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EXAMINING PROSPECTIVE U.S. PRESERVICE SECONDARY MATHEMATICS TEACHERS' CONTRIBUTIONS TO AN ONLINE DISCUSSION BOARD OF A BLOGGING ACTIVITY

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Abstract: *This paper examines the themes that emerged from an analysis of preservice secondary mathematics teachers' contributions to an online blogging activity. The blog was conducted as a standard component of a college Euclidean Geometry course offered in a university in the western United States. Participant contributions to the blog were analyzed with MAXQDA, a qualitative data analysis program. About twenty major themes emerged in the online discussion. These themes demonstrate that the preservice mathematics teachers who participated in this study raised a variety of important and relevant issues that they may not have otherwise considered. Additionally, this study suggests that blogs could provide a great opportunity for students and classroom teachers to share their voices and perspectives on an open, free, and public forum.*

Keywords: Preservice teachers, blogging activity, Euclidean Geometry, online discussion, Web 2.0 technology

INTRODUCTION

Technology is one of the six principles stated in the U.S. National Council of Teachers of Mathematics (NCTM) Principles and Standards of School Mathematics. The NCTM (2000) Principles and Standards advocates for the appropriate and integrated use of technology in every aspect of mathematics education from what is taught in mathematics; how mathematics is taught and learned; and how mathematics is assessed (Powers & Blubaugh, 2005). Technology has been a powerful tool in the United States' mathematics classrooms for several decades. Although

many U.S. students excel in mathematics, as a whole, U.S. performance on international mathematics tests consistently remains between the second and third quartile (Leshner, 2009). The current progress in science, technology, and mathematics education in the U.S. is not satisfactory as evaluated by educators and legislators. There are wide disparities in mathematics achievement among various ethnic groups. Too many U.S. students and parents think that mathematics is a difficult and uninteresting subject. The result is that mathematics education in the U.S. is failing to instill students with sufficient skills and knowledge necessary to meet the century's challenging economy and leadership (Leshner, 2009).

Moreover, due to the high cost of purchased licenses and annual subscription fees of mathematics learning software and traditional web-based programs, many such programs are beyond the accessibility of students and teachers in underdeveloped countries as well as in many rural school districts in some developed countries (Sledge & Morehead, 2006). As a result, a large portion of students, teachers, and classrooms across the world, as well as in the U.S. cannot use mathematics software and web applications for teaching and learning purposes. Additionally, information technology use is not satisfactory in the mathematics education programs nationwide in the U.S. (Gunter, 2001; Kurz & Middleton, 2006). Studies show that many teacher education programs in the U.S. have not integrated technology appropriately (Mistretta, 2005; Watts-Taffe, Gwinn, Johnson, & Horn, 2003). The preparation of preservice teachers to use technology is one of the critical challenges teacher education programs face (Powers & Blubaugh, 2005). Many teacher education programs use the computer as a teacher-centered tool rather than as a student-centered tool (Wang, 2002). Without adequate knowledge, these teachers get little opportunity to integrate technology into their actual classrooms (Brush, Glazewski, & Hew, 2008).

Meanwhile, the advancement of Web 2.0 technologies and their access through laptop, netbook, iPad, iPhone, and handheld cellular devices has made a radical change in the lifestyles of young students in the U.S. and worldwide (Baker, Wentz, & Woods, 2010; Hodson, 2008). Research shows that young students spend more time with computer, Internet, and mobile phone use than any other age group, with most of that time spent on social network sites (Clark, Logan, Luckin, Mee, & Oliver, 2009; Lenhart & Madden, 2009; Selouani & Hamam, 2007). Text messaging, blogging, online discussion groups, social networking sites, and other Web 2.0 tools have become integral parts of their lives (Baker et al., 2010). These young students are arriving in high schools, colleges, and universities having multitasking operation skills in blogging, podcasting, tweeting, and other Web 2.0 applications.

