to be motivated in any situation, but believed students in an online course must be more motivated than the student in the traditional face-to-face course. Depending on the set up of the course, students may be working at their own pace. In a situation like this, distractions can make studying more difficult than if a student were in a classroom.

In addition to being motivated to learn mathematics, a feat for some students, learning the technology can also be difficult. Freddie believed this is one reason a student in an online mathematics course must be more motivated than the student in a face-to-face course. Online students must learn both the mathematics and the technology. An additional argument here is similar. While not being a prominent theme in this research there were students who claimed instructors to be the ones who have a technology block,
not the students. Thus students have a difficult time understanding the material because
the instructor cannot portray the information properly using the given technology. Freddie
said, “…they have to be motivated, more motivated because they have to be willing to
put up with the failures of the technology in order to get the material.” While the
technology can give some students extra courage some instructors believe the technology
can cause headaches for other students making the experience less positive.

Success based on motivation. There was another component that suggested the
relative success of online students. Many instructors viewed time management as a skill
the motivated online student must possess to be successful. Students must be able to
successfully manage their time so they are able to complete coursework on time.

Benny summed up several instructors’ views by stating,

Well, in my experience it takes a special kind of student to in be a
completely online or a completely asynchronous class because a lot of our
students now seem to have issues with time management, so without
having those skills I think it makes it a little bit more difficult.

Francine stated, “…time management skills are crucial to success in an online
course.” It seems a motivated student also values time management, making success in
the course more attainable. Online courses provide flexibility to students and instructors.
While flexibility is welcomed by many, some students are more successful when on a
stricter schedule. Thoughts like, “I can do this later,” are more easily entertained when
there is no class time in an online course. Motivated students placing a high priority on
time management, may complete assignments in a more timely fashion than the non-
motivated.

The right student. All students learn differently, making online courses suitable for
a fraction of students. Unfortunately for students they may not know how they best learn
and if the can be successful online. Dane discussed a policy used to allow students to find
out whether an online course is appropriate for their learning style. The policy was used
at the university where he taught. He discussed in depth how only some students are cut
out to be successful in the online classroom, however, there are students who want to try
the online format not knowing if the format is conducive to their learning style. In a
normal circumstance, students would have to take a class and either sink or swim. At the
university where he teaches they allowed students to enroll in an online course and they
were then permitted to drop the course at any time within the first four weeks. No
repercussions. No questions asked. Tuition back. He stated, “…we found we had much
better success…when I taught there if we just left students opt out of a course in the first
four weeks….No penalty, tuition back. That would be my suggestion.” He suggested this
as a remedy to the influx of students wanting to take online classes knowing there will be
students who realize they are better in face-to-face classes. He believed this ends up
being the best case scenario for both types of learners.

In the Future Prevalence section there was a professor who suggested the online
community is now saturated with the right amount of online students, feeling many
students need the face-to-face classroom to be successful. Having this drop-out option
would allow students to test the water before committing to the online format of a
class/degree. This option could change the outlook for online courses, as students would
not need to make an unnecessary commitment to something about which they may or
may not be ready.

Instructors saw students’ ability to “hide” in an online course as a way students
were able to be less motivated without being noticed. On the other hand, some instructors
felt they were able to more easily force participation on the online students, requiring online posts and discussions as part of their grade. Some instructors felt non-traditional students make up many online courses, possibly attributing their motivation to the age or type of student, instead of the mode of instruction. Instructors differed in their perspectives as to whose responsibility it is to motivate students, instructors or students themselves. Some instructors were skeptical about the students’ ability to realize whether or not they could succeed in an online environment, suggesting they be allowed to take an online course for a trial run without repercussions if the student decided to drop the course.

Deep understanding is important for students. The survey asked students the following question, “In the future, how do you envision yourself using distance learning as a part of your classroom?” One student who also had experience teaching online courses for a college/university responded, “I don’t. I teach online courses for a terrible university and I am far too aware of how inadequate this type of education is for deep and meaningful understanding.” The students interviewed were asked to give their perspective on this quotation. Responses ranged from agreeing whole-heartedly with the statement to completely disagreeing. While the motivation theme was unique to the instructors, interestingly Deep Understanding is unique to the student responses.

Deep and meaningful understanding? Yes. Pam, Thelma, Walter and Xavier believe deep and meaningful understanding can come from an online class, disagreeing with the quotation embedded in the question, however they do not agree completely on how this understanding can be achieved.

Instructor Responsibility. Is deep and meaningful understanding the
instructor’s responsibility? Yes. It is the instructor’s job to present a course which allows students to be successful in understanding the relevant material, in any kind of class, online or face-to-face. Pam’s response,

I have had some excellent distance learning classes. For example, even this semester Angela Smith (name has been changed) is teaching a class that is face-to-face and online. I learned as much when we have our class online as when it is face-to-face. This is because the professor puts an adequate amount of time in helping us succeed at the content. She is constantly posting things online for us to look at and ways to better prepare us for our profession.

This response shows the respect Pam has for a current hybrid, non-mathematics instructor who makes her online portion just as meaningful as the face-to-face portion of the class. The instructor provides the avenues students can use to be successful in learning the material.

**Student Responsibility.** Does the responsibility for deep and meaningful understanding fall under the students’ responsibility? Yes. While it is important for an instructor to provide meaningful lessons having the potential for students to gain deep understanding, the student can not be a bystander. They too, must put forth the effort required to attempt to understand the material at hand. Thelma believed it is true, online students can slack off, but that is true of any student.

I think that it is true that students can really slack off in online courses and learn enough just to get by. However, I think this is the case in non-online classes as well. I believe the majority of students would use the class time more wisely and pay more attention because they would be working through problems and not just listening to someone teach it. Then, if they still do not understand it, they can go back and try to review the lecture material online.

While she knew students can (and do) “slack off” she believed working through problems and “not just listening” makes online course more effective. In addition,
students can go back and review material at any time.

Walter agreed when students apply themselves, they gain deep and meaningful understanding. However, he also believed human interaction is a necessity.

If you apply yourself and if you regiment yourself, you’re probably going to be at least if not more understanding of the material. I do agree that there needs to be that human interface, human communication. That’s what you need and that’s what’s missing with distance learning.

Walter felt the missing piece in online education is communication. (See Communication.) Communication was one of the most common themes found in both instructor and student interviews. The importance of having all around good communication, between teacher and student(s) along with student and student is a very important component for a successful class, online or face-to-face.

An effective student is aware of his resources. College students in online and face-to-face courses have fingertip-ready resources. The internet is overflowing with sites ready to help students with questions in mathematics. Sites associated with and sites not associated with textbook publishing companies are available. For this reason, Xavier felt students have the opportunity to be at least as successful in online courses as they are in face-to-face courses.

I think students can learn as much, if not more, from an online course. We have more resources at our fingertips and it forces us to be proactive and responsible for keeping up with the course. “Deep and meaningful understanding” can still happen, even if the teacher can’t physically see his students when they get the “AHA” moment of understanding.

Xavier sent a reassuring message that students can still have an “Aha!” moment at home, even if the instructor is not a witness. While students are unable to see the non-verbal cues given by the instructor in an online course, likewise instructors are unable to see the non-verbal cues given by the students in an online course.
Deep and meaningful understanding? Maybe. Wayne, Zane, and Tierni gave less definitive answers to this question. They all believe perhaps deep understanding could be achieved, but are not willing to say “yes” or “no”. Tierni said, “I think that’s pretty accurate. I don’t know. If it was more of a Skype-based class and you could interact and raise your hand and stuff, you would be more able to retain stuff if you use it, I don’t know…”

After saying she felt the quotation was fairly accurate, she backtracked and said if the instructor were to use a Skype-type mode of communication where the students were able to raise their hand and ask questions in real time, she would believe students would be able to retain more information. She ends her response with “I don’t know.” Tierni seemed to believe there is a stigma surrounding online courses, making them seem as if learning concepts in a deep and meaningful way is generally not obtained through online methods. However, when she took the time to truly think about her response, she gave suggestions as to how an instructor could make an online course better, allowing students to gain deep and meaningful understanding.

