SOCIAL MATHWORKING: THE EFFECTS OF ONLINE REFLECTION ON ALGEBRA I STUDENTS' SENSE OF COMMUNITY AND PERCEIVED LEARNING

by

Patricia Elizabeth Allanson

Liberty University

A Dissertation Presented in Partial Fulfillment

Of the Requirements for Degree

Doctor of Education

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ABSTRACT

The purpose of this study was to determine if online reflections through social networking affect students' sense of community and levels of perceived conceptual learning in Algebra I courses. Social constructivism, connectivism, and computer-mediated communication in relation to reflective practices form the theoretical and practical framework for the use of Web 2.0 technologies in this investigation. A quasi-experimental nonequivalent control group design was used to examine Algebra I students' sense of community as measured by the Sense of Classroom Community Index, and perceived learning as measured by Perceived Learning Instrument. The sample consisted of 27 Algebra I students at a Central Florida middle school. There were 14 participants in the experimental group and 13 students in the control group. Both groups completed pre and posttest survey instruments for the independent variables of sense of community and perceived learning. The tests were separated by four weeks of instruction on Algebra 1 course content and participation in discourse through face-to-face and discussion board formats. Independent *t*-tests were employed in data analysis. The results of the study revealed no significant differences between experimental and control groups in relation to students' sense of community and perceived learning. However, the findings support curriculum design targeted to those concepts Algebra I students have the most difficulty with, and advance the understanding of students' cognitive development and feelings regarding comfort when communicating their mathematical thinking through Web 2.0 technologies.

Descriptors: Technology, Social Networking, Mathematics, Algebra I, Discussion Boards, Computer-Mediated Communication, Blogging.

DEDICATION

This dissertation is dedicated in loving memory of my father Richard C. Bolton Jr.

July 9, 1935- July 4, 1999

ACKNOWLEDGMENTS

I would like to first and foremost thank God for giving me the strength to finish my dissertation especially when my faith in myself was lacking. I can do all things through Christ who strengthens me – Philippians 4:13.

To my family, thank you for your patience through this process. I hope that I have inspired you to dream big, and attain the goals you have set for yourselves. To the best friend anyone could ask for, Cindy, thank you for being there for me yet again.

Throughout my time at Liberty, I have been blessed with many new friendships- To Karen- thank you for pushing me to move forward. You have been a great friend, confidante, cheerleader, supporter, and encourager. Without you, I would not have arrived at this point. To Linda – thank you for our fellowship luncheons in your classroom, and our continued friendship. To Melanie and Shane – thank you for two glorious weeks filled with laughter and inspiration. Finally, to my friends on Watson's 919 Facebook group (Stephanie, Cherri, Karen, Melanie, Shane, Janice, Joe, Christy, Tia, Shannan, and Dave); I truly appreciate all of your encouragement and guidance. Thank you for those who finished first and helped the rest of the group finish strong.

Finally, to my Chair, Dr. Ackerman, I thank you sincerely for having faith in me after a humble beginning. Your expertise, professionalism, and kindheartedness are an inspiration to all.

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LIST OF ABBREVIATIONS

Association for Middle Level Education (AMLE)

Common Core State Standards Initiative (CCSSI)

Community of Practice (CoP)

Computer-Mediated Communication (CMC)

Exception Student Education (ESE)

Florida Comprehensive Assessment Test (FCAT)

Individualized Educational Plan (IEP)

Information and Communications Technology (ICT)

Learning Management Systems (LMS)

National Council of Teachers of Mathematics (NCTM)

National Middle School Association (NMSA)

Sense of Classroom Community Index (SCCI)

Sense of Community (SOC)

Social Networking Sites (SNS)

CHAPTER ONE: INTRODUCTION

Background

The internet has become this generation's primary means of information exchange and is home to a constant flow of emerging technologies. Social networking sites like Facebook, Twitter, Myspace, and LinkedIn are among the most visited websites. Tham and Ahmed (2011) reported that there are currently more than 800 million active Facebook users, with MySpace and Twitter ranking a close second. They additionally reported that 49% of Facebook users were between the ages of 8-17.

Today's students are immersed in the digital world, which is altering the way they think and develop cognitively (Jukes, McCain, & Crockett, 2010), and "are being socialized in a way that is vastly different from their parents" (Prensky, 2001, p.1). Small and Vorgan (2008), neurologists in the field of brain research and the authors of *Understanding the Digital Generation*, report that daily exposure to Web 2.0 technologies "stimulates brain cell alteration and neurotransmitter release, gradually strengthening new neural pathways in our brains while weakening old ones" (p. 1). Although cognitive skills are being developed through the use of Web 2.0 technologies, the development of social interaction skills and sense of community can be impeded by virtual relationships. A significant change in behavior for adolescents is the increase in the amount of time they spend with friends. Today's adolescent students interact with their peers from a digital perspective, keeping in contact through emails, text messaging, and cell phones, which is considered a healthy development (Casas, 2010).

Habits of continuous use of Web 2.0 technologies are also being developed. Limayen and Cheung (2011) sought to examine the internet-use habits of 100 university

level students through a contingency model approach. Their results showed that "habit significantly moderates the relationship between intention and continued use of an information system" (p. 98) used in the study (Blackboard). Based on these results, the authors implied that educators should encourage students to form habits of using Internet-based learning technologies to augment knowledge exchange.

The cognitive changes, impediments, and positive habits of use are of interest to educators who seek pedagogical benefits from using Web 2.0 technologies to open access to information and communication beyond the walls of the classroom, thus producing a different source for developing social interaction skills and a sense of community (Jukes, McCain, & Crockett, 2010; Kist, 2010; Limayen & Cheung, 2011).

During the adolescent years, the school environment plays an important role in the intellectual and social development of students (Casas, 2010). According to Vieno, Santinello, Pastore, and Perkins (2007), "school environments that are perceived as supportive, caring, and emphasizing individual effort and improvement are related to a more adaptive pattern of cognition, affect, and behavior" (p. 179). The middle school student's early adolescent development centers on a sense of belonging, social support, and peer acceptance, thus making a students' sense of classroom community a primary concern for educators, and encourages the development of programs that increase this sense of community.

Problems Addressed by the Study

This study addressed a number of problems including: (a) newer technologies (for example blogging and social networking) which are slowly making their way into the K-12 educational settings and have not been sufficiently researched in mathematics as the

studies in the literature focus mainly on writing and literature-based platforms (Zawilinski , 2009); (b) the absence of studies pertaining to communicating mathematical thinking, reasoning and sense-making skills utilizing Web 2.0 technologies, especially at the middle school level; (c) the need to develop middle school programs that foster a sense of community and belonging during adolescent development in a digital world; and, (d) reluctance on the part of some teachers to utilize Web 2.0 technologies in mathematics instruction.

Purpose Statement

The purpose of this study was to determine if online reflections, through social networking, affect students' sense of community and levels of perceived conceptual learning in Algebra I courses. The researcher hoped that the findings would support curriculum design targeted to those concepts with which Algebra I students have the most difficulty, such as proportional reasoning, rate of change/linearity/related graphs, systems of equations, manipulating expressions, and exponential growth and decay (Dick & Burrill, 2009). It is also hoped that the findings will: (a) advance the understanding of students' comfort with communicating their mathematical thinking when they perform authentic learning; (b) provide additional information about Web 2.0 opportunities for students' cognitive development; (c) illustrate how sense of community in and outside the middle school math classroom walls can be developed for and by students; and (d) provide information that could be used to create professional development programs to help teachers see how social networking impacts student mathematical achievement at the local district level.

Significance of the Study

This research problem is important to study for three reasons. First, the research purpose is aligned with the position statements of the National Council of Teachers of Mathematics (NCTM), the Common Core State Standards Initiative (CCSSI), and the major goals of the Association for Middle Level Educators (AMLE), which support the use of technology in instruction. Secondly, publication of the study results can inform understanding of teachers' misconceptions that limit technology use in the classroom. Lastly, this study addressed the significance of reflective practices through social networking in mathematical instruction, a concept teachers might apply in a manner that will deepen conceptual understanding for students.

NCTM is a proponent of technology use and recommends it through their 2005 Position Statement:

> Technology is an essential tool for learning mathematics in the 21st century, and all schools must ensure that all their students have access to technology. Effective teachers maximize the potential of technology to develop students' understanding, stimulate their interest, and increase their proficiency in mathematics. When technology is used strategically, it can provide access to mathematics for all students (NCTM, 2010, para. 1).

The NCTM also contends that the use of technology enhances computational fluency and extends mathematical reasoning and sense-making skills.

Communication is addressed specifically in NCTM 2000 Principles and Standards for School Mathematics (NCTM, 2010). The standard is as follows:

> Instructional programs from prekindergarten through grade 12 should enable all

students to:

- Organize and consolidate their mathematical thinking through communication;
- Communicate their mathematical thinking coherently and clearly to peers, teachers, and others;
- Analyze and evaluate the mathematical thinking and strategies of others; and
- Use the language of mathematics to express mathematical ideas precisely (NCTM, 2010, para 1).

Closely related to this standard is the CCSSI Standard Three for Mathematical Practice which addresses communication about math saying students should "Construct viable arguments and critique the reasoning of others" (CCSSI, 2012, p. 9). Mathematically proficient students should also be able to make conjectures and communicate their justifications to peers as the standard further states, "Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve arguments" (p. 10). Together, these statements advocate for the ability, on the part of students, to have meaningful and constructive interaction about mathematical concepts they have learned or are learning.

The emphasis on communication as a key element of analytical and technological learning has been championed for decades. In 1982, the Association for Middle Level Education (AMLE, formerly known as National Middle School Association, NMSA) released an executive summary describing major goals to assist young adolescents in becoming fully functioning, self-actualized individuals. Of the 13 goals, four specifically addressed communication and technology. They are: (a) "be able to think rationally and critically and express thoughts clearly", (b) "respect and value the diverse ways people

look, speak, think, and act within the immediate community and around the world", (c) "develop the interpersonal and social skills needed to learn, work, and play with others harmoniously and confidently", and (d) "use digital tools to explore, communicate, and collaborate with the world and learn from the rich and varied resources available" (NMSA, 1982, p.1).

While the National Council of Teachers of Mathematics and Common Core State Standards have advocated student-centered learning through relevant information and communication technologies (ICT), there are still teachers reluctant to incorporate Web 2.0 technology practices into the curriculum. According to Lemke, Coughlin, Garcia, Reifsneider, and Baas (2009), who surveyed over 1,200 district based administrators and technology supervisors, use of Web 2.0 technology as a learning tool is low. Factors that may prevent or limit these practices include teachers' confidence levels, access to technology and application (Kimber, Pillay, & Richards, 2002), and teachers' beliefs (Chen, Looi, & Chen, 2009).

Based on the emphases of the three organizations discussed, it is the researcher's contention that a paradigm shift needs to occur in which instructional content in mathematics, layered with meaning and reasoning skills, and Web 2.0 technology are utilized in conjunction rather than in isolation. Ideally, middle school mathematics curricula infused with Web 2.0 technology would be designed that address those mathematical concepts that give students the most trouble, while helping them learn to communicate mathematical reasoning and visualize the thinking of others.

Research Questions

The research questions of the study address sense of community and perceived

cognitive learning. They assume a quasi-experimental design employing an experimental group that participated in online social networking and a control group that did not.

Research Question #1 (RQ 1)

When comparing the use of reflective practices in online computer-mediated communication (CMC) and face-to-face formats, is there a difference in students' sense of community as measured by the Sense of Classroom Community Index (SCCI) (Rovai, 2002)?

Research Question #2 (RQ 2)

Does the classroom format, online (CMC) versus face-to-face, have any effect on students' perceived learning towards Algebra I course content as measured by the Perceived Learning Scale survey (Halic, Lee, Paulus, & Spence, 2010)?

Null Hypotheses

H_{01}: There will be no statistically significant difference in the sense of community means for the experimental group and the control group as measured by the Sense of Classroom Community Index adapted from Rovai (2002).

H_{02}: There will be no statistically significant difference in the perceived learning scores for the experimental group and the control group as measured by an adapted version of Perceived Learning Instrument (Halic, Lee, Paulus, & Spence, 2010).

Definitions

The following are definitions of terms that are applicable in this study, including the identification of key variables.

1. 21st century skills is a commonly used phrased indicating a set of competencies necessary for successful living in the 21st century. For the purpose of this study, it will be defined to mean critical thinking, problem solving, communication, collaboration, and (ICT) Information, Communication and Technology literacy skills necessary to prepare students to compete globally and promote effective working conditions (The Partnership for 21st Century Skills, 2011).
2. Asynchronous learning is a mode of learning that enables individuals to learn with online technologies in their own time, at their own pace, and from a variety of locations (Spector, Merril, Van Merrienboer, & Driscoll, 2008, p. 260).
3. Blogs/blogging is a common phrase referring to Weblogs, which are defined below.
4. Classroom learning communities are groups of students, linked geographically or by shared interest, which collaborate and work in partnerships to address members' learning needs.
5. Computer-mediated communication (CMC) is defined as communication between two or more individuals with text-based tools such as email, instant messaging, or computer-based conferencing systems (Spector, Merril, Van Merrienboer, & Driscoll, 2008, p. 226).
6. Connectivism is defined as a learning theory describing the associations and relationships that develop in digital environments that influence human cognition, and reshape the ways that the human mind creates, stores, and shares learning (Pettenati & Cigognini, 2007).

7. Digital divide describes the existence of two categories of people in the modern world, those who have access to and the capability to use digital technologies such as the Internet and people who do not have this access and/or capability.
8. Discussion boards are asynchronous tools for group communication and cooperative learning that promote a level of reflective interaction (Penny & Murphy, 2008).
9. First generation web technologies include email, chat rooms, and discussion boards with limited collaboration between users (Beldarrain, 2006).
10. Inquiry learning is an approach that includes exploration, discovery and questioning practices to develop cognitive understanding.
11. Learning management systems (LMS) are computer-based systems to support classroom-based learning (e.g. Blackboard, Edmodo, Schoology,WebCT) (Spector, Merril, Van Merrienboer, & Driscoll, 2008, p. 226).
12. Perceived learning, a dependent variable in this study, is operationally defined by the Perceived Learning Instrument developed by Halic, Lee, Paulus, and Spence (2010) as an individual's understanding that learning has taken place.
13. Schoology is a social networking platform (defined below) adopted by the school district in which the study was conducted. The platform is used to manage lessons, promote collaboration, engage students, and connect with others.
14. Sense of community, a dependent variable in this study, is operationally defined by the Classroom Community Scale developed by Rovai (2002). The scale, originally designed for use with university students, addresses the feelings that

members have of belonging, and the feelings that members matter to one another and to the group.

15. Social constructivism is defined based on Vygotsky's theory about children's learning, which places emphasis on the social context of learning in which culture, as communicated through adults and older children, provides tools for children's development (Chen, 2010).
16. Social networking is a social media tool that supports "collaboration, community building, participation, and sharing" (Junco, Heibergert, & Loken, 2011, p. 119).
17. Social networking sites are web-based services that allow individuals to (a) construct a public or semi-public representation of their interests, experiences, background, and activities within a bounded system, (b) articulate a list of other users with whom they share a connection, and (c) view and traverse their list of connections and those made by others within the system (Boyd & Ellison, 2007).
18. Web 2.0 technologies are defined as internet applications that "share a common characteristic of supporting internet-based interaction between and within groups" (Selwyn, 2008, p. 4). Examples of Web 2.0 technologies include social networking sites (Facebook, MySpace), wikis, blogs, discussion boards, virtual worlds (Second Life) and multi-user gaming sites.
19. Weblogs are regularly updated web-pages organized as individual messages from users. The individual messages are arranged in a manner that shows their comment and response nature and often, in a way that displays the time and date the comments were made. They are similar to discussion boards in that they

"support asynchronous informational exchanges between individuals" (Gill, 2006, p. 373).

Research Plan

A quasi-experimental nonequivalent control group design was used (Gall, Gall, & Borg, 2007). While this design results in an experimental and a control group, it does not involve randomization in assignment to these groups (Gall, Gall, & Borg). The rationale for choosing this method is twofold, scheduling students in course sections based on random assignment is not feasible and random assignment of students violates policy in the district in which the study was conducted.