Thus, there exists a possibility of using the interactive features of Web 2.0 technologies to motivate today's technologically advanced students to create and participate in many virtual platforms where they can enrich their mathematical knowledge and understanding by posting mathematical problems and quizzes; providing solutions to problems posted by others; and sharing their thinking in solving and creating mathematics problems. Such activities may change the lackluster attitudes toward learning mathematics held by many U. S. students who are more willing to spend their time on social networking sites than practicing mathematics. This may improve their performance in national and international mathematics assessments. More importantly, it might provide a way of learning and understanding mathematics for those teachers and students who cannot afford costly mathematical software.

The rapid growth of Web 2.0 technologies and their free access through computers and handheld mobile devices have potential to provide a new possible alternative means of improving the teaching and learning of mathematics. It is expected that the open, free, and easy accessibility of Web 2.0 technologies can meet the increasing demand of new generation students and teachers. The interactive features of Web 2.0 technologies can be utilized by mathematics students, teachers, and educators to develop many online platforms in which students can participate and contribute to developing and extending web-based mathematical repositories. The emergence of Web 2.0 technologies is receiving intense and growing interest across many sectors of the education industry for addressing the needs of today's diverse students (Alexander, 2006; Allen, 2008; Lee & Ge, 2010; McLoughlin & Lee, 2008). In the fields of law, business, communication, and politics users have been grappling with advanced features of Web 2.0 tools for at least several years (Lemley & Burnham, 2009). However, the use of Web 2.0-based activities has not been reached to the classroom as it is supposed to be.

As Web 2.0 tools allow users to create Web content from text based web pages and online journals to visual format, Web 2.0 could provide appropriate technologies to create multiuser virtual teaching-learning systems. Blogs are an easy to use application of Web 2.0 technologies (Maddux, Liu, & Johnson, 2008) that offer unlimited possibilities for building collaborative teaching and learning environments for mathematics education. Creating a blog is one of the fastest growing Web 2.0 applications among mobile Internet users (Kairer, 2009). Blogs promote reflective practice as well as collaboration and social interaction among users (Ray & Hocutt, 2006) and can be used as a means of obtaining or outsourcing solutions to quizzes and other mathematical problems students need to know to be prepared for competitive tests.

This study examined the contributions of prospective U.S. secondary mathematics teachers to a blog created as a supportive tool in a Euclidean Geometry course offered by a university in the western United States. Based on the findings of this study, appropriate recommendations are made to students, teachers, and teacher educators regarding the potential use of Web 2.0 activities such as blogging. Additionally, the results of this study may provide important information for policy-makers or those responsible for instructional design.

METHODOLOGY

The data presented in this paper was collected and analyzed qualitatively to answer the following research question: *What trends emerge in the analysis of preservice secondary mathematics teachers' contributions to an online discussion board on a blog used in a college Euclidean Geometry course?*
The data was collected from an online discussion board, which was a component of a semester long blogging activity conducted as a supportive teaching and learning tool in a college Euclidean Geometry course. The study was conducted for 12 consecutive weeks, as a standard component of the course, in fall 2011 semester, offered in a university in the western United States. The blog can be visited at: http://edsc353fall2011.wordpress.com/.

There were 28 students in the class, all of whom willingly participated in the blogging activity. It is noted that, the students were given a choice to join or not to join in the blogging activity; with an alternate assignment provided by the instructor to those students who did not wish to participate in the blogging activity, but nobody refused to join in the blogging activity.

Before starting the activity, the students were divided into six groups with five students in five of the groups and three in the remaining group. The six groups were randomly assigned to a pair of weeks, 1st and 7th, 2nd and 8th, 3rd and 9th, 4th and 10th, 5th and 11th, or 6th and 12th. Each week the researchers uploaded a new problem set. During the weeks to which their group was assigned, group members were responsible for solving problems and leading the discussion board activity on the blog. The schedule was purposely set so that each group was assigned one week during the first half of the activity and another week in the second half. During the assigned week, at least one group member was responsible for initiating a new discussion thread and the other group members were expected to contribute to the thread. Each group member was responsible for submitting a complete solution to one of the eight problems posted during the weeks assigned to their group. Each student created a pseudonym to maintain confidentiality throughout the activity