Zane also gave an “I don’t know response.” He made it clear it is up to the student to make the most of a course, believing a student can learn as much or as little as desired in an online course or a face-to-face course. Zane went on to say he has friends who have taken face-to-face courses having only three or four assignments for an entire semester, compared to the many more he had in his online course.

I think with online education in general, that can be the case. It’s really up to the student … you can learn as much or as little as you want to. You can learn enough to pass the course but then again, that’s sort of true with any course, whether it be face-to-face or online and I think it’s really up to the school to make sure that the work that the student has to submit is adequate enough. Now I know some of my friends that went to traditional
four-year schools, they would have only three assignments or four assignments the whole semester that were graded, whereas online we had a lot more than that.

Face-to-face courses are very different when taught by different instructors at different institutions. Likewise online courses are very different when taught by different instructors at different institutions. It is conceivable some online courses are better than other online courses and are better than some face-to-face courses. Likewise it is conceivable to believe some face-to-face courses are better than other face-to-face courses and better than some online courses. It is also believable different students would have opposing views on each of these courses. Zane believed it is up to the student to make the best out of the course situation he is in.

Wayne responded to the question with a question. “What is deep and meaningful understanding?” That is a good question. From where does this understanding come anyway? Deep and meaningful understanding can come from different places, at different times, doing different tasks for different people.

What is deep and meaningful understanding? Well, sometimes I get deep and meaningful understanding by reading a book on my own. Some people need to think outside of the box here. If someone thinks, including an instructor or professor at any school, that the only deep and meaningful understanding comes from listening to them lecture on a subject, I would think they are very narrow minded and are not really concerned with the students in the first place.

While this research looks at the perspectives of online learning from both the students’ and instructors’ perspectives. Wayne’s perspective is insightful. Teaching is so much more than using just one more means of communication to convey information to students. If Wayne is able to gain deep and meaningful understanding by reading, gaining this kind of understanding in an online course is definitely possible.
Deep and meaningful understanding? No. Some students felt obtaining deep and meaningful understanding through online learning is impossible. Rachel, Rhett and Raul all have his feeling saying, “I agree. That is why I left the college setting,” “It’s dead on accurate,” and “Fairly well said,” respectively. Rachel is a graduate student in mathematics education who has some experience teaching online. While it is obvious from this response she was turned off by teaching in the online classroom, it is not clear what her perspective was when she was a student in the online mathematics classroom. Neither Rhett, nor Raul have experience with taking mathematics courses online.

Sandy, who has taken online mathematics courses, and enjoyed them said several times in his interview that online classes are not for all types of student learners. He is employed full time and enjoys teaching himself, thus he is well-suited for the online environment. His response “I’ll agree with that. That’s, I think that’s 100% true. ..there’s a difference between understanding how to do the problem and knowing how to do the problem.” His response exemplified while he enjoys taking online courses he does not truly feel that he is getting a deep and meaningful education in those courses.

Again it is conceivable students in both face-to-face courses and online courses may only learn procedures and not concepts. Sandy’ response, however leads one to believe the online environment is not conducive to effectively teaching concepts at all, at least not in his experience.

As with many themes the inability to learn concepts in a deep and meaningful way may fall back on communication. Yara valued communication and interaction with the instructor in order to gain understanding. “I agree,” she said, “Many students require that personal interaction with the professor and actual classroom learning, in order to
fully understand the material. But it is not true in all cases.” As mentioned earlier, students learn in different ways. A one-size fits all scope in looking at how a mathematics course is taught most certainly does not work. The different personalities of the instructors and students, along with the outside forces of life, make it impossible for one type of instruction to always be better than another.

**Limitations, Conclusions, Areas for Additional Research**

The original aim of this study was to gain knowledge based on students’ and instructors’ perspectives on the incorporation of any type of technology in the collegiate classroom. The aim was changed such that the focus of the study became distance learning, mainly online learning, in the college mathematics classroom from the perspectives of instructors and students.

Modifications to the original study were found in the following areas: Participants, Survey and Interview Implementation, and Literature. Included are descriptions of the modifications along with discussion about how these changes affected the overall research.

In addition, the results obtained in this study led to unanswered questions relevant for future studies. The three large areas in need of additional research are: Immediate Feedback, Student Motivation, and Student Integrity. Descriptions of potential research areas are also included in this section.

**Changes in focus.**

*Participants.* Originally, student participants were going to be gathered from both Bowling Green State University and the University of Toledo only using a large introductory education class as my audience for soliciting volunteers. Because proximity
and student demographics from these two universities were too similar, students majoring in Adolescent and Young Adult (AYA) mathematics education were targeted. Gaining access to AYA mathematics majors with varying amounts of online experience proved to be difficult leading to very few volunteers. To broaden the participant pool, the restriction of AYA mathematics education was lifted and any college student volunteering to take the survey or be interviewed was a welcome participant. Thus the information presented in this research better represents the general college student population.

A wide variety of students volunteered to participate. This provided perspective from college students who have online experience and those who do not. While only 38 (26.21%) of the students surveyed had experience in an online mathematics class, a total of 72 (58.54%) showed potential interest in taking a mathematics course online. There were 40 (27.59%) students who had taken a mathematics education class. These were most likely students majoring in mathematics education. Seven of these 40 students had some online experience in a math education class, although none of the mathematics education classes were held 100% online. Students not taking mathematics education classes made up over 80% of the participants. Determining what these students were majoring in is not possible, as they could be majoring in mathematics education and simply have not taken a mathematics education course yet.

Math education majors generally look at a course from a different angle, not only learning material, but also analyzing the experience from a pedagogical point of view. The participant change impacted the study because the original goal of gaining the perspectives from preservice teachers only was lost as these responses were grouped together with all student responses. Because the intent was to gather insight from AYA
majors only, no question in the survey asked the students about their course of study or major. Additional research in this area including focus on mathematics education majors is necessary.

Instructors from 98 college and universities were contacted either via telephone or email, inquiring participation. In many instances, several instructors from the same institution were contacted. These instructors were asked to volunteer to take the survey, and they were also asked to send the survey on to their students. Obtaining student participants was difficult without the aid of instructors, as contact information is confidential. Future research may include incorporation of a larger student and instructor population. Obtaining participation from a 100% online university was denied. Interview participants were gained through 1) volunteering contact information as a part of the survey or 2) volunteering through instructor participant solicitation of their own students.

Additional research areas

Immediate feedback. Immediate feedback was a much discussed component, for both successful traditional and online courses. Instructors and students alike believed students benefit from feedback instantaneously, while they are thinking about a problem. Immediate feedback can be provided through software programs, such as MyMathLab® (MML). In such a program, a student attempts to find the solution to a problem. Upon inputting the solution into the computer, the program informs the student whether or not the answer is correct. Should the answer be wrong, there are ways a student can get help in finding the correct solution. Students are able to get a hint, or look at the solution for a similar problem. Much of this feedback is procedural in nature helping the student find computation errors.
Gaining conceptual feedback in this manner is more difficult. The software programs described in this research were very procedural in nature. The type of immediate feedback a student would receive from an instructor in a face-to-face setting would most likely vary from instructor to instructor and course to course. The objectives of the courses within this research is unknown. Some course objectives may be procedural in nature wanting students to learn how to obtain the correct answer, while some course objectives are concept based, wanting student to understand a concept and realize why and how a procedure works.