CHAPTER TWO: LITERATURE REVIEW

In the past decade, there has been an exponential growth in the number of people who utilize Web 2.0 tools, create weblogs, or participate in social networking (Deng & Yuen, 2009). The Pew Internet and American Life Project reported in 2008 that 62% of Americans were:

> part of a wireless, mobile population that participates in digital activities away from home or work. Teens are creating and sharing material on the Internet in greater numbers, with 28% of online teens maintaining their own blogs…. Virtually, all American teens play computer, console, or cell phone games and the gaming experience is rich and varied, with significant amount of social interaction and potential for civic engagement (as cited in Kist, 2010, p. 3).

According to Tham and Ahmed (2011), there are currently more than 800 million active Facebook users, with 49% between the ages of 8-17. With this high statistic within this age demographic, interest in the pedagogical benefits of using Web 2.0 technologies has arisen and increased, and research studies on the effects of these practices have begun.

Computers are available in most classrooms; however, they are primarily used as word processors, or to display a Website the teacher has found (Kist, 2010). Newer technologies have replaced older versions, such as interactive whiteboards for chalkboards, and PowerPoint presentations for overhead transparencies, but the newer versions continue to be used with the same show-and-tell philosophy. According to one principal, by using this philosophy "We're creating another generation of students who

know how to consume information, when what we need to be nurturing is a generation that knows how to produce new ideas" (as cited in Kist, 2010, p.1).

The Internet has become one of the present generation's primary means of communication and is home to a constant flow of new technologies. However, the integration of technology as educational practice, such as the use of computer-mediated communications, must effectively impact learning and not be used just for the sake of including it in the curriculum. According to Clark (1983), the type of media used in delivering instruction has no significant impact on learning. He states that "only the content of the vehicle can influence achievement" (p. 445). A consideration of the present literature will aid in determining if this is an outdated perspective.

Theoretical and Practical Framework

In reviewing the literature, it was found that the theoretical framework for social networking, or blogging, is based on the theories of social constructivism and connectivism.

Constructivism Theory

Constructivism is a theory that draws instructional methods primarily from cognitive psychology and is based upon the works of Piaget and Vygotsky. Driscoll (2005) contends that "there is no single constructivist theory of instruction" (p. 386); however, there is a common thread that assumes "knowledge is constructed by learners as they attempt to make sense of their experiences" (p. 387). Matthews (2000) proposed that there are over 20 types of educational constructivism derivations, and each can be distinguished by how its perspective defines the meaning of knowledge. For example, perspectives that focus upon the construction of knowledge through individual means are

referred to as psychological constructivism, whereas perspectives that focus on the construction of knowledge through cultural and social interactions are referred to as social constructivism. As a discrete example, Vygotsky's (1978) social constructivism theory of how children learn places emphasis on the social context of learning, in which culture, communicated by adults and older children, provides tools for children's development. This stands in contrast to Piaget's cognitive theories, in which adults play a very limited role in learning (Chen, 2010).

Sousa's (2011) brain-based research directly relates to Vygotsky's (1978) findings, and contends that knowledge is the result of cultural and social interactions. According to Sousa, constructivist pedagogy should include practices that (a) "use student responses to alter their instructional strategies and content, (b) foster student dialogue, (c) question student understanding, (d) encourage students to elaborate on their initial responses, and (e) allow students time to construct relationships and create metaphors" (p. 157).

Constructivism Enacted within Web 2.0 Technologies

The vocabulary of constructivism entered the field of educational technology in 1990 through the works of Jonassen, and was embraced due to its similarities to a learner-centered approach (Driscoll, 2005). Several technologically-based constructivist principles have been developed to assist in instructional settings. These five principles include:

(a) Embedding learning in complex, realistic, and relevant environments;

(b) Providing for social negotiation as an integral part of learning;

(c) Supporting multiple perspectives and the use of multiple modes of representation;

(d) Encouraging ownership in learning; and

(e) Nurturing self-awareness of the knowledge construction process (Driscoll, 2005, pp. 394-395).

Because of the ease of use associated with social networking sites, their simple format, and the benefits of social interactions, they are a prime environment for social constructivism. Additionally, social networking or weblogs allow readers and writers to co-construct their own learning and develop a sense of belonging in the community of other readers and writers (Ducate & Lomicka, 2008). Writing is no longer considered for the teacher's eyes only. According to Ramaswami (2008), "writing becomes a real-life experience" (p. 25), where the process is viewed and responded to by others in a faster and more ubiquitous application.

Participation in online educational environments portrays elements of constructivist and social learning theories. According to Hrastinski (2009), "Online learner participation is a process of learning achieved by taking part [*sic*] and maintaining relations with others. It is a complex process comprising doing, communicating, thinking, feeling and belonging, which occurs both online and offline" (p. 80). Participation is supported by physical and psychological tools. For example computers and language, when used in conjunction with each other, provide engaging learning opportunities. Participation is also supported by engaging activities, for example collaborative learning, and is seen as the driving force in learning from both personal and social levels by some theorists.

Information and communication technologies have increased the amount of information made readily available to people in the information age. According to Wang, Woo, and Zhao (2009) this increase leads to the need for "critical-thinking skills …to analyze and compare information, construct arguments, respect diverse perspectives and view phenomena from different points" (p. 95). Additionally, the authors reported these skills are especially important when people seek to work together and effectively communicate to solve complex problems. Critical thinking is not easily defined, and many different definitions can be found in the literature. Ennis (1987) defined critical thinking as, "reasonable and reflective thinking skills that focus on deciding what to believe or do" (p. 97). In 2011, Scriven and Paul claimed that critical thinking is the "intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action" (para. 1).

Levy and Murnane's (2004) empirical study of occupational patterns, between 1969 to 1999, showed that the demand for jobs requiring complex communication and expert critical thinking rose 14% and 8% respectively, while jobs requiring cognitive tasks dropped 8%. This growth, evident in both the economy and in society, highlights the importance of technological media and why it is needed in the field of education. Affording students opportunities to develop 21st century skills prepares them for future roles in society and closes the digital divide. According to Warschauer and Matuchniak (2010), "effective deployment and use of technology in schools can help compensate for unequal access to technologies in the home environment and thus help bridge educational

and social gaps" (p. 180). However, Levy and Murnane (2004) contend that access to technology alone is not sufficient; assessments that show mastery and measure thinking and complex communication skills must be developed. In most states, students are required to show mastery on state tests that focus on recall of facts, therefore assessments that measure performance of critical thinking and communication skills, such as in portfolio assessments, remain a need.

Social networking sites (SNS) provide environments that channel informal learning and promote social constructivism and critical thinking in learners (Selwyn, 2008). Wang, Woo, and Zhao (2009) contend that discussion forums or weblogs (blogs) provide an avenue in which students can interact with each other, promoting critical thinking, knowledge construction, and communication skills based on their investigation of how individual reflections, group collaboration, and class discussions promoted students' knowledge construction and critical thinking within an interactive learning environment. Seventeen students, enrolled in an elective course during their second year of undergraduate school, participated in the study. For a period of 12 weeks, students completed online reflections as follow-up activities to either face-to-face tutoring, or online independent learning sessions. The results of their study suggested that critical thinking was promoted through the use of online reflections while blogging; however, several limitations challenged the results. One limitation was that the nature of the discussion topic influenced how students responded and constructed knowledge. A topic suitable for one student was not necessarily suitable for others. The authors contend that topics should be meaningful, relevant, and challenging to participants. A second limitation to the study was the fact that the online collaboration consisted of small

groups. For online collaboration to be effective, the researchers concluded the number of members in a group must include at least three to five. These noted limitations acknowledge several of the basic characteristics of group communication. Participant engagement is essential and small groups can facilitate interaction, but very small groups can limit the ability to maintain the stimuli necessary for extended conversation especially if one member is inactive; however the number of group members does not invalidate the efficacy of blogging for promoting critical thinking.

Zawilinski (2009) concurs that blogging practices emphasize higher order thinking skills in which students analyze information while communicating with others. Ducate and Lomicka (2008) acknowledged that blogs encourage feedback from reading and writing activities and encourages critical analysis through expressions of ideas and opinions. They contend that "blogs can facilitate knowledge sharing, reflection, debate, and act as a vehicle for self-expression and self-empowerment" (p. 10).

Connectivism Theory

Social constructivism is an effective view of learning in many contexts; however, the theory falls short when it comes to informal and networked learning as found in the digital arena. Connectivism is a learning theory connected to how learning happens in the digital age. According to Pettenati and Cigognini (2007), connectivism is defined as "the integration of principles explored by chaos, network, complexity, and self-organization theories" (p. 46), or "social networking applied to learning and knowledge" (p. 46). Connectivists believe that information and communication technologies heavily influence human cognition, and perhaps are reshaping the ways that the human mind creates, stores, and shares learning. Knowledge is not always constructed, it can be

received, but it is continuously connecting and adapting to the environment, much like a network or ecology (Siemens, 2006). According to Siemens (2006), "the act of learning is the process of creating external networks of nodes – where we connect and form information and knowledge sources" (p. 29).

Connectivism works on the premise that "the pipe is more important than the content within the pipe" (Pettenati & Cigognini, 2007, p. 44), and is characterized by nine principles that view learning as a social activity:

- Learning and knowledge require diversity of opinions to present the whole… and to permit selection of best approach.
- Learning is a network formation process of connecting specialized nodes or information sources.
- Knowledge rests in networks.
- Knowledge may reside in non-human appliances, and learning is enabled/facilitated by technology.
- Capacity to know more is more critical than what is currently known.
- Learning and knowing are constant, on-going process (not end states or products).
- Ability to see connections and recognize patterns and make sense between fields, ideas, and concepts is the core skill for individuals today.
- Currency (accurate, up-to-date knowledge) is the intent of all connectivist learning activities.
- Decision-making is learning. Choosing what to learn and the meaning of incoming information is seen through the lens of a shifting reality. While there is a right answer now, it may be wrong tomorrow due to alterations in the

information climate affecting the decision (p. 31).

Pettenati and Cigognini (2007) proposed a simplified model of these nine principles to illustrate knowledge flow in the connectivist environment (Figure 1). The model has five schemes, or knowledge processes, that are framed by enabling conditions that should occur during the learning process.

Figure 1. A Model for Effective Learning Experience

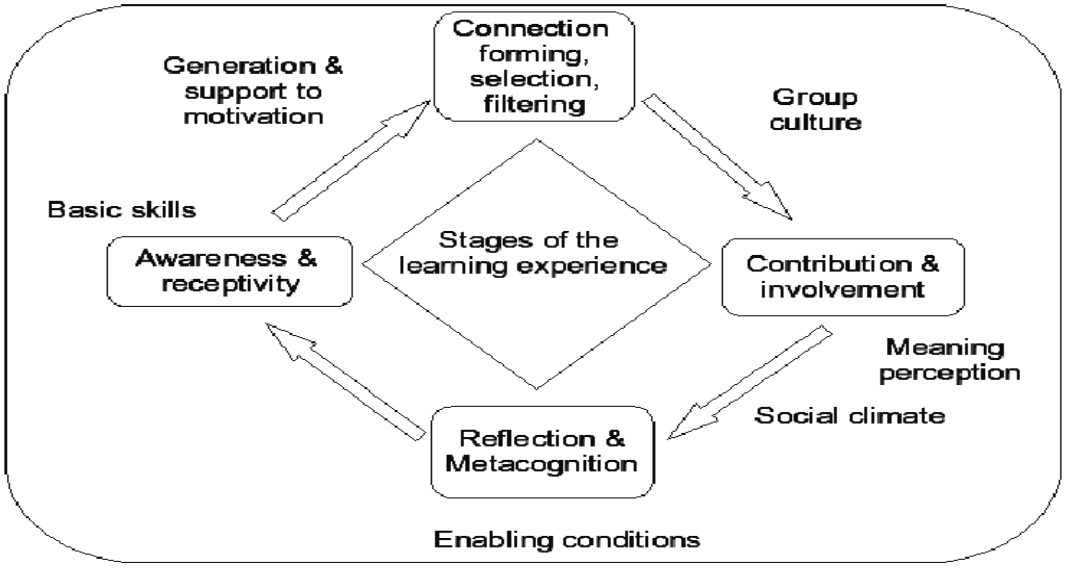

Figure 1. Knowledge process in a connectivist environment; stages of the Learning experience and enabling conditions. Adapted from by "Social Networking Theories and Tools to Support Connectivist Learning Activities" by M. C. Pettenati and M. E. Cigognini, 2007, *International Journal of Web-Based Learning and Technologies, 2*, p. 53.

An important stage in the connectivism learning theory is reflection and metacognition. Dewey (1933) defined reflective thinking as "active, persistent, and careful consideration of any belief or supposed form of knowledge in light of the grounds that support it and the further conclusions to which it tends" (p. 118). Dewey believed that rather than learning from experience, we learn from reflecting on that experience.

Kolb (1984) extended Dewey's beliefs and developed The Learning Cycle from the premise that learning comes from a cycle of experience, reflection, abstraction, and active testing. The concept of reflective practice in action was introduced by Schon in 1987 as a process to refine one's own practice. Many schools adopted Schon's practice as a way to train new teachers, and incorporated these techniques into professional development for pre- and in-service teachers. Educators have also adopted reflective practices as a tool for students to assess their own learning.

According to Porter and Cleland (1995), reflection allows learners to (a) "examine their learning process, (b) take responsibility for their own learning, (c) see 'gaps' in their learning, (d) determine strategies that supported their learning, (e) celebrate risk taking and inquiry, (f) set goals for future experiences, and(g) see changes and development over time" (p. 3). The promise of social networking sites has inspired many educators, as SNS claims to "share many of the desirable qualities of good official education technologies – permitting peer feedback and matching the social contexts of learning" (Mason, 2006, as cited by Selwyn, 2008, p. 158).

Another stage in the learning processes of connectivism is contribution and involvement where "the learner begins to actively contribute to the learning network" (Pettenati & Cigognini, 2007, p. 54). Contributing and communicating ideas helps others in the network develop shared understanding. Communication is addressed specifically in the NCTM 2000 Principles and Standards for School Mathematics (NCTM, 2010). The standard states:

> Instructional programs from prekindergarten through grade 12 should enable all students to:

- organize and consolidate their mathematical thinking through communication,
- communicate their mathematical thinking coherently and clearly to peers, teachers and others,
- analyze and evaluate the mathematical thinking and strategies of others, and
- use the language of mathematics to express mathematical ideas precisely (para. 3).

Although these standards apply across the pre-K-12 curriculum, in which communication is essential in the mathematics classroom and where students need to express their thinking both orally and in writing, this task becomes stringent at the middle school level where thinking is more complex and abstract than in previous grade levels. Students in the 6-8 grade levels are expected to explain strategies through the use of argumentation and defendable rationales rather than through procedural summaries. This age group is also susceptible to social norms and tends to be reluctant to express their thinking to their peers. It is of utmost importance that teachers develop an environment where students feel comfortable expressing their mathematical ideas without fear of embarrassment. Blogging through social networking is one avenue that produces such an environment.

Communication is also addressed in the Common Core State Standards Initiative for mathematics instruction (2011). According to the CCSSI, mathematical understanding is hallmarked by one's ability to justify or reason about why a mathematical rule is true or where it comes from. CCSSI states, "The student who can explain the rule understands the mathematics and may have a better chance to succeed at a less familiar task" (p. 4). Standard Three for Mathematical Practice specifically addresses communication, and states that students should be proficient in constructing

viable arguments and critiquing the reasoning of others. This is accomplished when students construct arguments, make and explore conjectures, justify, and communicate findings with others.

The Partnership for 21st Century Skills (2011) also advocates communication in the Framework for 21st Century Learning. The framework describes "skills, knowledge and expertise students must master to succeed in work and life; it is a blend of content knowledge, specific skills, expertise and literacies" (p.1). According to the framework, critical thinking, problem solving, communication, and collaboration skills are necessary to prepare students to compete globally. The framework also includes ICT (Information, Communications and Technology) literacy skills that promote effective working conditions in a "technology and media-driven environment" (p. 2).