Additionally, throughout the semester each class member was required to post at least five substantive comments to solutions posted by other students; and to actively participate in the online discussion. Substantive comments included verifying a solution posted by someone else, fixing an incorrect or partially incorrect solution, or providing an alternative solution. In the online discussion board, a student could raise a discussion topic such as a contemporary issue related to the topics taught in the class or comment on threads that had been started by other class members. The address of the online discussion board is: http://edsc353fall2011.wordpress.com/discussion-board/. During the 12-week activity, there were 174 responses with 66 threads on the discussion board.

Prior to collecting data, permission was sought from the Institutional Review Board (IRB) of the university where the study was conducted; and participants' consent was attained using an assent form, approved and prescribed by the university. An information script describing the purpose of the survey was read aloud to the students. The students were given a choice to participate or not participate in the study without any penalty or loss of rights to which they were entitled in the class. All 28 students who attended class regularly participated in the blogging activity.

Descriptive statistics showed that twelve (42.86%) of the participants were male and 16 (57.14%) were female. Pseudonyms of the male participants were: Heron, Ricky Martin, Indiana, Nevadatude, Razor, TheDude53, Golddust, Erdos, Reynold, Batman, Walter Sobchok, and TacoTuesday. Pseudonyms of the female participants were: Sam, Scooter, Wally, Eamesor, Jane Doe, Twoqayl, Fertis McCertis, Mathgirl, Winnifred, Giggles, Justin, Nemo, John Wayne, MathTeach, Pythagoras, and Woohoo. The participants ranged in age from 20 to 61 years old with a mean, median, and range of 26.43, 22.0, and 41 years respectively, and a standard deviation of 10.149 years.

A qualitative data analysis software package, MAXQDA, was used to identify emerging trends in student blog postings. The analysis revealed nineteen major themes in the discussion topics. Each of these themes was labeled by an in vivo code (actual word or phrase used by one or more of the participants), called a subtheme. This was done in order to preserve the words used by the participants regarding the discussion topics. These themes are not independent of one another; instead, they are interconnected aspects of an individual overall phenomenon.

FINDINGS

The study revealed that the participated prospective U.S. secondary mathematics teachers raised approximately twenty major themes throughout the online discussion. These themes include: participants' personal interest in Geometry; difficulties in teaching-learning Geometry; real-life applications of Geometry; teaching-learning strategies in Geometry; hands-on activities; kill and drill methods; use of a formula sheet; creating lesson plans; the importance and difficulty of word problems; career plans; math teachers' pay and benefits; self-motivation of becoming a math teacher; how to maintain professionalism; overloaded homework; test creation strategies; grading policy; use of advanced technology such as a smart board and overhead projector in Geometry classrooms; math jokes and fallacies; and, mathematics websites. Table 1 depicts the themes and subthemes of major trends that emerged. The table also delineates the subthemes that emerged within these major themes.

Table 1. Themes and Subthemes of Major Trends that Emerged in the Discussion Board.

Themes	Subthemes (in vivo codes)
Geometry in Real-life	Geometry in real life, real world, real situation, everyday
Difficulties in Geometry	Barriers, difficulty, hard, problem, struggle
Interest on Geometry	Interest on Geometry, like Geometry, love Geometry
Teaching-Learning Geometry	Teaching Geometry, learning Geometry
Hands-on Activities	Hands-on activities, hands-on learning, hands-on techniques
Drill and Kill Methods	Drill and kill, kill and drill
Using Formula Sheets	Making formula sheet, using formula sheet
Creating Lesson Plans	Lesson plan, lecture sheet, lesson sheet
Test Creation Strategies	Test creation, test making, standardized tests
Grading Policy	Grading policy, no points, partial points, full points,
Word Problems	Difficulties, importance, understanding word problems
Career Plan	Career plan, career goal, master's, PhD degree
Payment and Benefits	Benefits, incentives, payment, salary
Self-motivation	Self-motivation, self-satisfaction, motivated
Professionalism	Professionalism, professional life, personal life
Overloaded Homework	Assignment, homework, classwork
Use of Smart Board	Smart board, overhead projector, new technology
Math Jokes	Math jokes, fun, fallacies
Mathematics Websites	Mathematics programs, software, websites

Figure 1 depicts the major trends that emerged in the online discussion board of the blogging activity, drawn by the *MAXMaps* feature of MAXQDA.