As mentioned above, immediate feedback can also be viewed as face-to-face feedback, much like students receive in a traditional class when asking the instructor a question receiving the answer instantaneously. Many students viewed this kind of feedback as desirable and even necessary for success. Students crave the immediate feedback they receive from an instructor. The immediate feedback concept is in need of more research because it truly is not clear what the students desire: face-to-face communication or immediate feedback? In a face-to-face class students only receive immediate feedback when they are actually attending the class or during office hours and asking questions. This means if a student is doing homework and is looking for an immediate response, the student must wait until the next class meeting time, which may be days away. Even if the student is to attend the instructor’s office hours, it too is most likely not immediately available to the student. In reality, many students do not take the time to attend office hours for traditional classes. A major complaint for online courses is the lack of face-to-face, immediate feedback. The time lag in responding to student emails was frustrating to students, making them wish they had some face-to-face time
with the instructor.

Take for instance the online student who emails the instructor inquiring about a homework problem and the instructor takes a day or two to respond to the inquiry. This time lag proves to be an annoyance to the student. In reality, the student would most likely have to wait for the answer to her inquiry for a couple days in a traditional class as generally, because they do not meet every day. Students’ true desire is still unclear. Do they want face-to-face immediate feedback for the quick response, or for interpersonal communication with the instructor?

Students desire and benefit from both types of immediate feedback. The immediate feedback used in online homework settings can help students while at home completing their homework. They know right away whether or not they correctly answered a particular question. On the other hand students also benefit from being able to ask their instructor a question and obtain a face-to-face answer, complete with facial expression and insight.

An instructor can be more thorough with their answer as students ask questions not only pertaining to procedure, but also to conceptual understanding. Getting the thumbs up or down from the computer is helpful, and the extra help a computer program provides can also aid students in understanding, but ultimately, students still desire feedback from their instructor face-to-face.

Some instructors like the online world, as they are given time to answer questions. They are never asked to answer something “on the spot”. Answers can be more thorough and thoughtful than the ones given off the cuff during class.

Motivation. Many instructors believe students in online courses need to be more
motivated than students in traditional courses. The flexibility online courses allow the unmotivated student easy access to becoming unfocused. When there is no predetermined class time for students to meet, and when there is no meeting place outside of a student’s living room, finding or allowing distractions becomes easier in an online course than in a course that meets at a particular time in a particular place with a particular instructor. Physically attending class, minimizes distractions. For these reasons online students are said to need internal motivation to succeed in such a course.

The student demographics of an online course, however are different than the demographics of a traditional course. Many non-traditional students who already have a career, a family, or other obligations take online courses because of the flexibility they allow. In some cases the only reason they are able to take classes at all is because of the flexibility online courses provide.

There are many variables attached to a student termed “non-traditional”. Generally, these students are older than the 18-23 year old traditional students who attend college. Traditional college students are younger and attend college immediately following high school. While many of these younger students do have aspirations, there are some who begin their college career wanting to get a college degree, but not knowing in what they want to major. Non-traditional students generally come back to college with a clear goal in mind. They have had more time to experience life and understand in which direction they would like to take theirs, whether it is to continue down a career path, or change paths completely. Reasonably students who have career aspirations would be more motivated to do well in courses than students who have no idea if the course they are taking matters to their future or not, thus a large majority of non-traditional students
have a clear goal in mind.

Non-traditional students have different responsibilities than traditional students. Non-traditional students may be juggling careers and even families along with other obligations. These obligations and responsibilities are different from that of a traditional college student, who does not have a career and generally does not have families for which they are responsible. These other responsibilities make having traditional college courses for non-traditional students difficult if not impossible.

Online courses are more flexible, fitting the non-traditional student’s lifestyle. In fact, without online courses earning a college degree may be impossible for these students. The flexibility some traditional students enjoy is a necessity for some non-traditional students.

While instructors commented that online students need to be more motivated to succeed, more research needs to be done to filter whether the successful online students are simply more motivated individuals than face-to-face students, or whether non-traditional students are more motivated than traditional students and they saturate the online community? A non-traditional student who is thankful to be able to take online college courses has a different perspective than the traditional college student taking an online course because it’s convenient.

In general, a motivated student is a successful student. If a student is motivated to do well in a course, any course, they will take the appropriate measures to obtain that goal, whether it be in an online class, or in a face-to-face class. Students are motivated by different things, though. Some students are motivated by the end goal of graduation, looking at each course like an item on a to-do list. Their motivation is to pass the course
and move on to the next one. Others are motivated because they truly want to learn the material being taught, for one reason or another. Sometimes it is because they are going to be using the material in their future careers. Still others are motivated by outside forces, such as commitment to family. Knowing that a college degree increases the chances that a student will get a job paying more money is motivation for the student who is looking for a way to financially support his or her family.

Based on the responses in this study, a clear conclusion can not be made about motivation, and whether or not the online student is more motivated than the face-to-face student. It is agreed that motivation is important factor for both online students and face-to-face students, however defining the online student as more motivated is inappropriate. Researching what motivates students, how they stay motivated, and the difference (or similarity) of motivation among online and face-to-face students would be appropriate.

**Integrity.** A very popular theme among students and instructors, specifically the ones interviewed was integrity. While the online courses provide the flexibility some students need or desire, the setting for online classes allows students to use any resources available to them. Online sites providing calculations of mathematical formulas answering inquiries regarding a plethora of questions spanning a wide variety of mathematical subjects are available to anyone. Personal relationships with individuals having a stronger mathematical understanding is also available to students. These resources are actually available to both students taking online and students taking face-to-face courses. The difference is in the monitoring of these resources.

The setting of a face-to-face course allows an instructor to assess her students using appropriate methods, monitoring the resources available to the students during the
assessments. However, in an online setting the instructor has a more difficult time monitoring the kind of resources a student utilizes at any time.

While not all students and instructors believe integrity is a problem in the online course, many of the ones who do feel it is a problem, believed it is a large one. Because an online course is more conducive to cheating, is it reasonable to believe more students cheat in them? There is undoubtedly cheating going on in the traditional face-to-face classroom as well. Here is where more research needs to be done. Because the setting is more conducive to cheating, does that mean more students cheat?

Perhaps a more philosophical question is, “How honest are college students?” Participants stating there are no measures to keep the students honest in an online course, could be looked at through a different lens. If the only thing keeping college students honest is the monitoring of the assessments done in the face-to-face settings, then it is absolutely logical to believe online courses are quite corrupt harboring all sorts of dishonest behavior. On the other hand if students’ moral and ethical belief systems keeps them honest, then it would be logical to believe these students will be honest in any setting, online included. Likewise, if a student is dishonest, lacking moral character, will they most likely find means to maintain this character trait in any setting? How big of a problem is this? How should the problem be handled?

Online courses are most likely going to be a prominent part of college mathematics courses in the future, the very near future. Continuing research in this area is needed to ensure students continue to get a quality education, one equivalent to that in the face-to-face classroom.

Integrity can be a problem in any type of class. Based on this research
assessments should be proctored. Distance learning is just that – learning from a distance. Students are learning the material in a different setting than the face-to-face traditional one, however distance learning does not have to incorporate distance assessing. It is the instructor’s responsibility to compile an effective course, giving students the resources and tools to be successful. It is important to think about the objective of not only a course, but of an individual activity. For instance, a lesson or activity usually has the objective of introducing or teaching a student a particular concept. This kind of lesson or activity can be done in several different atmospheres, whether it be in the classroom or at home. However, when it comes time to assess a student’s understanding of a concept, the objective changes. When giving an assessment, I want to know what the student knows in a given setting. I want to know if the student knows concept x, concept y, and concept z without resource a, resource b, and resource c. There is no way to monitor this without having the students in a face-to-face setting. I believe we are doing our students a disservice by not having proctored assessments.

Answers to Research Questions

What is the appropriate usage of distance learning in the college mathematics classroom from both the student and instructor perspective?