Connectivism Enacted within Web 2.0 Technologies

Blogs create a virtual community in which readers have opportunities to react or add to the discussion. This practice in itself leads to collaborative activity and ways to communicate ideas socially, which leads to understanding (Pettenati & Cigognini, 2007, p. 44). However, computer-mediated communication does not imply immediate, effective, and efficient communication skills, but simply bridges the gaps between "out of school and in-school literacies" (Zawilinski, 2009, p. 652).

In school settings, Moon (1999) promotes conditions for effective reflection, which include time and space, a good facilitator, and a supportive curriculum and environment. She states tasks that encourage reflection include those that are ill-structured or based on real-life situations, ask the right kinds of questions, challenge learners to incorporate previous learning, demand the ordering of thoughts, and require

some type of evaluation. Social networking sites and weblogs provide for these conditions and tasks, and are rich in reflective practice, which is "understood as a process of internal dialogue facilitated by thinking or writing and through an external dialogue with others" (Killeavy & Moloney, 2010, p.1,071). Benefits of reflective practice include a deeper understanding of concepts, validation of ideas, and respect for diversity. Furthermore, technology encourages the development of reflective practices and enriches written communication through collaborative communities (Killeavy & Moloney, 2010).

Communication on Social Networking Sites

In addition to requiring consideration of the theoretical and practical frameworks for the study, the approach to the study makes necessary comparison of existing Web 2.0 technologies which focus on the use of communication in an educational social networking site. Following a description of the gaps in this literature, the following are described: (a) Definitions and histories of discussion boards and webblogs ; (b) educational benefits of Blogging; (c) disadvantages of blogging, (d) math applications through blogging, (e) definition and history of social networking, (f) students attitudes and motivation with technology practices, and (g) sense of community.

Gaps in the Literature

The researcher conducted a broad literature review search for the topics of social networking and education utilizing the Academic Search Complete database in October 2012. Over 80 empirical studies were found. However, when the key descriptors social networking, sense of community, and education were used as a filter, the results were narrowed to 18 peer reviewed journal articles between 2006 and 2012. Among the 18 articles, 78% of the studies pertained to university level students, and only 22% were

found to deal specifically with high school students. It was also found that 11% focused on language learning. No studies were found pertaining specifically to mathematics. The problems addressed in the current study consider topics in the following gaps in the literature: (a) lack of research incorporating Web 2.0 technologies in the middle school mathematics setting, and (b) absence of studies pertaining to communicating mathematical thinking, reasoning and sense-making skills through social networking, especially at the middle school level.

Discussion Boards and Weblogs

History and definitions of discussion boards and weblogs. Online asynchronous discussion boards, considered a first-generation web tool, have been around for over 25 years and evolved from electronic bulletin board (BBS) forums and newsgroups. In this environment, users have the ability to create public messages other users can access and interact with in an online community (Cox & Cox, 2008; Gill, 2006). In an asynchronous discussion board format, an individual posts an original "thread" in response to an open-ended topic posted by the instructor of the course. Other individuals within the community, in turn, read the thread and then comment with their own remarks. They are primarily used in post-secondary distance learning in the form of computer-mediated communication and are referred to as "a powerful tool for group communication and cooperative learning that promotes a level of reflective interaction often lacking in a face-to-face teacher-centered classroom" (Penny & Murphy, 2008, p. 804). Cox and Cox (2008) contend that the interaction that discussion boards afford is helpful to students' cognitive development and can "contribute to student performance,

self-efficacy and satisfaction" (p. 382). There are many advantages for utilizing discussion boards to supplement in a face-to-face environment. These include:

- extending the classroom discussion beyond the walls of the classroom (Jewell, 2005),
- requiring students to engage in well-articulated argumentation and critical reasoning allowing for more time to analyze and reflect on their responses,
- allowing each student to participate in a more comfortable environment, especially if the student is shy or does not speak fluent English, and
- providing an outlet for students to pose their questions and receive feedback from all community members in a decentralized and constructivist environment (An & Frick, 2006, p. 486).

There are primarily four different types of discussion board formats: "direct discussions, debates, critiques, and mentoring" ("Learning Technologies at Virginia Tech", 2011, pp. 3-5). Direct discussions are utilized to invite students to discuss various topics and are facilitated by a course instructor who leads and guides the discussion. Debate discussion forums usually divide the community of learners into two groups and each argues for or against a specific issue. Critique forums can be used to provide students with feedback from the community on various projects. The final forum type is a mentoring discussion board that can be used to provide answers to questions, or to help students develop construction techniques of the English language.

Weblogs, otherwise known as blogs or microblogs, are regularly updated webpages organized as stand-alone items. They are similar to discussion boards as they "support asynchronous informational exchanges between individuals" (Gill, 2006);

however, they are limited to postings from an original author. The posts are arranged in a linear fashion, and they do not require a computer-managed system. People often use this online publishing tool to express their passions, hobbies, likes, dislikes, and insights on whatever interests them. The posts generally have 1,500 words or less on a specified topic, may or may not include digital photo or videos, and appear in reverse chronological order with the most recent post at the top of the main webpage. The weblog is seen as a communal and collective enterprise (Caraher, 2008) and maintains "follower" interest in what the authors have to say. Weblogs first appeared on the Internet in the mid to late 1990s, but it wasn't until the late 1990s that the term "weblog" was coined by Jorn Barger. These primitive sites shared only a few features of today's weblogs, consisting primarily of links to other websites and brief commentaries. As the Internet and bandwidth capabilities grew, so did the expansion of blogging.

There are several forms of weblogs, such as professional blogs for profit, blogs that express a particular interest or hobby, and blogs that serve purposes in the educational setting. According to Zawilinski (2009), there are four common types of blogs found in the elementary setting; (a) "classroom news blogs, (b) mirror blogs, (c) showcase blogs, and, (d) literature response blogs" (p. 652). Classroom blogs are generally used to share news and information with students and parents, such as announcements and assignments. This type of blog is typically the format teachers utilize first to initiate a home-school connection. Mirror blogs utilize reflective practices and are generally implemented as a journaling technique to express thoughts on a particular lesson or content learned. Mirror blogs can be implemented in any subject within the educational setting. Showcase blogs are a means to post students' art projects, writing

samples, or podcasts. Finally, literature response blogs are the most commonly used format, moving a traditional journaling method to the online world. Literature response logs can extend into collaborative blogs where students negotiate what is important to share with others. This type of teamwork increases students' collaborative writing skills and is necessary in the 21st century global market (Partnership for 21st Century Skills, 2011) .

There are several differences between discussion boards and blogs. Weblogs are usually authored by an individual who drives the topic discussion, in contrast to the discussion board in which the group shares the responsibility of authorship. Another area of contrast is intent. The intent of a weblog is to address/reflect on personal or professional accounts and provide news, whereas the intent for discussion boards is to facilitate collaboration and group decision making. A final distinction is the type of response generated in each format. Both weblogs and discussion forums allow for responses; however, weblogs do not need replies for content posting to continue. Discussion boards, on the other hand, need replies to continue, or a discussion would not occur (Cameron & Anderson, 2006; Fichter, 2005).

Educational benefits of blogging. There are several benefits of blogging in the educational setting. In respect to instruction, blogs can be accessed anytime and anywhere through an Internet connection; they are user-friendly requiring very little technical knowledge; they allow teachers to assess and enrich classroom learning; and they are highly motivating to students (Sun, 2009). According to Deng and Yuen (2009), most research on weblogs used in education focus on reflective and interactive practices. Much like paper-based journaling, weblogs provide individuals with a mode of personal

reflection; however, weblogging "enables peer interaction and collaboration" (p. 95) and feedback received can foster critical thinking. Ramaswami (2008) reported that blogging improves writing skills and allows students opportunities to write more frequently. The writing may happen at all times of the day rather than only while the students are in the classroom.

Stiller and Philleo (2003) found, in their empirical study, that blogging had a positive effect on the depth and breadth of student reflections, which were perceived to be more analytical and evaluative compared to previous journal entries. The most prominent reason for blogging comes from a practicing teacher's response to the question "Why should educators take the time to blog?"

> I think the biggest advantage to blogs is that they provide an authentic audience for student writing and work in general. In the past, the teacher was usually the only person who read student work. With a blog, student work can be read by classmates, parents, extended family members, school-community members, project partners, classroom teachers, pre-service teachers, and anyone around the world who locates the class blog (as cited by Zawillinski, 2009, p. 653).

Blogs can also be created to develop online professional learning communities where teachers reflect on best practices or provide support to inexperienced teachers (Killeavy & Moloney, 2010).

Disadvantages of blogging. With all the positive potential of integrating blogging into the math curriculum, or any content area, there are also a few possible complications. First of all, blogging "is not immune to the menaces of social networking" (Ramaswami, 2008, p. 25). Collaboration with site administrators must be

orchestrated to avoid inappropriate material. Additionally, policies and procedures must be in place to enforce appropriate behaviors of participation. Teachers may find themselves policing comments left behind by others; however, if blog software is found with appropriate filtering capabilities, then this is not an issue.

Although blogging can be used for a variety of purposes and offers a versatile and flexible medium for learning opportunities, it does pose challenges for teachers in the area of maintenance and implementation (Deng & Yuen, 2009). It is suggested that educators first examine the focus and purposes for blogging, followed by the development of a structured design for students that states specific guidelines and expectations, including the modeling of appropriate blogging methods. It is also reported that many studies have shown that compulsory blogging de-authenticates reflections and can "dilute the overall quality and experience of educational blogging" (p. 96); therefore, Deng and Yuen recommended that blogging be voluntary in nature and not be graded. In several interviews, educators and principals warned against "putting the technology ahead of the instruction – blogging doesn't solve a problem just because you have the technology" (p. 24). Ideally, the process of blogging would be embedded throughout the curriculum and pedagogy. Ramaswami (2008) reported that some of the drawbacks to blogging are related to implementation, as noted previously.

Math applications through blogging. Research is limited regarding the effects of blogging in the mathematics classroom, particularly at the middle school level. Most of the literature on blogging addresses language arts or higher education. Administrators and technology supervisors surveyed in a study by Lemke, Coughlin, Garcia, Reifsneider, and Bass (2009) reported that "Perceived opportunities for the use of Web 2.0 varied

significantly by subject area with language arts perceived as offering the greatest number of opportunities for use and mathematics the least" (p. 37). However, there are many websites that address weblogs in the mathematics classroom. According to one model of a mathematical weblog, (Tubbs, 2004), blogs can serve three basic functions for mathematical learning. First, they can be used for writing prompts, accomplished through initial entries created by the teacher, to which students create a response. For example, the teacher posts the following prompt: "What is the difference between an equation and an expression? Give an example of each." Three things occur while responding to a writing prompt blog post: (a) "the teacher has a quick way to assess student knowledge and provide feedback, (b) students can read and respond to other students' comments, and (c) students have the ability to respond without fear of embarrassment" (para. 1). A second function utilizes links found in a website and involves creating an assignment that students complete after reviewing the material to which the weblink connects. The students post their response to the assignment as comments on a blog. The third function involves posting digital images that make the mathematical concepts come alive by connecting them to real-world problem solving and by giving visual learners a point of reference. For example, a weblog might provide an account that refers to a prior lesson on finding the midpoint of a circle and includes a picture of a crop circle with a brief synopsis. The teacher then asks students to explain how they would go about finding the midpoint of the crop circle.

Another avenue to explore utilizing Web 2.0 technologies is digital portfolios, in which students can show growth in understanding of mathematical concepts in an electronic format. All three functions primarily follow the format of mirror blogging, and

depending on whether students are allowed to collaborate with others, the format could be considered a literature response blog as well (Zawilinski, 2009).

Social Networking

Social networking (SN) is seen as a "practice of expanding knowledge through connections with other individuals with similar interest" (Gunawardena et al., 2009, as cited by Hung & Yuen, 2010, p. 705). The concept of social networking is not a new phenomenon, as it was first proposed in 1929 by Karinthy when he introduced the concept that "any two people on earth could be connected by five handshakes" (Shu & Yu-Hao, 2011, p. 29). Pool and Kochen (1978) later developed a mathematical model based on Karinthy's conjecture, and hypothesized that "no more than three or four degrees of separation would be needed to connect any two people in the world" (Shu & Yu-Hao, 2011, p. 29). Milgram (1967) conducted several experiments to continue the works of Karinthy, Pool and Kochen. His goal was "to find short chains of acquaintances linking pairs of people in the United States who did not know one another" (Kleinberg, 1998, p. 1). The initial chain of communication experiment consisted of a small number of participants (source) in which each received a letter with the task of sending it to a specific target person not personally known by the sender. The letters were passed on to another person, and then to another until it reached its targeted recipient. The results of the first experiment reported a completion rate of only 5%, and subsequent experiments resulted in a completion rate of 35%. Milgram's limited conclusion stated that it took four intermediary people for the letters to reach the intended recipients, more formally known as six degrees of separation, thus establishing that we live in world with interconnected personal networks, a "small world". Milgram's small world phenomenon

"explored the probabilities of how each person, or network node, in a chain seeks out the next messenger using only the limited local knowledge they possess" (Goth, 2012, p. 13). The experiment became a favorite among social scientists and behaviorists to explore "probabilistic algorithms for best use of network resources to epidemiologists exploring the interplay of infectious diseases and network theory" (p. 13). In a recent study by researchers at Facebook and the University of Milan, 721 million Facebook users were found to have 69 billion unique friendships (Goth, 2012).

Educational researchers have also found social networking a topic of interest to explore how the social environments make connections to formal and informal learning (Hung & Yuen, 2010; Madge, Meek, Wellens, & Hooley, 2009; Selwyn, 2009; Veletsianos & Navarrete, 2012; Wodzicki, Schwammlein, & Moskaliuk, 2012). Since social networking is prominent in the lives of adolescent learners and "mirrors much of what we know to be good models of learning" (Selwyn, 2009, p. 158), it has prompted great interest for educators.

Social networking, as it is known today, began in 1995 with the introduction of Classmates.com™, which set the standards for future social networking sites such as MySpace , Facebook and Twitter. Boyd and Ellington (2007) defined social network sites as:

> web-based services that allow individuals to (1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users with whom they share a connection, and (3) view and traverse their list of connections and those made by others within the system (para. 4).

Social networks focus on building relationships and interests, rather than on specific topics. People in these networks know each other and connect through common interests (Zaidieh, 2012). A three-year ethnographic study conducted for the MacArthur Foundation, Ito et al. (2008) sought to find outhow today's youth integrated Web 2.0 technologies into their daily practices, and how this integration of technology changed the dynamics of learning and knowledge. The authors found three themes of student engagement with Web 2.0 technologies emerging from the data collected, which included, "hanging out, messing around, and geeking out" (p. 19). When "hanging out", teenagers are with friends discussing personal interests and gaming expertise, and their primary desire is "to maintain social connections" (p. 20). "Messing around" is "a more intense, media-centric form of engagement" (p.20). It involves experimenting with new media sources and may or may not include friends. The final theme, "geeking out" refers to "an intense commitment to or engagement with media or technology, often one particular media property, genre, or type of technology" (p. 28). Within this type of engagement, youth receive feedback from peers and other community members based on their level of expertise, in addition to gaining recognition or earning reputations. The authors indicated a critical need for educators and policy makers to consider how social and new media can be used as a site for individual and peer based learning, and as a guide for appropriate positive interactions.

Selwyn (2009) investigated when and for what purposes students were using the social network Facebook, and how these interactions related to formal and informal university education. The study consisted of 909 undergraduate students enrolled in the School of Social Sciences at Coalsville University in the United Kingdom. Selwyn

collected data for a period of 18 weeks for the non-participant ethnographic research. The data revealed five main purposes of student use: (a) "recounting and reflecting on the university experience; (b) exchange of practical information; (c) exchange of academic information; (d) displays of supplication and/or disengagement; and (e) 'banter' (i.e. exchanges of humor and nonsense)" (p. 161). Selwyn also indicated that half of the reflections submitted by students were responses in regard to absences, or to clarify peer support. Academic information was reported, but at a less frequent basis, in addition to students recommending journal articles or books to help support educational activities. Selwyn concluded that the development of community was more prevalent than the discussion of academics, and regarded Facebook as "an important site for the informal, cultural learning of 'being' a student, with online interactions and experiences allowing roles to be learnt, values understood and identities shaped" (p. 171).