Perspectives regarding the appropriate usage of distance learning in the college mathematics classroom varied greatly from instructor to instructor, student to student, and student to instructor. It is clear students and instructors alike value communication, with emphasis placed on face-to-face communication. Face-to-face courses and hybrid courses were deemed appropriate, while less instructors and students valued the distance learning courses, especially if they were looking to gain a deep conceptual understanding of the
What are the similarities and differences found among the students and the instructors’ perspectives?

The three most prevalent similarities found among the students and instructors’ perspectives include integrity, future prevalence, and communication. Integrity concerns refer to the potential issue that students may not be honest about their role as a student in an online course, meaning they may get assistance from non-approved resources. In addition, it is conceivable that a student may enroll in a course and have someone else do the work for them. Future prevalence refers to the overwhelming perspective regarding the inevitability of the role distance learning will play in the future education of college mathematics courses. Communication refers to the importance both instructors and students placed on the role communication plays in a successful distance learning, hybrid, or face-to-face class. The emphasis in this theme was placed on the desire to have immediate feedback from instructors.

Two emergent differences among perspectives was motivation and deep understanding. Instructors discussed the importance of students having motivation in order to be successful in an online course, some emphasizing the increased level of motivation an online student must have while others viewing motivation important in any course. Students on the other hand discussed the importance of deep understanding. While there are students who see a course as a checkbox on a to-do list of courses in order to be qualified for a job or career, there were other students who felt they really some grades earned in online courses are unrepresentative of their understanding, specifically when earning a high grade. Students emphasized their desire to earn a grade
representative of their understanding of the material.

**What might these differences, if they exist, mean?**

Motivation refers to the motivation of students. Thus when instructors are thinking about motivation, they are thinking about the motivation of students as whole, however, while students can also think about student as whole, they are also thinking about themselves within this group. In general, students who are willing to be interviewed regarding their perspectives of online learning are likely to be motivated students. To them, motivation may not be something about which they are concerned, making it seem as if it was non-issue.

When students discussed the importance of obtaining deep understanding, they too are thinking about their personal understanding of material. Instructors on the other hand, view the grades students earn as a good indication of their understanding. Instructors do believe deep understanding is important, but most likely believe they have an effective gauge as to how well their students understand the material based on their grade.

**Where is there a disconnect or gap (either real or perceived) when comparing student and instructor perspectives?**

The largest disconnect was emerged as a survey theme. When asked about their willingness to teach an online mathematics course, approximately one-third of the instructors said they would not be willing, one-third said they would be willing, and one third said they may be willing. On the other hand 24% of the students said they would be willing to take a distance learning mathematics course, 35% said they may be willing, and 42% said they would not be willing. Based on these percentages, instructors are more
willing to teach these courses, than the students are willing to take the online courses.

**How can the disconnect or gap be addressed?**

One way to address the disconnect would be through the implementation of the hybrid course. These courses allow students and instructors alike to enjoy the type of course they find to be most effective based on their specific, personal needs. The flexibility of an online course is desirable by some, while the type of communication a face-to-face course offers is coveted by others.

**Closing thoughts**

**Regarding research.** Additional research in the areas of student motivation, integrity, and communication associated with distance learning are needed. Based on the findings of this research, answers to questions such as: What are the similarities and differences regarding the motivation of students in online and face-to-face classes? Is one group of students more or less motivated than the other? Are the students internally motivated or externally motivated? Motivation was an emergent theme within this research, however, differing views of motivation were present. Future research needs to be conducted to explore these questions.

In addition to researching motivation, integrity is also an area of potential research. Appropriate questions might include: Do students in online courses honest regarding who is taking the course and the resources they are using? Are students more likely to cheat if they are taking an online course, than if they are taking a face-to-face course? Do students take online courses for this reason (because it is easier to cheat)? What are the most effective ways to help in maintaining integrity in the online classroom, and perhaps in the face-to-face classroom as well?
Communication also has areas for which more research is appropriate. Questions regarding immediate feedback are necessary. Research questions might include: What is more desirable, face-to-face immediate feedback, or online immediate feedback? Why? Is it more effective to be given face-to-face feedback (but not immediate) or immediate online feedback?

**Regarding teaching.** Effective teaching can take many forms. This research concludes that distance learning can be effective, however, gaining conceptual understanding may be more suitable in the face-to-face setting. The hybrid course seems to offer the most effective ways to teach while allowing students and instructors desirable characteristics.

The hybrid course offers flexibility, while also allowing students the desirable face-to-face component. While it seems hybrid courses would be more accepted than 100% online courses, more research is necessary in this area. Preferences between just face-to-face and hybrid courses is unknown. Questions such as: Would you rather take a face-to-face course or a hybrid course (with no option of 100% online)? What components of the hybrid course are essential? What components of the course are appropriately implemented online and what components are appropriately implemented in face-to-face?

An increase in distance learning at some level seems inevitable in college mathematics courses. There must be a balance between continuing to offer effective courses while allowing participant flexibility, without sacrificing the quality of the course. Is it plausible that online courses are just as effective as face-to-face courses? Could they be more effective? What characteristics are present in an effective course?
Technology plays an immense role in college students’ lives. It is logical that technology, specifically distance learning courses, would begin to be part of college level mathematics courses. These courses provide flexibility for both the instructors and the students, making them desirable. However, the face-to-face interaction and communication present in a face-to-face course is also desirable. This study looked at the perspectives of instructors and students regarding online learning in the college mathematics courses. There were both positive and negative perspectives shared from instructors and students about both online mathematics courses and face-to-face mathematics courses. It is imperative as distance learning becomes even more prevalent in the college mathematics classroom, that research is continuous such that these voices are heard so colleges and universities can offer distance learning courses, or hybrid courses, or face-to-face courses that provide students a sound mathematic experience.
References


Gibbons, A., Mize, C.D., & Rogers, K.l. (2002). That's my story and I'm sticking to it: Promoting academic integrity in the online environment. (ERIC No. ED.477016).


Miller, Christina M. *Geometer’s Sketchpad and the Pythagorean theorem*, Unpublished graduate research, The University of Toledo, Toledo, OH.


Appendix A

Solicitation Email

Dear _____________________________,

The University of Toledo IRB #107846

My name is Christina Miller. I am a doctoral candidate at the University of Toledo (Ohio). I am focusing my dissertation research on the perspectives of both college students and instructors related to the use of distance learning in the college mathematics classroom. I hope to find where the perspectives overlap and where there are perhaps gaps in these perspectives. Instructor participants include professors, instructors, and lecturers. Student participants include both undergraduates and graduate students, who may or may not be majoring in mathematics. I am using an online survey as one tool to gather data.

Participation in this study is voluntary and anonymous. Replies will be held in the strictest confidence. Names and/or other identifying information will not be used unless volunteered by the participant within the study (question #27).

Completion of the survey should take about 10-15 minutes of your time. If possible, I would like participants to complete the survey within two weeks.

Would you consider taking the survey for me? Might you have some online students from previous semesters that you would be willing to forward the student survey onto?

Links to the surveys are below:

Instructor Survey:
https://www.surveymonkey.com/s/InstructorSurveyonDistanceLearning

Student Survey:
https://www.surveymonkey.com/s/StudentSurveyonDistanceLearning

I look forward to hearing from you. Please feel free to email or call me with any questions. I really appreciate your help.

Thank you for your consideration,
Christina Miller
(419)308-4955

Dissertation Advisor:
Dr. Robert Schultz (419)530-2469
robert.schultz@utoledo.edu
Appendix B

Instructor Survey

1. How long have you been a mathematics instructor?
   - 1-5 years
   - 5-10 years
   - 10-25 years
   - 25+ years

2. Which mathematics courses have you taught? (Check all that apply)
   - College Algebra
   - Calculus
   - Probability
   - Pre-calculus
   - Statistics
   - Linear Algebra
   - Elementary Statistics
   - Finite Mathematics
   - Linear Algebra
   - Calculus
   - Other

3. Additional experiences (Teacher's Assistant)
   - Teacher's Assistant
   - Other

4. How do you feel about teaching a DL mathematics course?
   - Yes
   - No
   - Unsure

5. Have any of the above mathematics courses taught on distance-learning (DL) meaning that the course was at least partially online? If so, please continue with 4c. If not, continue with 6c.
   - Yes
   - No

6. Please rate the following characteristics of a DL mathematics course according to their contribution to attracting you to possibly teaching the course.
   - Importance of time flexibility
   - Importance of immediate feedback
   - Importance of student interaction
   - Importance of student interaction
   - Importance of student interaction
   - Importance of student interaction
   - Importance of student interaction
   - Importance of student interaction
   - Importance of student interaction
   - Importance of student interaction
   - Importance of student interaction

IF YOU HAVE NOT TAUGHT A DL MATHEMATICS COURSE, PLEASE CONTINUE WITH 6c. IF YOU HAVE NOT TAUGHT A DL MATHEMATICS COURSE PLEASE CONTINUE WITH 6c.
6. What percent of the course(s) or courses was provided via distance or web computer-mediated? (For instance, if the entire course was online, you would describe the course as 100% online. If you need only mark the percentage of the courses that you have taught as a DL course.)

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<thead>
<tr>
<th>Course Name</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
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<tbody>
<tr>
<td>Statistics</td>
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<td>physics</td>
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<tr>
<td>Computer Sci</td>
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<td>Math</td>
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<td>English</td>
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<td>Science</td>
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<tr>
<td>Social Sci</td>
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</table>

7. Please write that question #2 and 11 are the same as #10, 11, and 12. Because you may have taught more than one DL mathematics course, please describe question #2 and #8 with regards to one of the DL courses you’ve taught. Likewise, answer questions #5 and #10 for DL mathematics course 2 (if applicable) and questions #11 and 11 for DL mathematics course 3 (if applicable). If you’ve taught less than three DL mathematics courses, simply leave the extra questions blank.

How often were the following components used in the DL mathematics course?

<table>
<thead>
<tr>
<th>Component</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Video</td>
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<tr>
<td>Audio</td>
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<tr>
<td>Interaction</td>
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<tr>
<td>Courseware</td>
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<tr>
<td>Other tools</td>
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</table>

8. (Regarding DL mathematics course 1) How beneficial to your students’ learning were the components used in the DL mathematics course?

<table>
<thead>
<tr>
<th>Component</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
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<tbody>
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<td>Video</td>
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<td>Interaction</td>
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<tr>
<td>Courseware</td>
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<tr>
<td>Other tools</td>
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</tbody>
</table>

178
15. Did you teach more DL mathematics courses than the ones used to answer questions 47-49?

No

Yes

Please indicate the difference if yes.

16. Rate the following characteristics of a DL mathematics course according to their contribution to attracting you to teaching the course.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time flexibility</td>
<td></td>
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<tr>
<td>Learning flexibility</td>
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<tr>
<td>Ability to control content</td>
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<tr>
<td>Ability to tailor content</td>
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<tr>
<td>Ability to engage students</td>
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<tr>
<td>Ability to foster learning</td>
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<tr>
<td>Other (please specify)</td>
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</tbody>
</table>

17. What would you say is the average grade earned in each DL mathematics course?

<table>
<thead>
<tr>
<th>Course</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course 1</td>
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<tr>
<td>Course 2</td>
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</tbody>
</table>

18. Overall, how well would you rate your student's understanding of the material in the DL mathematics courses?

<table>
<thead>
<tr>
<th>Course</th>
<th>NotUnderstanding</th>
<th>PartiallyUnderstanding</th>
<th>Understanding</th>
<th>VeryUnderstanding</th>
<th>CompletelyUnderstanding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course 1</td>
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<tr>
<td>Course 2</td>
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</tbody>
</table>
18. While the previous question asked you to rate your students' overall understanding of the material taught in the DL mathematics course, these next questions (18-21) are asking you to rate different levels of understanding. Conceptual understanding refers to true and deep understanding of the main ideas of the course, while procedural proficiency refers to the ability to correctly perform the appropriate procedure(s) to answer a question/promise correctly.

Rate your students' conceptual understanding of the material taught in the DL mathematics course.

<table>
<thead>
<tr>
<th>Conceptual Understanding</th>
<th>Conceptual Understanding</th>
<th>Conceptual Understanding</th>
<th>Conceptual Understanding</th>
<th>Conceptual Understanding</th>
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</thead>
<tbody>
<tr>
<td>80-100</td>
<td>60-79</td>
<td>40-59</td>
<td>20-39</td>
<td>0-19</td>
</tr>
</tbody>
</table>

19. Do you feel that the DL component AIDED or HINDERED your students' conceptual understanding?

<table>
<thead>
<tr>
<th>Grade 1</th>
<th>Grade 2</th>
<th>Grade 3</th>
<th>Grade 4</th>
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20. Rate your students' procedural proficiency of the material taught in the DL mathematics course.

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<tr>
<th>Procedural Proficiency</th>
<th>Procedural Proficiency</th>
<th>Procedural Proficiency</th>
<th>Procedural Proficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>80-100</td>
<td>60-79</td>
<td>40-59</td>
<td>20-39</td>
</tr>
</tbody>
</table>

21. Do you feel that the DL component AIDED or HINDERED your students' procedural proficiency?

<table>
<thead>
<tr>
<th>Grade 1</th>
<th>Grade 2</th>
<th>Grade 3</th>
<th>Grade 4</th>
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</table>
22. Should your university be offering a DL mathematics course in addition to a non-DL mathematics course?

- [ ] Yes
- [ ] No
- [ ] I am not sure

23. Based on your experiences in DL and non-DL mathematics courses, and your opinions on learning mathematics, rate the approximate usage of distance learning in the college mathematics classroom.

- [ ] Very Low
- [ ] Low
- [ ] Medium
- [ ] High
- [ ] Very High

24. The amount learned in a source is directly related to: (Choose all that apply)

- [ ] The source
- [ ] The researcher
- [ ] The research level
- [ ] Method used to create the source
- [ ] Other relevant source
- [ ] Other Source/Environments

25. In the future, how do you envision yourself using distance learning as a part of your classroom? (Choose DL may or may not be an option. For this question please answer that DL is an option.)

- [ ] DL
- [ ] Non-DL
- [ ] Both
- [ ] None

26. What tasks do you see as necessary to use distance learning for it to be an effective part of instruction?

- [ ] Task 1
- [ ] Task 2
- [ ] Task 3
- [ ] Task 4

27. Thank you for participating in my research regarding perspectives of college students and instructors using distance learning in the mathematics classroom. Do you think there is a possibility being contacted for an interview to further my understanding of your perspectives? If yes, please provide contact information below, including your name and either phone number or email address. All information gathered will remain confidential.

- [ ] Please provide contact information.
  - Name:
  - Phone:
  - Email:

Contact information received are either private or email addresses.
Appendix C

Student Survey
5. Have any of the above mathematics courses taken via distance learning (DL) increased the course was at least partially online? If so, please continue with Q4. If no, continue with Q8.

6. Would you be interested in taking a DL mathematics course?

7. Please rate the following characteristics of a DL mathematics course according to their contribution to attracting you to potentially taking the course.

<table>
<thead>
<tr>
<th>CHARACTERISTIC</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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<th>7</th>
<th>8</th>
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<th>10</th>
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<tr>
<td>Location near campus</td>
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<td>Location near library</td>
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<td>Location near computer lab</td>
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<td>Location near writing center</td>
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<td>Location near bookstore</td>
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<td>Location near study group</td>
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<td>Location near campus residence</td>
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<td>Location near the gym</td>
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<td>Location near the cafeteria</td>
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If you have additional feedback, please provide a narrative in the space provided below.