Hung and Yuen (2010) conducted a study to investigate how social networking can be used as an educational tool to enhance students' sense of community. Their research focused on university students' views regarding the addition of supplemental social networking interaction to traditional classroom-based instruction, and their perceived sense of community while using SNS technology. The mixed method study included 67 students enrolled in face-to-face classrooms at two universities in Taiwan during the spring of 2009. An electronic survey was sent to the participants to collect primary data seeking to understand how the classroom community was supported by social networking. A second instrument included three open-ended questions to collect student feedback addressing the design of the course, and the Sense of Classroom Community Index (Rovai, 2002) was used to assess student sense of community. The

results indicated that students responded positively to supplementing face-to-face instruction with social networking technology, and this practice benefited students' sense of classroom community. Although the results of the study were positive, the authors indicated a need for researchers to continue investigating social media integration on a larger scale.

Social networking can be described as the best of both discussion boards and blogging combined, as people connect by voicing their opinions or commenting to others. This feature is often referred to as blogging, or in Facebook's terms, status updates. Current educational social networks include such sites as Ning, Schoology and Edmodo. The educational social networking Web 2.0 tools meet the needs of today's learner and allows for the creation of "learning environments that will indeed prepare students to be life-long learners, who can problem solve through collaboration with global partners" (Beldarrin, 2006, p. 150). Problem solving and collaboration are skills advocated by The Partnership for 21st Century Skills (2011) and related to the present study.

Student Attitudes toward and Motivation with Technology Use

Attitude is a significant concept in the field of mathematics education and having a positive attitude can be a source of motivation for reluctant learners. According to Gall, Gall, and Borg (2007) attitude is defined as "a measure of an individual's viewpoint or disposition toward a particular person or thing" (p. 633). Ellington (2003) identified attitude toward mathematics as the category in mathematics education most widely researched over the past 30 years, and noted a need for research to include attitude toward the use of calculators in mathematics. In respect to the inclusion of technology, consideration of student attitude can reveal students' reactions to the technologies and

may also show induced changes in behavior related to the particular technology (Ellington, 2006).

Closely related to attitude is motivation. Motivation is defined as "the attribute that moves us to do or not to do something" (Broussard & Garrison, 2004, p. 106). Motivation is sometimes compared to a drive; however, this drive is based more on physical need, such as those classified by Maslow (1943); whereas Bandura (1986) saw a person's beliefs playing an important role in motivation. Motivation can be classified by two distinct categories: intrinsic (inner self-fulfillment), or extrinsic (for a specific reward). People are all born with a high level of intrinsic motivation, which is based on needs (Carlton, 2003).

Brophy (1987) stated that motivation can be characterized as either a "general trait" or a "specific state" (p. 40). He described students who strive to learn as having a motivational trait, and those who acquire skills for general knowledge, or concept mastery, as being in a state of motivation. Motivation also has ties to learning and performance as based on conceptual and behavioral learning. Learning is the process of acquiring skills (conceptual), and performance is the demonstration of the acquired skills (behavioral). Those with the motivation to learn are driven to later performances based on the motivation, or process that occurs while learning.

Motivation, or the lack thereof, has always perplexed educators, and has been the topic of major research studies. Early studies indicated that students thought school was boring (Rothman, 1990) and tuned out most instruction (Goodlad, 1984). In 1991, Tomilson (as cited by Manzo, 2008) tied low achievement to lack of student motivation.

More recently, it has been found that attendance, behaviors, and drop-out rates are also impacted by students' level of motivation (Manzo, 2008).

According to Brewster and Fagan (2000), students, like any individual, can either be intrinsically motivated or extrinsically motivated. Those students who are intrinsically motivated "actively engage themselves in learning out of curiosity, interest, or enjoyment, or in order to achieve their own intellectual and personal goals" (p. 1). These students usually learn for the sake of learning, or for a challenge, and often fare better than those students who are extrinsically motivated. Students who are extrinsically motivated learn for the sake of earning something tangible, such as candy, rewards, or grades. They "rarely exert more than the minimum effort necessary to meet their goals" (p. 2), and often exhibit lower achievement than intrinsically motivated students. Brewster and Fagan concluded that even though intrinsically motivated students excel over extrinsically motivated students in a number of areas, researchers caution educators in labeling students as intrinsic or extrinsic, and should cater to the needs of both types of learners.

Another perspective on motivation is the level of psychological and behavioral engagement. Students who are psychologically engaged are intrinsically motivated through their "curiosity, interest, and enjoyment" (Jablon & Wilkinson, 2006, p. 128). Behaviorally engaged students are intrinsically motivated with increased concentration, enthusiasm, and effort. Carlton (2003) perceived intrinsic motivation as the product of behavioral characteristics. A child who is highly motivated is persistently involved in a task for a long period of time, welcomes different choices of activities, independently works without assistance from adults, and shows positive emotions.

Disengagement of intrinsic motivation occurs as early as third grade (Jablon & Wilkinson, 2006) when natural motivation begins to decline. During pre-adolescence, or around the seventh grade, motivation takes another plunge during the time when students are deciding whether school is important (Dweck, 2009). These observations highlight the necessity of considering student motivation during instruction. Davis (1993) stated that although there is no simple solution to motivating students, there are some general strategies that teachers can implement to help in the endeavor. The first is to address students' needs, such as the need to do well or be involved, and create assignments geared toward these specific interests. A second strategy is to actively engage students in the learning process with activities that are hands-on and creative. Another strategy is to ask students directly what makes class motivating. Technology has also been found to impact student motivation.

There are many technology practices that can be incorporated into the classroom. Utilizing a variety of these techniques, such as the Internet, gaming programs, blogging, graphing calculators, videos, and others, has a large impact on student motivation and interest. The greater the variety of techniques, the more likely students are to become engaged and participate. Students also like to impress their peers with what they can do with technology, which in turn internalizes motivation, and increases the acquisition of skills (Ruthven, Hennessy, & Brindley, 2004). As a result, researchers recommend using social networking applications (Second Life, YouTube, blogs, wikis, Del.icio.us, Facebook, Folksonomy) in combination to create "a powerful environment for communication and learning" (Gunawardena et al., 2009).

Sense of Community

Social networking creates a community of learners. Although there is a plethora of literature on sense of community (SOC), a consensus on a definition has yet to be achieved. Research about SOC began in the mid-1970s through the work of Sarason (1974), who defined SOC as "the perception of similarity to others, an acknowledged interdependence with others, a willingness to maintain this interdependence,…a feeling that one is part of a larger dependable and stable structure" (as cited by Rovai, 2002, p. 321). Another perspective, more aligned to the classroom and the adolescent, includes "a shared faith that members' needs will be met through their commitment to be together" (McMillian & Chavis, 1986, p. 9). McMillian and Chavis' definition was created from four elements: "Membership, influence, reinforcement, and belief" (p.9).

These elements of SOC appear in Rovai's (2002) definition of classroom community. For this reason, classroom community, a form of SOC, will be operationally defined for the study following Rovai's pattern as:

> a feeling that members have of belonging, a feeling that members matter to one another and to the group, that they have duties and obligations to each other and to the school, and that they possess shared expectations that the members' educational needs will be met through their commitment to shared learning goals (p. 322).

Rovai (2002) contends that this definition is comprised of two components: a feeling of connectedness among community members, and shared learning expectations and goals. Connectedness refers to the sense of belonging and the ethic of caring, and once this feeling is established, safety and trust are built. With connectedness, students

are more willing to expose their learning weaknesses and feel that others within the community will provide support. The other component, learning expectations and goals, is when the member feels that knowledge and meaning are being "actively constructed within the community" (p.322), and is being enhanced and satisfied through the community. According to Rovai, the ultimate goal of the community is that of learning. From these premises, classroom community could be summarized as "a social community of learners who share knowledge, values, and goals" (p. 322). Other researchers support this conclusion. Learning in the classroom has been tied to how well students feel accepted within the classroom community (Wighting, 2006). Nichols (2008), who conducted a mixed methods study on sense of community beliefs, found that students attributed their successes to the level of support contributed by the community members, both teachers and peers. Hung and Yuen (2010) contend that to nurture a sense of community, social, cognitive, and teaching elements need to be interrelated.

Rovai (2002) saw a need to answer the question, "Is increased learning an outcome of strong classroom communities?" (p. 322) and delved deeper into the research on sense of community. Rovai developed a survey instrument to measure classroom community. The instrument consisted of 20 items such as, "I feel uneasy exposing gaps in my understanding," and utilized a five-point Likert-type scale with responses of strongly agree, agree, neutral, disagree, and strongly disagree. Field testing of this instrument was conducted with 314 online graduate students who yielded factors of connectedness and learning with valid and reliable measures. The participants were enrolled in distance education courses utilizing the Blackboard^{SM} classroom management system. The results of the study indicated that there was a strong relationship between

perceived cognitive learning and sense of community; however, it was not a causal relationship. Additionally, Rovai argued, "If online learners feel a sense of community, it is possible that this emotional connectedness may provide the support needed for them not only to complete successfully a class or a program but also to learn more" (p. 321). Rovai stated that additional studies need to be conducted to rule out any other variables contributing to this relationship that would further explain the strong relationship, and the research should also be conducted on a larger scale.

Closely related to sense of community is community of practice (CoP), which is defined as "a group of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis" (Wenger, McDermott, & Snyder, 2002, p. 4). The CoP is structured through three elements: domain, community, and practice. In a social networking site, the domain denotes the topic for the community and presents an environment where participants share their ideas and knowledge through discussions and interactions. The community element is the group of people who are discussing and interacting together in the social networking site, and the practice refers to the specifics of the topics the community is addressing. When these three elements function collectively they produce an ideal knowledge structure, which is defined as "a social structure that can assume responsibility for developing and sharing knowledge" (Wenger, McDermott, & Snyder, 2002, p. 29).

Community of practice is promoted by many researchers, and is one way to integrate these elements into the online or face-to-face classroom. Hung and Yuen (2010) explored using social networking as a supplementary tool to enhance students'

sense of community, and to promote community of practice. Data were collected from 67 university level students enrolled in face-to-face courses. The results of the study provided positive implications and educational value for incorporating social networking for learning into higher education. The researchers contend that strategic planning must be in place "to manage and maintain the CoP in the class social networks" (p. 713), or the effectiveness of social networking will be lost. Because of the small sample of participants, the authors implicated a further need to empirically study the learning effectiveness of social networking in higher education.

Summers and Svinicki (2007) investigated the empirical relationship between classroom community and student achievement goals of the university student while participating in cooperative learning activities. The authors found that the subjects who participated in cooperative learning activities had a higher perceived sense of classroom community and greater motivational goals than those subjects who did not participate in activities that fostered cooperative learning.

Research provides many positive aspects for the use of social networking and weblogs in the educational environment such as developing a sense of community which fosters learning and establishing a community of practice to facilitate the educational potential of social networks; however, Selwyn (2008) expressed the concerns of critics for extended use of these technologies. These concerns include the "heightened disengagement, alienation, and disconnection of learners from education" (p. 158), and the "scholarly depowering of a Google generation of learners incapable of independent critical thought" (p. 158). The fact that some critics believe social networking can

distract learners from their studies has been a controversial issue in the educational environment.

Summary

The literature has shown that Web 2.0 technologies are rich and powerful tools to enhance sense of community, critical thinking, reflective practices, and communication skills needed in the 21st century global society (Rovai, 2002; Selwyn, 2008; Wang, Woo, & Zhao, 2009; Zawilinski, 2009). However, very little is known about the effects of these types of technology practices in mathematics, especially at the middle school level. How instructional application of these Web 2.0 technologies impact middle school math students has not, to the knowledge of this researcher, been identified. This provides incentive for further research on the essential and important integration of technology and combinations of technologies in mathematics curriculum.

CHAPTER THREE: METHODOLOGY

With the adoption of Common Core State Standards in a majority of states across the nation (CCSSI, 2012), and the increase in accountability for student proficiency, it is important for educators to initiate instructional practices that provide for student success (Dolan, 2008). According to Rovai (2002), "students with stronger sense of community tend to possess greater perceived levels of cognitive learning" (p. 330). The purpose of this study is to determine if online reflections, through social networking sites, affect students' sense of community and levels of perceived conceptual learning in an Algebra I course. This chapter includes the research methods that were used for the study.

Research Design

The research design used for this study was a quasi-experimental nonequivalent control group design (Gall, Gall, & Borg, 2007). While this design results in an experimental and a control group, it does not involve randomization in assignment to these groups (Gall, Gall, & Borg, 2007). The rationale for choosing this method is twofold, scheduling middle school students in course sections based on random assignment is not feasible, and random assignment of students is a violation of policy in the district in which the study was conducted. The units of analysis were the perceptions of individual participants enrolled in eighth-grade Algebra I courses at the middle school level.

Participants

Most educational research on social networking is limited to secondary and post-secondary settings (Johnson, 2006; Luebeck & Bice, 2005); however, the population from which the sample for the present study was drawn was Algebra I students from the

middle school level. The Algebra I course in which study participants were enrolled counts toward high school credit. Students in Algebra I and II Honors courses generally score within a range of 4 and 5 on the Florida Comprehensive Assessment Test (FCAT) (Figure 2), attain A's and B's quarterly, and show high intuitiveness for mathematics. Students scoring 3 or 4 on the FCAT, earn B's and C's quarterly, and have average intuitiveness for mathematics are placed in the regular Algebra I course in the eighth grade as per district guidelines. It is the latter population on which this study focused.

Achievement Level Policy Definitions	
Level 5	This student has success with the most challenging content of the *Sunshine State Standards*. A student scoring in Level 5 answers most of the test questions correctly, including the most challenging questions.
Level 4	This student has success with the challenging content of the *Sunshine State Standards*. A student scoring in Level 4 answers most of the test questions correctly, but may have only some success with questions that reflect the most challenging content.
Level 3	This student has partial success with the challenging content of the *Sunshine State Standards*, but performance is inconsistent. A student scoring in Level 3 answers many of the test questions correctly but is generally less successful with questions that are the most challenging.
Level 2	This student has limited success with the challenging content of the *Sunshine State Standards*.
Level 1	This student has little success with the challenging content of the *Sunshine State Standards*.

Figure 2. Florida Comprehensive Achievement Test Achievement Levels by Florida Department of Education (FLDOE).

The study was isolated to eighth-grade students assigned to Algebra I in two class sections (approximately 22 students in each section). As previously noted, the majority of students were assigned to the Algebra I course based on their overall level of math proficiency, receiving a 3 or 4 on the sixth-grade FCAT, year seven grades, and teacher recommendations. Students transferring from out of state, with no prior FCAT scores, are placed in courses based on withdrawal grades from their previous school.

The student sample for this study was from a Central Florida school district and was limited to a middle school from the west side of the county. At the time of the study, the school's population was 1,388 students, ranging from ages 11-14, and was comprised of 68% Caucasian, 7% African American, 20% Hispanic and 2% Asian, Indian, or multiracial. The population of students receiving English as a Second or Other Language (ESOL) services was 3%, and the population of students receiving exceptional student education (ESE) services for learning, behavioral, and emotional disabilities was 26%. Additionally, the school had an enrollment of at least 40% low-income students; therefore, it qualified to receive Title 1 funding for school-wide projects that focus on the improvement of teaching and learning of children in high-poverty schools.

There were 48 students assigned to the two classes selected for study. Convenience sampling was used because it was not feasible to schedule students in course sections based on random assignment. The student sample was 52% female and 48% male and was comprised of 67% Caucasian, 10% African American, 13% Hispanic, 6% Asian, and 4% Multiracial. The majority of the students scored at a Level 3 (49%) on their previous grade level FCAT, exactly in the middle of the scale. Two percent of the students scored at Levels 5 (highest score possible) and 1 (lowest score possible), and 17% scored at Levels 4 and 2. Six students (13%) did not have available FCAT scores. One student was staffed as Exceptional Student Education (ESE) and had an Individual Education Plan (IEP). Out of the 48 students, 29 consented to participate in the study (60.42%). The 29 participants accurately represented the entire group as indicated by FCAT scores and school based homogenous placement practices.

The participants in the study were assigned to an experimental group and a comparison group using non-randomized means. Since both groups were equivalent in academic characteristics (FCAT Scores) and gender make up, one class section was randomly designated as the experimental group and the second as the control group. The rationale for choosing this method is that it was not feasible to schedule students in course sections based on random assignment. There are many factors that are involved in the scheduling of students, including mathematics levels and elective courses that would prohibit random assignment. Random assignment is also against policy in the district in which this study took place.

The researcher recruited an Algebra I instructor who taught both the experimental and comparison group Algebra I sections, and had at least three years teaching experience with Web 2.0 Technologies. The instructor was also an adjunct teacher for an online university and had received training in substantive communication in the face-to-face and online settings.

Setting

The setting for this research study was two eighth-grade regular Algebra I course sections in a Central Florida school district. The sample middle school has exhibited below state average academic standards as shown on previous FCAT results in reading and mathematics (Percent of students scoring a level three or above: Reading 56%, State 58%; Math: 49%, State 56%, Florida Department of Education, 2012), as well as writing scores which are equivalent to state averages (Mean writing score 3.3, Florida Department of Education, 2012). The assigned teacher had been trained in the use of the social networking site Edmodo through professional development provided by the district

and school-based personnel. The social networking aspect of the study required students to utilize computer access outside of the classroom and independent from class time as defined in the Student Experimental Group Instruction Sheet (Appendix A). Any student needing internet access during school hours was directed to obtain a pass to the school Media Center. Student sign-up and use in Edmodo was monitored by the researcher.

Instrumentation

Data collected for this research were secured using a password-protected computer. Any back-up files were protected on a secure server that was password protected. Data analysis was executed by using the IBM Statistical Package for the Social Sciences (SPSS) software version 21.

Data to address both research questions were collected via a secured online survey site (Survey Monkey) using pretest and posttest survey instruments that address sense of community and perceived learning. Each item on the survey instruments was rated on a five-point Likert-type scale. The five points were strongly agree (SA), agree (A), neutral (N), disagree (D), and strongly disagree (SD).

The Sense of Classroom Community Index (SCCI) by Rovai (2002) was adapted as the measure for sense of community. It included 40 items that addressed feelings of connectedness, cohesion, spirit, trust, and interdependence in the traditional and virtual environments. Amendments to the survey included changing the term "course" to "class" since middle school students' instruction periods are referred to as classes rather than courses. This researcher consulted with Rovai, who confirmed that the adjustment would not interfere with the reliability or validity of the testing instrument (Appendix B). Cronbach's coefficient of .93, and a split-half coefficient (corrected by the Spearman-

Brown prophecy formula) of .91, indicated an excellent reliability for the instrument. Additionally, validity of the instrument was rated as totally relevant by three university professors, and according to Rovai, the instrument contains high content and construct validities based on content of community found in literature. Wighting, Nisbet, and Spaulding (2009) conducted research using Rovai's instrument with the K-12 population (high school level), and reported similar reliability and validity results; however, no studies have been published on whether it is valid and reliable for the middle school demographic.

The Perceived Learning Scale survey questions employed were adapted from Halic, Lee, Paulus, and Spence, (2010) and include seven items that indicate student perceived cognitive learning in connection with social networking. The original survey was developed for use with university level students and included the word "blog," which was changed to "discussion" by the researcher to match the terminology most commonly used with middle school students. According to Gill (2006), blogs and discussion boards are equivalent and viewed as a method of asynchronous informational exchanges between individuals. This researcher consulted with Halic, who confirmed that changing the terms would not have an effect on validity and reliability of the testing instrument (Appendix C). Halic, Lee, Paulus, and Spence, (2010) conducted factor analysis to test for validity of the seven perceived learning items. The results indicated that there was no unidimensionality present, thus supporting the construct validity. Halic et al. also conducted Cronbach's alpha to test for an internal consistency estimate of reliability. The results produced an estimate of 0.874, indicating good reliability.

Procedures

Prior to data collection, the researcher obtained permission from the participating school district, the participating school principal, and Liberty University's Institutional Review Board (Appendices D, E, and F). The school district granted provisional permission to conduct research as long as no instructional time would be used to conduct the research. The study followed a biblical basis as indicated in Mark 12:31 and Matthew 7:12 as a primary operational premise (i.e. The Golden Rule). Participants were recruited through their assigned Algebra I courses. Students were assigned to Algebra I based on sixth-grade Florida Comprehensive Assessment Test scale scores (Levels 1-5), and seventh-grade teacher recommendations during the spring of seventh grade. Placement recommendations were based on students scoring between a level 3 or 4 (success and partial success with the challenging Sunshine State Standards), and maintaining at least a B average in seventh-grade Advanced Math. The instructor of the Algebra I course recruited study participation through a recruitment script, and child assent and parental/student consent forms (Appendices G, H and I). Once forms were collected, the students in the experimental group were given a Student Instruction sheet (Appendix A), which included an overview of participation expectations, directions on how to sign up for Edmodo with a fictitious name, and directions on how to access the links for the initial pretests (Sense of Classroom Community Index and Perceived Learning Scale). The pretests were completed through a secure Internet survey site (Survey Monkey) off campus. The surveys included directions on how to complete, and did not have a time limit. In addition to classroom instruction, the experimental group participants were required to post an original response to discussion board prompts, and reply to at least

two other classmates twice a week in Edmodo as directed in the Student Instruction sheet. The control group students were given instructions on how to sign up for Edmodo and were provided with links to the initial pretests. This group was not required to participate in the group discussions via Edmodo during the duration of the study; however, they participated in oral discussions within the classroom, discussing the same context based on the daily lessons. During the four weeks, the students participated in class as usual, utilizing lessons that focused on tough to teach and learn algebra concepts. The lessons included systems of equations and graphing inequalities. After the four-week period, each student was given another link to access the two posttest electronic surveys. The posttests were completed through a secure Internet survey site (Survey Monkey) off campus. The surveys included directions on how to complete, and did not have any time limit.

The role of the course instructor on the social networking site was that of a co-facilitator, with the researcher, who ensured the discussions were staying on topic, and to provide lesson plans for the four weeks. The researcher was responsible for posting prompts and monitoring the discussions to ensure appropriate discourse based on the submitted lesson plans. Students in the experimental group completed the online discussions at home. The comparison group completed discourse within the classroom with questions from the daily course lessons.

Threats to Validity

Nonequivalent Group designs are highly susceptible to internal validity threats in participant selection due to non-randomized design. Two such threats specific to this study were selection bias and social validity. To control selection bias, the two groups

were made as equivalent as possible. This was accomplished by examining the measures on seventh-grade FCAT mathematics scores to determine whether the two groups were similar. This was the case for the two groups as it is a school-based practice to place students homogenously. To minimize social threats, the sample came from two different course sections so that the participants were isolated and not aware of each other's activities.

Sense of community and perceived cognitive learning, the focus for this study, were addressed in the following research questions and null hypotheses:

Research Questions

Research Question #1 (RQ 1): When comparing the use of reflective practices in online computer-mediated communication (CMC) and face-to-face formats, is there a difference in students' sense of community as measured by the Sense of Classroom Community Index (SCCI) (Rovai, 2002)?

Research Question #2 (RQ 2): Does the classroom format, online (CMC) versus face-to-face, have any effect on students' perceived learning towards Algebra I course content as measured by the Perceived Learning Scale survey (Halic, Lee, Paulus, & Spence, 2010)?

Null Hypotheses

$\mathbf{H_{01}}$: There will be no statistically significant difference in the mean sense of community scores between the experimental group and the control group as measured by the Sense of Classroom Community Index adapted from Rovai (2002).

$\mathbf{H_{02}}$: There will be no statistically significant difference in the perceived learning scores for the experimental group and the control group as measured by an adapted version of

Perceived Learning Instrument (Halic, Lee, Paulus, & Spence, 2010).

Data Analysis

To analyze the data addressing Research Question One, the researcher conducted an analysis of basic descriptive statistics, such as determining the mean scores and standard deviations for the pre and posttest exams. An independent sample *t*-test was conducted, using IBM SPSS statistical software (version 21), on the initial pretest data to determine if there were significant differences between the means of the experimental and control groups. The *t*-test was utilized to determine if posttest results could be attributed to the treatment and not initial differences between the groups (Zhang, 2009).

The independent variables were the experimental and control groups, and the dependent variable was the Sense of Community overall scale score. To test for assumptions of equal variances, an *a priori* level of significance of $p < .05$ was used, and was evaluated using Levene's Test for Equality of Variance. The researcher determined there were no initial differences existing between the groups; therefore, the SCCI pretest raw scores were not used as a covariate in the posttest analysis (Howell, 2008). Since there were no covariates as indicated in the pretest analysis, a *t*-test analysis was conducted rather than an ANCOVA to examine differences in the SCCI posttest scores. The data analysis for Research Question Two followed the same analysis as utilized for Research Question One, using the Perceived Learning scale score as the dependent variable.

CHAPTER FOUR: RESULTS

The purpose of this study was to determine if online reflections, through social networking sites, have any effect on students' sense of community and levels of perceived conceptual learning in Algebra I courses. This chapter presents the results of this research study and is divided into three sections, concluding with a summary of the results. The first section includes an overview of the data analysis procedures and final sample population statistics. The second and third sections include descriptive findings as related to the null hypotheses for Research Questions One and Two identified in Chapter One and summarized in the overview that follows.

Data Analysis Overview

This quasi-experimental quantitative pre and posttest study examined students' sense of community and perceived cognitive learning, which were addressed in the following research questions and hypotheses:

Research Question #1 (RQ 1): When comparing the use of reflective practices in online computer-mediated communication (CMC) and face-to-face formats, is there a difference in students' sense of community as measured by the Sense of Classroom Community Index (SCCI) (Rovai, 2002)?

H_{01}: There will be no statistically significant difference in the mean sense of community scores between the experimental group and the control group as measured by the Sense of Classroom Community Index adapted from Rovai (2002).

Research Question #2 (RQ 2): Does the classroom format, online (CMC) versus face-to-face, have any effect on students' perceived learning towards Algebra I course content as measured by the Perceived Learning Scale survey (Halic, Lee, Paulus, &

Spence, 2010)?

H_{02}: There will be no statistically significant difference in the perceived learning scores for the experimental group and the control group as measured by an adapted version of Perceived Learning Instrument (Halic, Lee, Paulus, & Spence, 2010).

The participants surveyed in this study were middle school students enrolled in Algebra I from two course sections during the spring of 2013. The instructor of the Algebra I course recruited study participation through a recruitment script, and child assent and parental/student consent forms (Appendices G, H, and I). Once forms were collected, the students in the experimental group were given a Student Instruction sheet (Appendix A), which included an overview of participation expectations, directions on how to sign up for Edmodo with a fictitious name, and directions on how to access the links for the initial pretests (Sense of Classroom Community Index and Perceived Learning Scale). The control group students were given instructions on how to sign up for Edmodo and were provided with links to the initial pretests. This group was not required to participate in the group discussions via Edmodo during the duration of the study; however, they participated in oral discussion within the classroom. The role of the course instructor on the social networking site was that of a co-facilitator who ensured the discussions were staying on topic with the classroom content. The researcher was responsible for posting prompts and monitoring the discussions to ensure appropriate discourse. Students in the experimental group completed the online discussions at home. The comparison group completed content questions within the classroom.

The final sample assigned to the experimental and control groups included 29 students. Table 1 indicates the demographics (gender, ethnicity, and group assignments)

for the initial participants (*n*=48), and the final group of consenting participants (*n*=29). The participants in the study were assigned to an experimental group and comparison group using non-randomized assignments. One instructor taught both class sections, which decreased the possibility of extraneous variables.

Table 1

Gender, Ethnicity, and Group Assignments

		Initial Participants		Consenting Participants	
		n = 48	Percentage	*n = 29*	Percentage
Gender					
	Male	23	47.9	10	34.2
	Female	25	52.1	19	65.8
Ethnicity					
	Caucasian	32	66.7	22	75.8
	African American	5	10.4	2	6.9
	Hispanic	6	12.5	1	3.5
	Asian	3	6.2	2	6.9
	Other	2	4.1	2	6.9
Group					
	Experimental	23	47.9	14	48.3
	Control	25	52.1	15	51.8

The majority of the students scored at a Level 3 (67%) on their previous grade level FCAT. Two percent of the students scored at Levels 5 (highest possible score) and 1 (lowest possible score), and 21% scored at Levels 4 and 2 (Figure 2). Three students (10%) did not have available FCAT scores as they were transfer students from another state that does not participate in FCAT testing. One student was staffed as Exceptional Student Education (ESE) and had an Individual Education Plan (IEP).

After consent forms were collected, all participants were required to sign up for a student account in Edmodo using a special code corresponding to their assigned group. Students were instructed to create a fictitious username that would be used in the Edmodo site and as a sign-in for each pre and posttest survey. The Experimental group had 14 members representing 48.3% of the initial consenting participants and the control group had 15 members (51.8%). Both groups were provided with links in their Edmodo "class" to access the SCCI (Rovai, 2002) and Perceived Learning Instrument (Halic, Lee, Paulus, & Spence, 2010) pretests. Twenty-nine students completed the pretests during the first of four weeks for the study. The 29 responses to the initial pretest for both the SCCI and the Perceived Learning Scale represented a 100% response rate, which is well above the recommended response rate of approximately 35-40% for survey research (Baruch & Holtom, 2008). According to Baruch and Holtom, "higher response rates will lead to a higher probability of a sample being representative of a population" (p. 1153). The researcher sent a message in the SNS site (Edmodo), as a follow-up technique to promote response rates (Anseel, Lievens, Schollaert, & Choragwicka, 2010), during the first week of data collection.

During the four weeks, the students participated in class as usual, utilizing lessons that focused on tough to teach and learn algebra concepts (Dick & Burrill, 2009). These lessons included systems of equations and graphing inequalities. In addition to classroom instruction, the experimental group participants were required to post an original response to discussion board prompts (Appendix J), and reply to at least two other classmates twice a week in Edmodo as directed in the Student Instruction sheet (Appendix A). Participation statistics were not collected as it was not part of the scope for the research study; however, participants were asked to voluntarily complete a final post reflecting on the use of the SNS Edmodo as an instructional tool (Appendix K). Nine students (31%) completed this optional activity.

After the four-week period, each participant was given another link, in their Edmodo class, to access the two posttest electronic surveys. All but two participants in the control group completed the posttest surveys, which represented a 93.1% response rate from the original 29 consenting participants, well above the recommended rate of return (Baruch & Holtom, 2008). Since the participants did not complete both pre and posttest instruments, their initial pretest data were excluded from the study. The final number in the sample size was $N = 27$.

Pre and Posttest Descriptive Statistics and Results

The researcher used IBM SPSS version 21 for statistical analysis. The pooled means and standard deviations for the SCCI (Rovai, 2002) pretest raw scores were $M = 110.56$($SD = 13.14$). The pooled means and standard deviations for the Perceived Learning Instrument (Halic, Lee, Paulus, & Spence, 2010) pretest scores were $M = 27.44$

(*SD* = 2.21). Table 2 lists the descriptive statistics of the pretest measures for both dependent variables.

Table 2

Pretest Descriptive Statistics

	Experimental Group (*n* = 14)		Control Group (*n* = 13)	
	M	*SD*	*M*	*SD*
SCCI	107.43	10.40	113.92	15.27
Perceived Learning Instrument	26.86	2.00	28.08	2.33

The pooled means and standard deviations for the SCCI (Rovai, 2002) posttest raw scores were *M* = 112.64 (*SD* = 9.85). The pooled means and standard deviations for the Perceived Learning Instrument (Halic, Lee, Paulus, & Spence, 2010) posttest scores were *M* = 30.00 (*SD* = 2.17). Table 3 lists the descriptive statistics of the posttest measures for both dependent variables.