8. What percent of the course or course(s) you provided via distance or was computer mediated? For instance, if the entire course was online, you would describe the course as being 100% online. You need only work the percentage of the courses that you have taken or DL courses.

<table>
<thead>
<tr>
<th>Course Type</th>
<th>0%</th>
<th>10%</th>
<th>20%</th>
<th>30%</th>
<th>40%</th>
<th>50%</th>
<th>60%</th>
<th>70%</th>
<th>80%</th>
<th>90%</th>
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<tr>
<td>Calculus II</td>
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<tr>
<td>Linear Algebra</td>
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<td>Statistics</td>
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<td>Discrete Math</td>
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<td>Differential Equations</td>
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<td>Physics II</td>
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If you have additional feedback, please provide a narrative in the space provided below.
7. Please note that questions 7, 8, and 11 are the same, as are 8b, 9a, and 11a. Because you may have taken more than one DL mathematics course, please answer questions 9 and 10 with respect to each DL course you’ve taken. Likewise, answer questions 9 and 11b for each DL mathematics course. If applicable; note questions 11c and 12 for DL mathematics course 2. If applicable, if you’ve taken less than three DL mathematics courses, simply leave the entire questionnaire blank.

### How often were the following components used in the DL mathematics course?

<table>
<thead>
<tr>
<th>Component</th>
<th>Very Often</th>
<th>Sometimes</th>
<th>Rarely</th>
<th>Never or Rarely</th>
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</thead>
<tbody>
<tr>
<td>Video presentation</td>
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<td>Discussion/lecture</td>
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<tr>
<td>Discussion without other students</td>
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</table>

### How beneficial to your learning were the components used in the DL mathematics course?

<table>
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<tr>
<th>Component</th>
<th>Very Often</th>
<th>Sometimes</th>
<th>Rarely</th>
<th>Never or Rarely</th>
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<tbody>
<tr>
<td>Video presentation</td>
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<td>Group project in class outside of class</td>
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</tbody>
</table>

8. (Answer for DL mathematics course 2. If applicable.)

### How often were the following components used in the mathematics DL course?

<table>
<thead>
<tr>
<th>Component</th>
<th>Very Often</th>
<th>Sometimes</th>
<th>Rarely</th>
<th>Never or Rarely</th>
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</thead>
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<tr>
<td>Video presentation</td>
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<tr>
<td>Discussion/lecture</td>
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<tr>
<td>Discussion with other students</td>
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<tr>
<td>Discussion without other students</td>
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<td>Group work</td>
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<td>Group work in class</td>
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<td>Group work outside of class</td>
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<td>Group project in class outside of class</td>
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10. (Answer for DL mathematics course 3. If applicable.)
16. What grades did you earn in the course(s)?

<table>
<thead>
<tr>
<th>Course 1</th>
<th>Course 2</th>
<th>Course 3</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
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<td>A</td>
<td>A</td>
<td>A</td>
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<td>B</td>
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<td>D</td>
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<tr>
<td>F</td>
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</table>

17. Overall, how well would you rate your understanding of the material in the DL mathematics course?

<table>
<thead>
<tr>
<th>Level</th>
<th>Far Below</th>
<th>Below Average</th>
<th>Average</th>
<th>Above Average</th>
<th>Far Above</th>
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18. While the previous questions asked you to rate your overall understanding, questions 18-21 are asking you to rate different kinds of understanding. Conceptual understanding refers to your ability to grasp and understand the concepts of the course, while procedural proficiency refers to your ability to correctly use the appropriate procedures to solve a problem correctly.

Rate your conceptual understanding of the material taught in the DL mathematics course.

<table>
<thead>
<tr>
<th>Conceptual</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understanding</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>F</td>
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</table>

19. Do you feel that the DL component AIDED or HINDERED your conceptual understanding?

<table>
<thead>
<tr>
<th>Component</th>
<th>Aided</th>
<th>Hindered</th>
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<tbody>
<tr>
<td>DL</td>
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</table>

20. Rate your procedural proficiency of the material taught in the DL mathematics course.

<table>
<thead>
<tr>
<th>Procedural</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understanding</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>F</td>
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</table>

21. Do you feel that the DL component AIDED or HINDERED your procedural understanding?

<table>
<thead>
<tr>
<th>Component</th>
<th>Aided</th>
<th>Hindered</th>
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<tbody>
<tr>
<td>DL</td>
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</table>
25. Based on your experiences in IL and non-IL mathematics courses, and your opinions on the teaching and learning of mathematics, what is the appropriate scope of distance learning in the college mathematics classroom?

24. The amount learned in a course is directly related to: (Choose all that apply.)

- The instructor
- The student
- The course level
- Course goals
- Whether the course is taught in a IL or non-IL format

26. As a future educator, how do you envision yourself using distance learning as a part of your classroom? (If course, IL may or may not be an option. For this question please assume that IL is no option.) Please explain.

27. What traits do you see as necessary in the use of distance learning for it to be an effective part of instruction?
Appendix D

Instructor Interview Questions

Date: Wednesday, September 19, 2012
Interviewee:

File information:___________________

Potential Interview Questions for instructors/students:

1) What is the appropriate use of distance learning in the college mathematics classroom? Describe the perfect course make up. Do you feel you’ve experienced (or you provide) this atmosphere?

2) If you had the choice teach a mathematics course online, face-to-face, or a combination of online and face-to-face, what would you choose? Why?
   a. What components would play a part in your decision?
      i. (Such as course material, online format)
   b. How has your previous experience(s) played a role in your choice of course make-up?

3) Do you feel instructors and students perceive the success of an online mathematics course in the same way? In other words, in what way(s) would an instructor claim that an online course is successful? Would a student have the same perceptions?
   a. If there are differences, what does this mean?
   b. What can be done about these differences? Or, should something be done?

4) Where do you see the future of online mathematics courses going in the next ten years? 25 years?
   a. How does your perception of the future of mathematics courses make you feel?
   b. Will your teaching-style be compromised or enhanced? Why?

5) What are your feelings on the following quote from an instructor: “…I think highly motivated students could succeed this way, but I’m not sure about the others. To be successful in any online course the student must be highly motivated.”
6) Do you think student reliability is a problem in distance learning mathematics courses? What can/should be done about this?

7) For question 26 (What tools do you see as necessary in the use of distance learning for it to be an effective part of instruction?) you answered, “There needs to be good orientation material for use of the LMS.” Can you explain what you mean?

8) Do you feel that DL components should be required in courses?

9) What is your perspective of mathematics courses that are offered 100% online? Can these be successful? If so, what is needed for them to be successful?

Anything else you would like to share?
Appendix E

Student Interview Questions

Date: Saturday, October 6, 2012
Student Interviewee: ___________________
File information: ___________________

1) What is the appropriate use of distance learning in the college mathematics classroom? Describe the perfect course make up. Do you feel you’ve experienced this atmosphere?

2) If you had the choice to take a mathematics course online, face-to-face, or a combination of online and face-to-face (sometimes called “hybrid”), what would you choose? Why?
   a. What components would play a part in your decision?
      i. (Such as course material/content, online format)
   b. How has your previous experience(s) played a role in your choice of course make-up?

3) Do you feel students and instructors perceive the success of an online mathematics course in the same way? In other words, in what way(s) would a student claim that an online course is successful? Would an instructor have the same perceptions?
   a. If there are differences, what does this mean?
   b. What can be done about these differences? Or, should something be done?

4) Where do you see the future of online mathematics courses going in the next ten years? 25 years?
   a. Do you feel teaching styles will be compromised or enhanced?
   b. When asked, “In the future, how do you envision yourself using distance learning as a part of your classroom?” one student responded, “I don’t. I teach online courses now for a ______ university, and I am far too aware of how inadequate this type of education is for deep and meaningful understanding.” What are your thoughts on this response?
5) What are your feelings on the following quote from another student: “There should not be DL learning for mathematics or any other subjects. You cannot sufficiently learn in isolation.”