Descriptive Findings and Data Analysis for Research Question One

Research Question One addressed the difference in sense of community between the online (SNS) face-to-face formats as measured by Sense of Classroom Community Index (SCCI), (Rovai, 2002). The null hypothesis for Research Question One states:

H_{01}: There will be no statistically significant difference in the mean sense of community scores between the experimental group and the control group as measured by the Sense of

Classroom Community Index (SCCI) adapted from Rovai (2002). The SCCI included 40

Table 3

Posttest Descriptive Statistics

	Experimental Group (n = 14)		Control Group (n = 13)	
	M	*SD*	*M*	*SD*
SCCI	112.64	9.85	116.00	10.12
Perceived Learning Instrument	29.07	1.27	30.54	2.70

items that addressed feelings of connectedness, traditional and virtual environments. Each item on the survey instruments was rated on a five-point Likert-type scale. The five points were strongly agree (SA), agree (A), neutral (N), disagree (D), and strongly disagree (SD). The weights of all 40 items were added to obtain an overall SSCI raw score. According to Rovai (2002), SCCI raw scores vary from zero up to a maximum of 160. Higher scores indicate a stronger sense of classroom community.

An independent *t*-test was conducted on SCCI (Rovai, 2002) pretest raw scores for the experimental and control groups to evaluate the null hypothesis that there would be statistically significant difference in Algebra I students' sense of community prior to treatment. The raw scores for the SCCI pretest were used as the independent variable and the grouping was the dependent variable (Table 4). There were no outliers in the data, as assessed by inspection of a boxplot. Since the sample size was small (N = 27), a Shapiro-Wilk's test was performed to test for normality. SCCI raw score was normally

distributed for the experimental and control groups, as assessed by Shapiro-Wilk's test ($p > .05$). There was homogeneity of variances for SCCI raw scores for the experimental and control groups, as assessed by Levene's Test for Equality of Variances ($p = .216$). This was done to control for the initial differences between the experimental and the control groups to determine if the treatment of reflecting within a social networking site (SNS) truly had effects on classroom sense of community in the experimental group. The results of the independent *t*-test were found to not be statistically significant $t(25) = -1.30$, $p = .21$ between the experimental group ($M = 107.43$, $SD = 10.40$, $n = 14$) and the control group ($M = 113.92$, $SD = 15.27$, $n = 13$), indicating that there were no significant differences between the groups for the SCCI raw test scores. Cohen's D was calculated at 0.50, indicating a medium effect size. The mean difference in SCCI raw score was -6.49, which asserts that the researcher can be 95% confident that the true mean difference lies somewhere between -16.78 and 3.79. There was no significant difference in the SCCI raw scores, therefore the assumption was made that the groups were similar and the researcher did not use the pretest scores as a covariate.

Table 4

Means, Standard Deviations, and t-test (Pretest Sense of Classroom Community Index)

Group	*n*	*M*	*SD*	*t*	Sig.
				-1.30	.21
Experimental	14	107.43	10.40		
Control	13	113.92	15.27		

Note. $p < .05$, two-tailed

Since there was no significant difference found between the pretest raw scores, the pretest measures were not considered as a covariate (Howell, 2008), therefore an independent *t*-test was conducted on the posttest data. Initial analyses, using IBM SPSS software (Version 21), were conducted to assess the assumptions of the *t*-test. There were no outliers in the data, as assessed by inspection of a boxplot. Since the sample size was small ($N = 27$), a Shapiro-Wilk's test was performed to test for normality. SCCI raw score was normally distributed for the experimental and control groups, as assessed by Shapiro-Wilk's test ($p > .05$). There was homogeneity of variances for SCCI raw scores for the experimental and control groups, as assessed by Levene's Test for Equality of Variances ($p = .196$). The results of the independent *t*-test were found to not be statistically significant $t(25) = -.87$, $p = .39$ between the experimental group ($M = 112.64$, $SD = 9.85$, $n = 14$) and the control group ($M = 116.00$, $SD = 10.12$, $n = 13$), indicating that there were no significant differences between the groups for the SCCI raw test scores (Table 5). Cohen's D was calculated at 0.34, indicating a medium effect size. The mean difference in SCCI raw score was –3.36, which asserts that the researcher can be 95% confident that the true mean difference lies somewhere between -11.27 and 4.56.

Table 5

Means, Standard Deviations, and t-tests (Posttest Sense of Classroom Community Index)

Group	*n*	*M*	*SD*	*t*	Sig.
				-.87	.39
Experimental	14	112.64	9.85		
Control	13	116.00	10.12		

Note. $p < .05$, two-tailed

The results of the *t*-test indicated that there was no statistically significant difference between the SCCI raw scores from students who participated in reflective discourse in the social networking site Edmodo and the students who participated in reflective discourse in the face-to-face classroom. Since there was no statistically significant difference found, the researcher failed to reject the null hypothesis.

Descriptive Findings and Results for Research Question Two

Research Question Two addressed perceived learning between the online and (SNS) face-to-face formats as measured by the Perceived Learning Instrument (Halic, Lee, Paulus, & Spence, 2010). An independent *t*-test was conducted on the Perceived Learning Instrument (Halic et al., 2010) pretest raw scores for the experimental and control groups to evaluate the null hypothesis that there would be statistically significant difference in Algebra I students' perceived learning prior to treatment. The null hypothesis for Research Question Two states: $\mathbf{H_{02}}$: There will be no statistically significant difference in the perceived learning scores for the experimental group and the control group as measured by an adapted version of Perceived Learning Instrument (Halic et al., 2010). Each item on the survey instrument was rated on a five-point Likert-type scale. The five points were strongly agree (SA), agree (A), neutral (N), disagree (D), and strongly disagree (SD). The raw scores for the Perceived Learning Instrument pretest were used as the independent variable and the grouping was the dependent variable.

There were no outliers in the data, as assessed by inspection of a boxplot. Since the sample size was small ($N = 27$), a Shapiro-Wilk's test was performed to test for

normality. The Perceived Learning raw score was normally distributed for the experimental and control groups, as assessed by Shapiro-Wilk's test ($p > .05$). There was homogeneity of variances for SCCI raw pretest scores for the experimental and control groups, as assessed by Levene's Test for Equality of Variances ($p = .54$). The results of the independent *t*-test were found to not be statistically significant $t(25) = -1.47$, $p = .16$ between the experimental group ($M = 26.86$, $SD = 2.00$, $n = 14$) and the control group ($M = 28.08$, $SD = 2.33$, $n = 13$), indicating that there was no significant differences between the groups for the Perceived Learning raw test scores (Table 6). Cohen's D was calculated at 0.66, indicating a medium effect size (Cohen, 1988). The mean difference in the Perceived Learning raw score was -1.22, which asserts that the researcher can be 95% confident that the true mean difference lies somewhere between -2.93 and .50. Because there was no significant difference in the Perceived Learning raw scores, the assumption was made that the groups were similar and the researcher did not use the pretest scores as a covariate.

Table 6

Means, Standard Deviations, and t-test (Pretest Perceived Learning Instrument)

Group	*n*	*M*	*SD*	*t*	Sig.
				-1.47	.16
Experimental	14	26.86	2.00		
Control	13	28.08	2.33		

Note. $p < .05$, two-tailed

Since there was no significant difference found in the pretest raw scores, the pretest measures were not considered as a covariate (Howell, 2008), therefore an independent *t*-

test was performed on the posttest data. Initial analyses, using IBM SPSS software (Version 21), were conducted to assess the assumptions of the *t*-test. The raw scores for the Perceived Learning posttest were used as the independent variable and the grouping was the dependent variable. There were no outliers in the data, as assessed by inspection of a boxplot. Since the sample size was small ($N = 27$), a Shapiro-Wilk's test was performed to test for normality. SCCI raw score was normally distributed for the experimental and control groups, as assessed by Shapiro-Wilk's test ($p > .05$).

Homogeneity of variances was violated, as assessed by Levene's Test for Equality of Variances ($p = .01$), so separate variances and the Welch-Satterthwaite correction were used. The results of the independent *t*-test were found to not be statistically significant $t(25) = -1.787$, $p = .09$ between the experimental group ($M = 29.07$, $SD = 1.27$, $n = 14$) and the control group ($M = 30.54$, $SD = 2.70$, $n = 13$), indicating that there were no significant differences between the groups for the SCCI raw test scores (Table 7). Cohen's D was calculated at 0.70, indicating a medium effect size. The mean difference in SCCI raw score was –1.47, which asserts that the researcher can be 95% confident that the true mean difference lies somewhere between -3.20 and .27.

Table 7

Means, Standard Deviations, and t-tests (Posttest Perceived Learning Instrument)

Group	*n*	*M*	*SD*	*t*	Sig.
				-1.83	.09
Experimental	14	29.07	1.27		
Control	13	30.54	2.70		

Note. $p < .05$, two-tailed

The results of the *t*-test indicated that there was no statistically significant difference between the Perceived Learning posttest raw scores from students who participated in reflective discourse in the social networking site Edmodo and the students who participated in reflective discourse in the face-to-face classroom. Since there was no statistically significant difference found, the researcher failed to reject the null hypothesis for Research Question Two.

Summary of Results

The purpose of this quasi-experimental nonequivalent control-group research study was to examine the effect of the use of an educational social networking site, Edmodo, on sense of community and perceived learning in two middle school, Algebra I classes. The total raw scores for two test constructs, Sense of Classroom Community and Perceived Learning Instrument, were the dependent variables. Student participants were separated into two subgroups. Students in the experimental group utilized reflective discourse in Edmodo, while students in the control group utilized reflective discourse in the face-to-face classroom. A pretest and posttest were administered for both test constructs to determine if the use of Edmodo had any effects on the two subgroups in relation to sense of community and perceived learning.

The pretest and posttest raw scores were entered into IBM SPSS software (Version 21) and analyzed through independent *t* -testing (pre and posttest). Each statistical test was used to compare the experimental group to the control group. An initial independent *t*-test was administered for the Sense of Classroom Community Index (SCCI, Rovai, 2002) to determine if the two subgroups were similar. There was no significant difference in the SCCI raw scores, therefore the assumption was made that the

groups were similar and the researcher did not use the pretest scores as a covariate. Posttest raw scores were also analyzed using an independent *t*-test. It was determined through analysis that there were no statistically significant differences between students using Edmodo for reflective discourse and students who completed the same reflective discourse in the face-to-face classroom. This was also the case for the pre- and posttest results for the Perceived Learning Instrument (Halic, Lee, Paulus , & Spence, 2010) raw scores, which followed the same analysis procedures. From the results of the analysis, both null hypotheses for Research Question One and Research Question Two were accepted.

Chapter Five provides a more detailed discussion of the results and implications in relation to the literature and theoretical frameworks. It also includes an outline of the research study limitations, methodological and practical implications, and recommendations for further research.

CHAPTER FIVE: DISCUSSION

The purpose of this chapter is to review and discuss the results of this quasi-experimental quantitative study. The chapter consists of the following five sections: a summary of the findings, a discussion of the findings, implications in light of the relevant literature and theory, study limitations, methodological and practical implications, and recommendations for future research.

Statement of the Problem

The Internet and social networking has experienced an exponential growth over the past few years. Today's students are immersed in the digital world as "Tweets", text messages, and chatting are major forms of communication. Research has shown that daily exposure to these Web 2.0 technologies can alter brain cell functions while impeding social interactions skills and sense of community (Small & Vorgan, 2008). Communication is a focus in both the National Mathematics Principles and Standards (NCTM, 2010) and the Common Core State Standards adopted currently by 46 states in the nation. CCSSI Standard Three for Mathematical Practice "Construct viable arguments and critique the reasoning of others" (CCSSI, 2012, p. 9), specifically addresses communication. This standard states that mathematically proficient students should be proficient in constructing viable arguments and critiquing the reasoning of others. They should also be able to make conjectures and communicate their justifications to peers.

With the growth of available technologies that appear to be advancing cognitive skills of today's youth (Small & Vorgan, 2008), and the focus on communication by national standards, an interest in the pedagogical benefits of using Web 2.0 technologies

in education has increased. Research-based programs for the K-12 level need to be developed that take advantage of the influx of Web 2.0 technologies in conjunction with the requirements of national mathematical standards; however, there is little research available in this area. The effect of mathematical reflective discourse in a social network educational site was the focus of this study.

Summary of the Findings

Research Question One

The purpose of Research Question One was to examine students' sense of community as a result of reflective discourse in the educational social networking site Edmodo, and determine if there were any significant differences in SCCI (Rovai, 2002) between raw scale scores of students in the experimental and control groups. The sample consisted of 27 Algebra I students (experimental group = 14; control group = 13) chosen from one middle school in the Central Florida area. Students in both the experimental and control groups completed the SCCI pretest (Rovai, 2002). During the following four weeks, the students participated in class as usual, utilizing lessons that focused on tough to teach and learn algebra concepts (Dick & Burrill, 2009). In addition to classroom instruction, the experimental group participants were required to post an original response to discussion board prompts, and reply to at least two other classmates twice a week in Edmodo. At the end of the four weeks, both the experimental and control groups completed the SCCI posttest (Rovai, 2002).

An independent *t*-test was conducted on the SCCI pretest scores. The results of the test ($p = .21$) indicated that there were no initial differences existing between the groups, therefore the SCCI pretest raw scores were not used as a covariate in the posttest

analysis (Howell, 2008). A separate *t*-test was performed with the SCCI posttest scores. The results of the *t*-test showed no significant difference ($p = .39$) in sense of classroom community between students in the experimental and control groups, therefore the researcher failed to rejected the null hypotheses for Research Question One.

Research Question Two

The purpose of Research Question Two was to examine students' perceived learning as a result of reflective discourse in the educational social networking site Edmodo, and determine if there was a significant difference in Perceived Learning Instrument (Halic, Lee, Paulus, & Spence, 2010) raw scale scores of students in the experimental and control groups. The sample consisted of the same 27 Algebra I students (experimental group = 14; control group = 13) used for Research Question One. Students in both the experimental and control groups completed the Perceived Learning Instrument pretest (Halic et al., 2010). The students completed the same tasks in the four-week period as for Research Question One. At the end of the four weeks, both the experimental and control groups completed the Perceived Learning Instrument posttest (Halic et al., 2010).

An independent *t*-test was conducted on the Perceived Learning Instrument posttest scores. The results of the test ($p = .16$) indicated that there were no initial differences existing between the groups, therefore the Perceived Learning Instrument pretest raw scores were not used as a covariate in the posttest analysis (Howell, 2008). A separate *t*-test was performed with the Perceived Learning posttest scores. The results of the *t*-test showed no significant differences ($p = .08$) in perceived learning between

students in the experimental and control groups, and the researcher failed to reject the null hypothesis for Research Question Two.

Discussion of the Findings

Research Question One

There was no significant difference found for sense of community between the experimental and control groups. This finding is consistent with a similar study examining sense of community and academic achievement (Wighting, Nisbet, & Spaulding, 2009). Wighting et al., conducted a small-scale correlation study ($N = 150$) to examine the relationship between sense of community and academic achievement among high school students at three independent settings. The independent variable of sense of community was measured using Classroom and School Community Inventory (CSCI) developed by Wighting in a previous research study (2006). Academic achievement was measured using the PSAT/NMSQT test. Correlational analyses were conducted to determine relationships between PSAT scores and total CSCI scores among the students at the three different schools. The results indicated no significant difference, but did indicate positive to moderate correlations between sense of community and academic achievement among all three schools. A one-way multivariate analysis of variance (MANOVA) was conducted on the effects of gender in relation to the test constructs. This analysis also indicated no significant difference, but did reveal higher sense of community scores for females. The researchers reported that they were unable to draw any conclusions about particular differences based on insufficient data; however, the findings warrant consideration in order to improve future learning.

The current study's findings are also similar to another study involving students at the post-secondary level using the SCCI. Hung and Yuen (2010) conducted a study to investigate how social networking can be used as an educational tool to enhance students' sense of community. Their research focused on university students' views of inclusion of social networking sites to the face-to-face classroom, and their perceived sense of community while using SNS technology. The mixed method study included 67 students enrolled in face-to-face classrooms at two universities in Taiwan during the spring of 2009. An electronic survey was sent to the participants to collect primary data seeking to understand how the classroom community was supported by social networking. A second instrument included three open-ended questions to collect student feedback addressing the design of the course, and the Sense of Classroom Community Index (Rovai, 2002) was used to assess student sense of community. The results of the study were descriptive, and indicated that students responded positively to supplementing face-to-face instruction with social networking technology, thus the authors concluded this practice benefited student sense of classroom community. Although the results of the study were positive, the authors indicated a need for researchers to continue investigating social media integration on a larger scale.

The current study was unique in the respect that it was completed with participants from the middle school level and in the content area of mathematics. To the best of the researcher's knowledge and according to Rovai (Appendix B), this was the first time that the SCCI was used in the middle school setting to measure students' sense of community. The survey instrument used and data collected from this study, can serve as a baseline for future studies just as Wighting, Nisbet, and Spaulding's (2009) study on

high school students' sense of community and academic achievement. Results from the current study, and the lack of empirical research in the literature, support the need to explore the use of social networking in the mathematics classroom as a way to expand classroom sense of community.

Research Question Two

There was no significant difference found for perceived learning between the experimental and control groups. This finding is similar to those found in the research of Judson (2009), who investigated links between gains in technology literacy and reading, mathematics, and language arts academic achievement. Judson (2009) conducted research with a sample of fifth-and eighth-grade students utilizing the TechLiteracy Assessments and TerraNova test scores. ANOVA tests showed no significant difference in mathematics; however, there was a correlation between improved technology literacy and academic achievement in the content area of language arts. Judson attributed the correlation to the writing objectives in language arts content and the high use of word processing programs.

Results of the current study also supported the research of Baturay (2011), who investigated the relationship between students' sense of community, perceived cognitive learning, and satisfaction in an e-learning classroom. The study consisted of 88 participants enrolled in an undergraduate language course in Turkey. Data to address perceived learning were collected using CAP Perceived Learning Scale developed by Rovai, Wighting, Baker, and Grooms (2009), and were analyzed using a standard multiple regression to evaluate cognitive learning and course satisfaction. There was no

statistical significance found, $t(88) = 1.46$, $p = 0.15$. Baturay implicated limitations that could have possibly contributed to the findings included setting and sample size.

Results from the current study show inconsistencies with other research findings. Rovai (2002) conducted a study on the relationship between students' sense of community and perceived learning. The study consisted of 302 participants enrolled in 26 online classes at a private university in Virginia. Data for perceived learning were collected using a self-reported measure and analyzed through correlational procedures. The correlation between sense of community and perceived learning was found significant at the .01 level. The results indicated that students with a stronger sense of community showed tendencies of greater perceived learning.

Although text from the discussion board postings were not analyzed, the researcher noted comments similar to those found in previous research relating to perceived learning. Walker and Arnold (2004) evaluated students' perceptions of asynchronous postings in blended undergraduate economics course, and found that 67% of participants perceived the online experiences enriched their personal learning. Wang (2004) also found that students who participated in online discussion showed increased academic achievement over students who did not participate online.

The findings for each research question from the current study confirm results from other studies in the literature (Baturay, 2009; Hung &Yuen, 2010; Judson, 2009; Wighting, Nisbet, & Spaulding, 2009), and counter those found by Rovai (2002); therefore, there is no conclusive evidence for or against utilizing Edmodo as a way to increase sense of community and perceived learning for the middle school Algebra I student. Results from this study, expressed limitations in the few available studies found

in the literature, and the overall lack of other empirical research support the need to explore the use of social networking in the middle school mathematics classroom as a way to expand sense of community and perceived learning, and also as a way to engage and motivate students.

Theoretical Implications

The current study addressed the learning theory of social constructivism and connectivism through social networking as applied to learning and knowledge acquisition. Social constructivism places emphasis on the social context of learning within the culture. According to Pettenati and Cigognini (2007), connectivism works on the premise that the "the pipe is more important than the content of within the pipe" (p. 44). The "pipe," or what is considered the culture in the social constructivism perspective in this research study took place through discussions. The discussions in which the experimental and control groups participated, enabled conditions that should be occurring during the learning process as indicated by Pettenati and Cigognini's Model for Effective Learning Experiences (2007). The participants discussed topics that were relevant to their current learning situations, and were able to communicate their thinking both orally (face-to-face) and in written word (Edmodo) through connection, forming, selecting and filtering. Several advantages that the experimental group had over the control group were that they could refer back to the written word of discussion posts and replies through Edmodo (the pipe), providing for reflection and metacognition. The students in this group were thus able to spend time thinking about their responses prior to submitting them. Another advantage is that the social networking environment provided a safe place for students to be more involved in the discussions and contribute more

frequently. Although the results of the current study were not found to be significant, evidence showed that levels of perceived learning did increase from pretest to posttest scores, indicating some growth in perceived learning.

The discussions both groups participated in supported the NCTM Principles and Standards' and the Common Core State Standards' emphasis on mathematical discourse and reflective practices. As a focus of this study, the social networking environment (Edmodo) showed evidence of an environment that channeled informal learning, promoted critical thinking in learners (Selwyn, 2008), and provided ways to communicate mathematical ideas socially. It extended the constructs of Dewey (1933) and Kolb's Learning cycle by creating conditions for reflection, including time and space, and a supportive curriculum and environment. The initial discussion topics asked the right kinds of questions, challenged learners to incorporate previous learning, and required some type of evaluation (Moon, 1999) in the form of replies to classmates. The discussions and replies also provided students with opportunities to construct arguments, make and explore conjectures, justify, and communicate findings with others as addressed in Standard Three for Mathematical Practices (CCSSI, 2011).

Practical Implications

The results of this study may help educators at the middle school level determine if social networking is a Web 2.0 tool to utilize in order to increase students' sense of community and perceived learning. The educational social networking site Edmodo is designed as a learning management system (LMS), and has features other than discussions. Although the discussions could be used as formative or summative assessments, Edmodo has the capability of providing quizzes and assigning individuals to

small groups as well. The small groups can be used for collaboration, and these groups can be organized based on levels of SCCI and Perceived Learning scores. Edmodo is not content specific, therefore it can be used in all subject areas. For the Algebra I course, Edmodo can be utilized as a way to monitor collaboration on problem solving tasks, and as a way for students to communicate their mathematical thinking especially with the tough to teach and learn algebra concepts (Dick & Burrill, 2009).

The use of SNS in the middle school holds promise for increasing students' sense of community and perceived learning. Since the district used for this study supported the use of Edmodo, privacy and information security were not an issue; however, this would be something other districts would need to consider in planning. Another issue to consider is the fact that using social networking can be time intensive, as teachers will spend more time outside of the regular classroom day immersed in the social networking community posting threads, replying to students, assigning work, and updating the planner. Web 2.0 technology integrations coupled with pedagogy need to be in place as well. Without an organized plan for management and maintenance purposes, the use of the SNS will not be effective. A final issue to contend with is student accountability for completing assigned tasks within the SNS. The participating researcher observed that several students failed to post or reply on a bi-weekly basis. This could be due to students not receiving a grade for posting, and there was no extrinsic motivation. Educators utilizing SNS in their curriculum need to plan how tasks completed in the SNS will be graded, if at all. The results of this research can serve as a basis for planning, development, and implementation; however, more empirical evidence is needed.

Limitations

A major limitation of this study was the size of the sample. The sample was relatively small, including only two sections of Algebra I courses. The study also has limited generalizability due to the sample being selected from an accessible population at the middle school where the researcher worked. This research study was limited to the students who voluntarily agreed to participate and returned signed informed consent forms. From the available population of 48 students, 29 returned parental consent forms, and only 27 students completed both the SCCI and Perceived Learning pre and posttest survey instruments. Since the sample size was relatively small, mortality was a potential threat to internal validity; however, only two students dropped from the study for undisclosed reasons. Convenience sampling was also used because it was not feasible to schedule students in course sections based on random assignment. There are many factors that are involved in the scheduling of students, including mathematics levels and elective courses that would prohibit random assignment. Random assignment is also against policy in the district in which this study took place.

Nonequivalent group designs are highly susceptible to internal validity threats in participant selection due to non-randomized design. Two such threats specific to this study were selection bias and social validity. To control selection bias, the two groups were made as equivalent as possible. This was accomplished by examining the measures on previous seventh-grade FCAT mathematics scores to determine whether the two groups were similar, and confirming the school-based placement practice of homogenous grouping. The researcher also used pretest measures to help control the selection bias. To minimize social threats, the sample came from two different course sections so that

the participants were isolated and not aware of each other's activities. Also, participants were required to use fictitious names while in the SNS so they were unaware of each other's identities.

Although both pre and posttest instruments, SCCI (Rovai, 2002) and the Perceived Learning Instrument (Halic, Lee, Paulus, & Spence, 2010), are considered valid and reliable, participants completed them outside of instructional time and the classroom environment as per district permission conditions. Since the nature of each survey instrument is a self-reported measure, the individual responses should be considered a threat to internal validity as they leave open claims to truthfulness. The assumption was made that the participants respond to all measures to the best of their abilities and with integrity; however, since several participants were former students of the researcher, they may have responded to the questions based on how they may have thought the researcher would have wanted them to respond. A threat to external validity based on the survey instruments is pretest sensitization, as only one form of each construct was used for both pre and posttests. According to Rovai (2002), a time frame of two weeks between tests is acceptable for maintaining validity. The duration of this study was four weeks, which was well above the acceptable level.

A final threat to internal validity was researcher bias. To reduce researcher bias, the participating instructor introduced the study and disseminated all consent forms. The researcher had no interaction with the participants for the duration of the study, with the exception of monitoring the SNS for appropriate discourse, nor did she try to influence their participation.

Recommendations for Further Research

Based on the limitations of this study, the researcher recommends replicating the study with a larger sample size, and obtaining the sample from several middle schools, providing for a more diverse setting and generalization. This recommendation concurs with other studies dealing with small sample sizes (Baturay, 2009; Hung &Yuen, 2010; Judson, 2009; Wighting, Nisbet, & Spaulding, 2009). In addition to increasing the sample size, the researcher recommends lengthening the duration of the study from a four-week period to a complete school year. This study was conducted from January 7, 2013 through February 5, 2013 and only included two Algebra I instructional units. Lengthening the study would encompass all tough to teach/learn algebra concepts (Dick & Burrill, 2009), and End of Course exams could be used as a test construct. Lengthening the duration of the study would also eliminate the possibility of pretest sensitization.

Future studies could investigate additional constructs. Since previous studies reported gender differences with sense of community and perceived learning among high school and post-secondary level students (Baturay, 2009; Wighting, Nisbet, & Spaulding, 2009), the researcher recommends that future studies investigate gender differences at the middle school level. Future studies could employ quantitative approaches but focus on constructs related to those investigated in the present study. For example, a correlational study to investigate if the level of sense of community correlates with academic achievement or a content analysis could be conducted on the number and quality of posts/replies in discussion boards as a predictor of perceived learning. Additionally,

qualitative studies such as a case study to investigate students' perceptions of using SNS as an instructional tool should be conducted.

Finally, many teachers recognize the importance of technology integration; however, there are several factors impeding pedagogy that employs Web 2.0 technology. These factors may include teachers' confidence levels, access to technology, and application (Kimber, Pillay, & Richards, 2002). Future studies on Web 2.0 technologies should investigate the reasons for and elements of these impediments in order to assist educators in making sound research-based decisions on technology integration.

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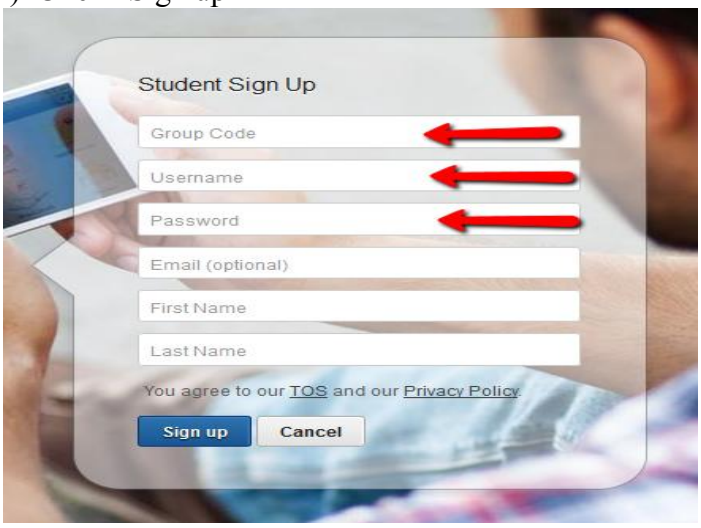
APPENDIX A

STUDENT EXPERIMENTAL GROUP INSTRUCTION SHEET

Dear Student.
Thank you for agreeing to participate in my study. I appreciate your help and without it my research would not be possible. If you do not have a computer at home, or no Internet, please see me or Mrs. XXXX for a pass to the Media Center.
Please complete the following two tasks by the end of the week (January 12, 2013):
1) Create a new account in Edmodo using an appropriate fictitious name. (If you already have an account DO NOT USE this account)

a.) Go to Edmodo.com.
b) Click "I'm a Student"
c) Complete the first three lines (see below). For Group Code use: **r8gd6s**. Remember to use an appropriate fictitious name, and a password you will remember. For example: Username: Turtle317 Password: Math 317
d) Do not include your email.
e) Your first and last name will be your username.
f) Click "Sign up"



2) Your first assignment is to complete the two survey links found in the Edmodo classroom. This surveys will take you approximately 15-20 minutes to complete.

For the next four weeks you will complete two discussion posts per week (Mondays and Wednesdays) and reply back to at least two classmates for each discussion (Tuesday for the first discussion and Thursday for the second). It is important that you post and reply by the stated due dates. The original post must be at least two complete sentences, and the replies need to be **appropriate and helpful**. Try to think of a question to ask your classmates to extend the discussions. Please also try not to leave anyone out of the discussions (if you see someone with no reply – respond to their post).

Example:

Explain how you would graph the equation y=3x – 2

Original post: Turtle317: I would first graph the point (0, -2) since this is the y-intercept. From this point I would go over three and up one to get to the next point on the line. Then I would connect the two points extending the line in both directions.

Reply: Rabbit 42: Hi, Turtle. I agree with you that you first need to graph the y-intercept, but remember that slope is rise over run. You would have to go up 3 and over 1 to the right. Try this and see what you get for the line. Since the slope is positive, what direction would the line go?

During the four weeks, you may also be asked to complete polls or online quizzes (for practice only). If you find a video or game that helps explain/practice the concepts you are learning in class, please feel free to post them in the Edmodo classroom. If there is something you would like Mrs. XXX or me to post, do not hesitate to ask/post in Edmodo. We will both be in Edmodo monitoring the discussions daily.
I am looking forward to your interactions in our virtual classroom.
Mrs. Allanson

APPENDIX B

Author's Correspondence for SCCI Instrument

On October 24, 2012 5:21:10 PM PDT, Patricia Bolton Allanson wrote:

Hi,
My name is Patricia Allanson and I am a doctoral student at Liberty University. I am currently conducting research on sense of community with the middle school mathematics student and would like to use your Sense of Classroom Community Index. To do so, I would like to make one adaption which is to change the word course to class as I feel middle school students would be more familiar with the choice of word even though they are synonymous. Also, since the index was used initially for "higher education", do you feel it would be appropriate to use with adolescents? Thank you so much for your time and consideration.
Patricia Allanson
On October 24, 2012 5:55:52 PM PDT, Alfred Rovai wrote:

Hi Patricia,

Yes, you may use the instrument as you describe and make the one word change. Although I've not used the instrument in a K-12 population, I know some researchers have done so. Mervin Wighting is a colleague at Regent University who has done so and published his work.

Best wishes,

Fred Rovai

APPENDIX C

Author's Correspondence for Perceived Learning Instrument

Sure, you can use the instrument. It can be used with other age groups as long as students have been exposed to blog discussions in connection with a course (And in our context the blog discussions were part of the class requirements). We have described the validation of the instrument in the article, in section 5.1. Factor analysis, page 209. and the reliability in the next section. All analyses were performed in SPSS.
Regarding the implementation, we set it up as an online survey but it can work on paper, too. The responses are on a 5-point scale; if I remember correctly, we used 5 for "strongly agree" to 1 for "strongly disagree".

I hope this helps. Good luck with your research!