6) Do you think student reliability is a problem in distance learning mathematics courses? What can/should be done about this?

7) For one of the questions on the survey, you stated “I feel that it is important to use DL as a part of my classroom because it gives students opportunities that non DL classrooms do not offer. In my opinion, DL reaches more students than non-DL classes although, I feel that it is important to have classes that involve both DL and non-DL as a part of the curriculum.” Can you discuss the additional opportunities DL classes offer?

8) Do you feel that DL components should be required in courses?

9) What is your perspective of mathematics courses that are offered 100% online? What is needed for them to be successful?

Anything else you would like to share?
Appendix F

Participant Demographics

Instructor Survey Demographics

<table>
<thead>
<tr>
<th>Total usable surveys</th>
<th>Years of Instruction</th>
<th>Percentage Who Have Taught Online</th>
<th>Courses Taught</th>
<th>All/Some of Course Online Course: #, (% of instructors who have taught online, % of total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>82</td>
<td>1-5 yrs: 9 (11.0%)</td>
<td>Yes: 43 (52.4%)</td>
<td>Colg. Alg. I: 53 (64.6%)</td>
<td>Colg. Alg. I: 15 (34.9%, 18.3%)</td>
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<td></td>
<td>6-10 yrs: 11 (13.4%)</td>
<td>No: 39 (47.6%)</td>
<td>Colg. Alg. II: 45 (54.9%)</td>
<td>Colg Alg II: 5 (11.6%, 6.1%)</td>
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<tr>
<td></td>
<td>11-15 yrs: 13 (15.9%)</td>
<td></td>
<td>Geometry: 19 (23.2%)</td>
<td>Geometry: 0 (0%, 0%)</td>
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<tr>
<td></td>
<td>16-20 yrs: 8 (9.8%)</td>
<td></td>
<td>Intro. Stats.: 37 (45.1%)</td>
<td>Intro. Stats: 13 (30.2%, 15.9%)</td>
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<tr>
<td></td>
<td>21-25 yrs: 5 (6.1%)</td>
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<td>Trigonometry: 44 (53.7%)</td>
<td>Trigonometry: 3 (7.0%, 3.7%)</td>
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<tr>
<td></td>
<td>&gt;25 yrs: 35 (42.7%)</td>
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<td>Pre-Calculus: 54 (65.9%)</td>
<td>Pre-Calculus: 7 (16.3%, 8.5%)</td>
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<tr>
<td></td>
<td>Skipped Question: 1 (1.2%)</td>
<td></td>
<td>Calculus: 71 (86.6%)</td>
<td>Calculus: 11 (25.6%, 13.4%)</td>
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<td></td>
<td>Discrete: 24 (29.3%)</td>
<td>Discrete: 5 (11.6%, 6.1%)</td>
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<td></td>
<td>Adv. Calc.: 40 (48.8%)</td>
<td>Adv. Calc.: 2 (4.7%, 2.4%)</td>
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<td></td>
<td>Linear Alg.: 37 (45.1%)</td>
<td>Linear Alg.: 4 (9.3%, 4.9%)</td>
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<td></td>
<td></td>
<td>Diff. Equa: 22 (26.8%)</td>
<td>Diff. Equa: 0 (0%, 0%)</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Modern Alg.: 20 (24.4%)</td>
<td>Modern Alg: 1 (2.3%, 1.2%)</td>
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<td></td>
<td>Modern Geo: 17 (20.7%)</td>
<td>Modern Geo: 2 (4.7%, 2.4%)</td>
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<td></td>
<td>Analysis: 17 (20.7%)</td>
<td>Analysis: 1 (2.3%, 1.2%)</td>
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<td></td>
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<td></td>
<td>Number Theory: 10 (12.2%)</td>
<td>Number Theory: 0 (0%, 0%)</td>
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<td></td>
<td></td>
<td>Other: 36 (43.9%)</td>
<td>Other: 13 (30.2%, 15.9%)</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Skipped Question: 0 (0%)</td>
<td>Skip Ques: 39 (90.7%, 47.6%)</td>
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</table>
## Instructor Interview Demographics

<table>
<thead>
<tr>
<th>Total usable interviews</th>
<th>Years of Instruction</th>
<th>Percentage Who Have Taught Online (some component)</th>
<th>Courses Taught</th>
<th>All/Some of Course Online Course: #, (%of instructors who have taught online, % of total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
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</tr>
<tr>
<td></td>
<td>1-5 years: 0 (0%)</td>
<td>Yes: 10 (76.9%) No: 3 (23.1%)</td>
<td>Colg. Alg. I: 13 (100%) Colg. Alg. II: 12 (92.3%)</td>
<td>Colg. Alg. I: 5 (50.5%, 38.5%) Colg. Alg. II: 1 (10.0%, 7.7%)</td>
</tr>
<tr>
<td></td>
<td>6-10 years: 1 (7.7%)</td>
<td></td>
<td>Geometry: 5 (38.5%) Intro. Stats: 9 (69.2%)</td>
<td>Geometry: 1 (10.0%, 7.7%) Intro. Stats: 4 (40.0%, 30.8%)</td>
</tr>
<tr>
<td></td>
<td>11-15 years: 1 (7.7%)</td>
<td></td>
<td>Trig: 10 (76.9%) Pre-Calc: 10 (76.9%)</td>
<td>Trig.: 1 (10.0%, 7.7%) Pre-Calc: 0 (0%, 0%)</td>
</tr>
<tr>
<td></td>
<td>16-20 years: 2 (15.4%)</td>
<td></td>
<td>Calculus: 11 (84.6%) Discrete: 6 (46.2%)</td>
<td>Calculus: 6 (60.0%, 46.2%) Discrete: 2 (20.0%, 15.4%)</td>
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<tr>
<td></td>
<td>21-25 years: 4 (30.8%)</td>
<td></td>
<td>Adv. Calc.: 6 (46.2%) Linear Alg.: 5 (38.5%)</td>
<td>Adv. Calc.: 1 (10.0%, 7.7%) Linear Alg.: 1 (10.0%, 7.7%)</td>
</tr>
<tr>
<td></td>
<td>&gt;25 years: 5 (38.5%)</td>
<td>Skipped Question: 0</td>
<td>Diff. Equa: 3 (23.1%) Mod Alg.: 3 (32.1%)</td>
<td>Diff. Equa: 0 (0.0%, 0.0%) Modern Alg.: 0 (0.0%, 0.0%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Mod Geom: 3 (32.1%) Analysis: 3 (32.1%)</td>
<td>Mod Geom: 1 (10.0%, 7.7%) Analysis: 0 (0.0%, 0.0%)</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Number Thry: 1 (7.7%) Math. Ed.: 4 (30.8%)</td>
<td>Number Thry: 0 (0.0%, 0.0%) Math. Ed.: 3 (30.0%, 23.1%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Other: 9 (69.2%) Skipped Question: 0 (0%)</td>
<td>Other: 3 (30.0%, 23.1%) Skipped Question: 0</td>
</tr>
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</table>
## Student Survey Demographics

<table>
<thead>
<tr>
<th>Total usable surveys</th>
<th>College Experience (Survey Question 1)</th>
<th>Percentage Who Have Taught Online (some component) (Survey Question 3)</th>
<th>College Mathematics Courses Taken (Survey question 2)</th>
<th>All/Some of Course Online Course: #, (% of students who have taken online, % of total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>148</td>
<td>Freshmen: 21 (14.9%)</td>
<td>Yes: 38 (26.2%)</td>
<td>Colg. Alg. I: 37 (25.5%)</td>
<td>Colg. Alg. I: 8 (16.7%, 5.4%)</td>
</tr>
<tr>
<td></td>
<td>Sophomore: 20 (13.5%)</td>
<td>No: 107 (73.8%)</td>
<td>Colg Alg. II: 26 (17.9%)</td>
<td>Colg Alg. II: 1 (2.1%, 0.7%)</td>
</tr>
<tr>
<td></td>
<td>Junior: 20 (13.5%)</td>
<td>Skipped: 3</td>
<td>Geometry: 13 (9.0%)</td>
<td>Geometry: 0 (0%, 0%)</td>
</tr>
<tr>
<td></td>
<td>Senior: 25 (16.9%)</td>
<td></td>
<td>Int. Stat: 84 (57.9%)</td>
<td>Int. Stats: 28 (58.3%, 18.9%)</td>
</tr>
<tr>
<td></td>
<td>5th Year: 8 (5.4%)</td>
<td></td>
<td>Trig: 20 (13.8%)</td>
<td>Trig: 2 (4.2%, 1.4%)</td>
</tr>
<tr>
<td></td>
<td>Grad. Student: 54 (36.5%)</td>
<td></td>
<td>Pre-Calc: 27 (18.6%)</td>
<td>Pre-Calc: 7 (14.6%, 4.7%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Calculus: 49 (33.8%)</td>
<td>Calculus: 4 (8.3%, 2.7%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Discrete: 21 (14.5%)</td>
<td>Discrete: 1 (2.1%, 0.7%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Adv. Calc: 37 (25.5%)</td>
<td>Adv. Calc: 2 (4.2%, 1.4%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Linear Alg.: 24 (16.6%)</td>
<td>Linear Alg.: 3 (6.3%, 2.0%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Diff. Equa: 17 (11.7%)</td>
<td>Diff. Equa: 2 (4.2%, 1.4%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Mod Alg: 19 (13.1%)</td>
<td>Mod Alg: 1 (2.1%, 0.7%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Mod Geom: 9 (6.2%)</td>
<td>Mod Geom: 1 (2.1%, 0.7%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Analysis: 17 (11.7%)</td>
<td>Analysis: 2 (4.2%, 1.4%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Numb. Th: 16 (11.0%)</td>
<td>Numb. Th: 1 (2.1%, 0.7%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Math. Ed.: 40 (27.6%)</td>
<td>Math. Ed.: 11 (22.9%, 7.4%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Other: 17 (11.7%)</td>
<td>Other: 5 (10.4%, 3.4%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Skipped Question: 3</td>
<td>Skipped Question: 100 (67.6%)</td>
</tr>
</tbody>
</table>
The table below gives the background experience each of the instructor interviewees. The names have been changed to keep responses anonymous. Pseudonyms for instructors start with a letter from the first half of the alphabet to help in keeping student and instructor participants clear. All instructors are, or were, instructors at the college level. The Years of Teaching Experience column represents the total number of years the instructor has been teaching. The Distance Learning Experience column describes whether or not the instructor has had experience an online mathematics course. The Interest in Distance Learning column was only answered by the instructors who did not have distance learning experience. This column describes whether these instructors, given the change, would be interested in teaching online. The Teaching Preference Column has responses to the question, “Overall, I would rather teach a DL mathematics course than a non-DL mathematics course.” Responses consisted of a 0 (strongly disagree) to 4 (strongly agree) rating system. The last column describes the interview mode.

### Demographics of Instructors Interviewed

<table>
<thead>
<tr>
<th>Pseudonym</th>
<th>Years of Teaching Experience</th>
<th>Distance Learning Experience?</th>
<th>Interest in Distance Learning?</th>
<th>DL preference over traditional? (0-4)</th>
<th>Interview type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aaron</td>
<td>16-20</td>
<td>Yes</td>
<td>x</td>
<td>n/a</td>
<td>Face</td>
</tr>
<tr>
<td>Benny</td>
<td>11-15</td>
<td>Yes</td>
<td>X</td>
<td>2</td>
<td>Phone</td>
</tr>
<tr>
<td>Carla</td>
<td>&gt;25</td>
<td>Yes</td>
<td>X</td>
<td>4</td>
<td>Email</td>
</tr>
<tr>
<td>Denny</td>
<td>21-25</td>
<td>Yes</td>
<td>X</td>
<td>2</td>
<td>Email</td>
</tr>
<tr>
<td>Jim</td>
<td>16-20</td>
<td>No</td>
<td>Yes</td>
<td>X</td>
<td>Skype</td>
</tr>
<tr>
<td>Francine</td>
<td>&gt;25, retired</td>
<td>Yes</td>
<td>X</td>
<td>2</td>
<td>Email</td>
</tr>
<tr>
<td>Dal</td>
<td>21-25</td>
<td>Yes</td>
<td>X</td>
<td>2</td>
<td>Phone</td>
</tr>
<tr>
<td>Barb</td>
<td>&gt;25</td>
<td>Yes</td>
<td>X</td>
<td>4</td>
<td>Phone</td>
</tr>
<tr>
<td>Dane</td>
<td>&gt;25</td>
<td>Yes</td>
<td>X</td>
<td>1</td>
<td>Skype</td>
</tr>
<tr>
<td>Freddie</td>
<td>&gt;25</td>
<td>No</td>
<td>Yes</td>
<td>X</td>
<td>Skype</td>
</tr>
<tr>
<td>Cal</td>
<td>&gt;25, retired</td>
<td>No</td>
<td>Yes</td>
<td>X</td>
<td>Email</td>
</tr>
<tr>
<td>Haley</td>
<td>16-20</td>
<td>Yes</td>
<td>X</td>
<td>3</td>
<td>Phone</td>
</tr>
<tr>
<td>Henry</td>
<td>No</td>
<td>No</td>
<td>X</td>
<td>X</td>
<td>Phone</td>
</tr>
</tbody>
</table>
The table below gives the background experience of each of the student interviewees. The names have been changed to keep responses anonymous. Pseudonyms for students start with a letter from the second half of the alphabet to help in keeping student and instructor participants clear. All participants were college students. The Year in School column represents the year the student was in when being interviewed. The DL Experience column describes whether or not the instructor has had experience an online courses. The mathematics DL Experience column describes whether or not the student has had experience with online mathematics courses. The Interest in DL column describes whether or not the student is interested in taking an online mathematics course. It should be noted most of the information for this table was gathered during the surveys. The six students at the bottom of the table did not take the survey. These students volunteered to be interviewed after an instructor participant asked her students for volunteers. Therefore some of their information was not gathered.

### Student Interview Demographics

<table>
<thead>
<tr>
<th>Pseudonym</th>
<th>Year in School</th>
<th>DL Experience</th>
<th>Mathematics DL Experience</th>
<th>Interest in DL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pam</td>
<td>5th year</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Rachel</td>
<td>Gr. Stud.</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Paul</td>
<td>Junior</td>
<td>Yes</td>
<td>No</td>
<td>Maybe</td>
</tr>
<tr>
<td>Sarah</td>
<td>Soph</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Raul</td>
<td>Junior</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Rhett</td>
<td>Grad. Stu</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Thelma</td>
<td>Senior</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Tierni</td>
<td>Junior</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Walter</td>
<td></td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Sandy</td>
<td></td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Yara</td>
<td></td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Wayne</td>
<td></td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Zane</td>
<td></td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Xavier</td>
<td></td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>
Appendix G

Example of Analysis Card

1. Most math students would do better if never used, their preferred teaching methods would be great. My goal is to have as close to face as possible.

2. Reliably, it's an issue. Honored exams are better, but it's much more difficult. The question is, level of students is having problems. A 12.

3. DL going to grow and grow.

4. "They're really teaching themselves."

5. "I think a lot of students have the idea that it's easier and it's not. It's not because they're really teaching themselves." - Would not like what MML MyMathLab.

6. Absolutely agree that students must be highly motivated. More than P2F - you can hide behind a computer screen.

7. Teaching in the classroom helped - Communication. 15

8. "Somebody else could actually be taking the course for them. You would never know." Some DL should be required.

9. Other