Olivia Halic

From: Patricia Allanson
Sent: Wednesday, October 24, 2012 8:33 PM
To: Halic, Olivia Laura; Lee, David Elwood; Paulus, Trena M; Spence, Marsha Lynn
Subject: Permission to use survey instrument

Hi,
My name is Patricia Allanson and I am a doctoral student at Liberty University. I am currently conducting research on and perceived learning with the middle school mathematics student and would like to use your survey instrument from your 2010 research (the Perceived learning items 1-7). To do so, I would need your permission. I would like to make one adaption which is to include the word discussion with blog (i. e. blog discussion)as I feel middle school students would be more familiar with the choice of words even though they are synonymous. Also, since the instrument was used initially for "higher education", do you feel it would be appropriate to use with adolescents? Do you have specific instructions to implement and score the survey?
Thank you so much for your time and consideration.
Patricia Allanson

APPENDIX D

SCHOOL DISTRICT APPROVAL LETTER

December 13, 2012

Dear Ms. Allanson

I have received your request to conduct research within xxxxxxx County Schools and approved your topic of "Social Mathworking: The effects of online reflection on Algebra 1 students' sense of community and perceived learning."

As with all requests to do research; participation is at the sole discretion of the principals, teachers, and parents of all students involved. Parent Consent Forms will be necessary for all data gathered from the students of xxxxxxxx County Schools.

By copy of this letter, you may contact the school principals who all this research to conducted with their faculty and students. As your request indicated, no instructional time will be used to complete the study's pre- and posttests.

I would appreciate receiving a copy of your findings upon completion of the study.

Sincerely,

Xxxxx xxxxxxxx
Deputy Superintendent, Instructional Services

APPENDIX E

PRINCIPAL APPROVAL LETTER

November 7, 2012

To: IRB Committee, Liberty University

From: xxxxxxxxxxx, Principal

Re: Research study by Patricia Allanson

This letter grants Patricia Allanson, a Doctoral candidate at Liberty University, permission to conduct a study on the impact of using a social networking system on 8th grade Algebra I students at xxxxxxxxxxxx Middle School. I understand that the purpose of this study is to explore social networking as an instruction tool for students, and that the research will have minimal risks associated with it
I am confident that Mrs. Patricia Allanson will conduct herself, in regards to her study, in a professional manner, and collect and handle any data as deemed appropriate by IRB standards.

Sincerely,

Xxxxxxxxxxx, Principal

APPENDIX F

LIBERTY UNIVERSITY IRB APPROVAL LETTER

January 7, 2013

Patricia Elizabeth Allanson
IRB Approval 1496.010713: Social Mathworking: The Effects of Online Reflection on Algebra I Students' Sense of Community and Perceived Learning

Dear Patricia,

We are pleased to inform you that your above study has been approved by the Liberty IRB. This approval is extended to you for one year. If data collection proceeds past one year, or if you make changes in the methodology as it pertains to human subjects, you must submit an appropriate update form to the IRB. The forms for these cases were attached to your approval email.

Thank you for your cooperation with the IRB, and we wish you well with your research project.

Sincerely,

Fernando Garzon, Psy.D.
Professor, IRB Chair
Counseling (434) 592-4054

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APPENDIX G

RECRUITMENT SCRIPT

Mrs. Allanson is a graduate student at Liberty University working on her doctorate degree. As part of her coursework, she is conducting a study to see if online reflections (through Edmodo) affects students' sense of community and levels of perceived learning in Algebra 1, and she would like to use information from my class. During the next four weeks, you will be asked to complete lesson activities; two electronic surveys; and participate in reflective discussions in class or Edmodo. If you choose to participate, your completed work will be used to collect group data. If you choose not to participate, your information will not be used nor affect your grade in this class.

There are no anticipated risks involved, nor will you receive any extra credit or a grade for participating. Participation in this study is voluntary. You will not have to answer any questions you do not want to answer. Also, you may withdraw your participation at anytime with no questions asked. Would you like to participate?

APPENDIX H

CHILD ASSENT FORM

Assent of Child to Participate in a Research Study

What is the name of the study and who is doing the study?
Social Mathworking: The Effects of Online Reflection on Algebra I Students' Sense of Community and Perceived Learning by Patricia E. Allanson, Liberty University

Why are we doing this study?
Mrs. Allanson is interested in studying if online reflections (through the social network site Edmodo) affect students' sense of community and levels of learning in Algebra 1, and she would like to use information from our class.

Why are we asking you to be in this study?
You are being asked to be in this research study because you are currently enrolled in Algebra I.

If you agree, what will happen?
If you are in this study you will be asked to complete lesson activities, individual surveys, and participate in reflective discussions in class or via in Edmodo. If you choose not to participate, your information will not be used nor affect your grade in this class. You will not receive any extra credit or a grade for participating.

Do you have to be in this study?
No, you do not have to be in this study. If you want to be in this study, then tell the researcher. If you don't want to, it's OK to say no. The researcher will not be angry. You can say yes now and change your mind later. It's up to you.

Do you have any questions?
You can ask questions any time. You can ask now. You can ask later. You can talk to the researcher. If you do not understand something, please ask the researcher to explain it to you again.

Signing your name below means that you want to be in the study.

_____ _____

Signature of Child Date

Patricia Allanson, Principal Investigator
email at xxxx@xxxxxx

Dr. Ackerman, Faculty Advisor
email at xxxxxx@xxxxxx

Liberty University Institutional Review Board,
Dr. Fernando Garzon, Chair,
1971 University Blvd, Suite 1837, Lynchburg, VA 24502
or email at fgarzon@liberty.edu.

APPENDIX I

PARENT/STUDENT CONSENT FORM

Social Mathworking: The Effects of Online Reflection on Algebra I Students' Sense of Community and Perceived Learning

Patricia E. Allanson
Liberty University
Education Department

Your child has been invited to be in a research study of Edmodo, an educational social networking site, as an instructional tool in the middle school mathematics classroom. They were selected because he/she is currently enrolled in an Algebra I course. I ask that you and your child read this form and ask any questions you may have before agreeing to be in the study.

Prior to the commencement of this study, the students will be asked if they have an Edmodo account. Those students who do not have an account will be asked if they wish to open one in order to participate in the activities. Those who do not wish to open up an account will not be able to participate in the study. Please decline participation in this study if you do not wish for your child to open up an Edmodo account.

This study is being conducted by: Patricia E. Allanson, Liberty University

Background Information:

The purpose of this study is: to assess social and academic effects of online reflections (through an educational based social network site - Edmodo) when used in Algebra I courses.

Procedures:

If you agree to have your child participate in this study, I will ask your child to do the following things: Complete two electronic surveys (one at the beginning of the study, and another at the end) which asks questions about their feelings toward the classroom environment and their discussions about mathematics. Each survey will take approximately 15-20 minutes to complete. Your child will also be asked to participate in mathematical discussion in class, or online, weekly assigned by your child's classroom teachers for a period of four weeks. Online discussions will require an initial post and at least two replies to classmates. Time spent on online discussions will vary depending on your child's thoughts and responses. Regular classroom instruction will not be impacted due to this study.

Risks and Benefits of being in the Study:

With young participants, there is always the risk that they may say, or in the case of this study, write inappropriate comments. To minimize this risk, the instructors involved in this research will create an environment where such comments are deemed unacceptable. The instructors will model acceptable communication in both verbal and written formats. The Principal Investigator will have the ability to remove unacceptable comments from the social networking site.

The benefits to participation are: learning how to appropriately communicate effectively with peers from both a social and academic perspective.

Compensation:

Participating in the study will have no impact on student grades. Students will not receive any grades, compensation, or extra credit, for participating in the study, nor will any student be penalized for choosing not to participate.

Confidentiality:

The records of this study will be kept private. In any sort of report we might publish, we will not include any information that will make it possible to identify a subject. Research records will be stored securely and only researchers will have access to the records.
All data will be collected and secured through locked electronic files accessible by only the principal investigator, and hard copies (i.e. consent forms) will be secured in a locked file cabinet. The electronic surveys will be set up so that students will not be able to include names or any other identifying information. In addition, when students enroll in the social networking site, they will be required to use a fictitious name to mask identity. In this case, only the student his/herself will know their own identification and log in information. Records will be destroyed electronically, or shredded, after the required three-year data preservation period.

Voluntary Nature of the Study:

Participation in this study is voluntary. Your decision whether or not to participate will not affect your current or future relations with Liberty University or with Volusia County Schools. If you decide to participate, you are free to not answer any question or withdraw at any time without affecting those relationships.

Contacts and Questions:

The researcher conducting this study is Patricia E. Allanson. You may ask any questions you have now. If you have questions later, **you are encouraged** to contact her at xxxxxxx Middle School, xxx-xxx-xxxx, peallans@xxxxxxxxx, or her Dissertation Chair, Dr. Beth Ackerman at xxxxxxxx@xxxxxx.

If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher(s), **you are encouraged** to contact the Institutional Review Board, Dr. Fernando Garzon, Chair, 1971 University Blvd, Suite 1837, Lynchburg, VA 24515 or email at fgarzon@liberty.edu.

You will be given a copy of this information to keep for your records.

Statement of Consent:

I have read and understood the above information. I have asked questions and have received answers. I consent to participate in the study.

Parent or guardian Signature: _____ Date: _____

Signature of student: _____ Date: _____

Signature of Investigator:_____ Date: _____

APPENDIX J

DISCUSSION BOARD POSTS

Discussion Board Post #1

A system of equations is a set, or pair of equations with two variables. When we graph the equations, we are looking for a point of intersection, which is also called a solution of the system. The solution (ordered pair) will make both equations true.

Solve the system graphically:

$-2x + y = 1$
$3x + y = 1$

To solve this graphically write each equation in y-intercept form. Then graph each by plotting the y intercept and slope.

$y = 2x + 1$ (the y intercept is 0, 1 and the slope is 2 – or up 2 over 1)
$y = -3x + 1$ (the y intercept is 0, 1 and the slope is -3 – or down 3 over 1)

What is the solution? (Or point of intersection). How do you know? Make sure to check the solution.
Would there every be a time when solving a system by graphing would not be easy to use? If so, in what circumstances?

Discussion Board Post #2

Many times when we solve a system graphically, we are working with fractions, which can be difficult to determine an accurate solution. The substitution method comes to our rescue allowing us to solve algebraically.

First solve for one-variable in either equation. It doesn't matter which one – you will get the same result regardless. I always choose the easiest equation with the least amount of steps.

Let's look at the following example:

$2y + x = 1$
$y - 2x = 8$ * I chose this one because all you have to do is add 2 to both sides

$y = 2x + 8$

Now replace $2x + 8$ into the other equation for y and then solve for x

$2y + x = 1$
$2(2x + 8) + x = 1$
$4x + 16 + x = 1$
$5x + 16 = 1$
$-16 \quad -16$
$\frac{5x}{5} = \frac{-15}{5}$

$X = -3$

Last, substitute -3 for x in either equation, and solve for y.

$y - 2x = 8$
$y-2(-3)=8$
$y +6 = 8$
$-6 \quad -6$

$y = 2$ The solution is (-3, 2)

When using the substitution method, what is the solution for the system?

$8x + 5y = 184$
$x - y = -3$

Discussion Board Post #3

The elimination method is another way to solve systems of equations algebraically. The whole point of this method is to eliminate on of the variables using the addition principle (-2x and 2x would result in 0x or just zero).

$5x + 3y = 17$ Since 5x and -5x are opposites, they will eliminate.
$-5x + 2y = 3$ Add the two equation using the addition principle.
$5y = 20$ Solve for y
$5 \quad 5$

$y = 4$

Next, substitute 4 for y in either equation and solve for x:

$-5x + 2(4) = 3$
$-5x + 8 = 3$
$-8 \quad -8$
$\frac{-5x}{-5} = \frac{-5}{-5}$

x = 1 The solution is (1,4)

What is the solution for the system? Use the elimination method and explain your thinking.

$$-3a + 2b = 0$$
$$3a - 4b = -1$$

Discussion Board Post #4

Sometimes using the elimination method is not that simple and you have to do a little manipulating first.

For the system 2y +3x =12 and -4y +5x=-2, there are no variables that will eliminate, but if we multiply everything in the first equation by 2 we get 4y +6x=24. The y's will now eliminate. Solve for x, then y to obtain the solution.

$2(2y +3x) =2(12)$

$$4y +6x=24$$
$$\underline{-4y +5x=-2}$$
$$\frac{11x}{11}=\frac{22}{11}$$

$$X=2$$

To find y replace x with 2 in either equation

$$2y +3x =12$$
$$2y +3(2) =12$$
$$2y +6 =12$$
$$-6 \quad -6$$
$$\frac{2y}{2} = \frac{6}{2}$$

Y=3 The solution is (2,3)

Explain what you would need to do to eliminate a variable in the system:

$$3x + 2y = 3$$
$$9x-8y = -2$$

What would be the solution?

Discussion Board Post #5

You are probably asking yourself "When will I every use systems in the real world. Below is an application problem for your review similar to those found in the textbook. After many years of struggling with these types of problems (yes, I struggled), I finally figured them out and now they are my favorite ones to solve.

A sweatshirt shops sells college sweatshirts. Whites sell for $18.95 each and red sell for $19.50 each. Receipt for sale of 30 sweatshirt total $572.90, how many of each color did the shop sell. Let w = the number of the white sweatshirt sold. Let r = the number of red sweatshirt sold.

.

x= white
y = red

$x + y = 30$

$18.95x + 19.50y = 572.90$

$18.95x + 19.50y = 572.90$
$18.95x + 19.50(-x + 30) = 572.90$
$18.95x - 19.50x + 585.00 = 572.90$
$-.55x + 585.50 = 572.90$
$-.55x + 585.50-585.50 = 572.90-585.50$
$-.55x=-12.10$
$-55 \quad -55$

$x = 22$

$x + y = 30$
$22 + y=30$
$22-22 + y=30-22$
$y= 8$

There were 22 white t-shirts sold, and 8 red shirts sold.

Do you have an easier way to solve this problem?

Choose a problem from the text and solve in the discussion board. Make sure to include the page # and problem #.

Discussion Board Post #6

Inequalities, unlike equations, have many solutions that can make the sentence true. Therefore, we used set notation, and number line graphs to show all the possible solutions.

To graph x +(-32) > -17, we first isolated the variable on one side. The result is X >15 and written in set notation: {x|x> 15}. Any number greater than, but not including 15 would work.
The graph would be an open circle at 15 with the line shaded to the right.

Using the multiplication principle was a bit more difficult because if you were multiplying by a negative the inequality symbol had to be reversed.

Explain how to solve -5x + 3/4 < 15.2 , and what the graph of the solution set would look like.

Discussion Board Post #7

For the past several weeks we have studied all about systems of linear equations and graphing linear inequalities. What concepts did you find easiest? What concepts did you have the most difficulty with? What resources were most helpful (mini lessons, video posts, Websites)?

Optional Post – All participants
Please provide feedback on your thoughts about Edmodo as a tool in your learning. What did you like about Edmodo? What did you not like about Edmodo? What would you like to see Edmodo used for in your learning? (More of this, less of that).

APPENDIX K

Voluntary Discussion Board Posts by Participants

"I think Edmodo is useful because it lets us stay connected to each other!!!!!!!!!:-) "

"I liked the fact that students and teachers can comunicate outside of the classroom. It is another way for students to get help. I think that more teachers and students should get involved with edmodo."

" Edmodo helps students when they have nothing else to turn to. They can ask questions on Edmodo, just like if they were at school. Edmodo should be more about helping each other out."

"I like the fact that edmodo can help the whole education committee stay commutative with each other."

"Edmodo is a helpful resource I can turn to at any time and ask for help. I like the fact that I'm able to get help from people with any subject. I don't like that Edmodo can be used like Facebook. I believe that Edmodo should just be used for educational purposes and not as a social media network."

"I like having Edmodo as a back up, just in case I cant get a hold of someone on the phone to help. I like that we can communicate with our teachers through Edmodo as well. I think more students and teachers should use Edmodo. But, I don't like that its on the computer. Me personally, I don't like having tests on the computer and I am also at dance every night so I don't have time."

"The good thing about edmodo is that I get to communicate with my teachers so if i don't understand something i can just ask them on here. To me edmodo doesnt have anything i dont like. Although I would like to see more activities to practice fortest and that kind of stuff. Just to make sure iI understand the lesson we are working on."

" edmodo is useful because you can communicate with teachers so if you need clarification you can get it without just searching the web"

"I think that edmodo is very helpful. I wish that next year we could have one for every class because if I have trouble with homework or questions, there is always someone to turn to. I think it is very resourcful and helps people who might need more help on an assignment. I really like edmodo :)"