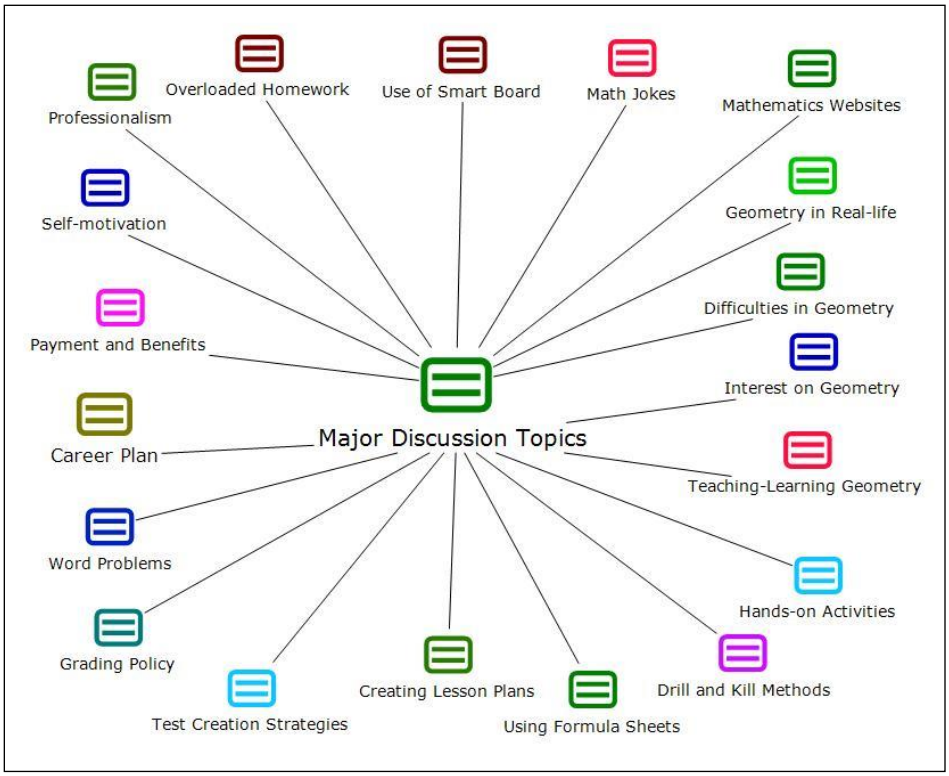

Figure 1. Major Trends that Emerged in the Discussion Board of the Blog.

The following section uses participant's pseudonyms and describes the major themes raised on the discussion topics.

Geometry in Real-life. Participant discussion included applications of Geometry in real life situations. Some preservice mathematics teachers believe that real life applications of Geometry should be included in mathematics textbooks much earlier than high school. Preservice mathematics teachers realize that Geometry is a branch of math that is all around them. They feel that Geometry is one of those subjects that can easily be applied to real life situations. A female participant, *Twoqayl*, raised this topic as follows, "Has there ever been a time where you have used Geometry in a real life situation when you were not planning to? Have any of you had any similar experiences?"

Many of the participants liked this topic, as one female participant, *Nemo*, mentioned, "I definitely feel that Geometry is one of those subjects that can easily be applied to real life situations. This may make it not as hard to teach to students if we are able to link the mathematics to the real world." While another female participant, *Sam*, mentioned, "There are a lot of jobs that require an understanding of Geometry." Another male participant, *Razor*, mentioned, "In my previous career in construction management I was able to quickly check if 2 walls were square by measuring out a 3-4-5 ft triangle. There were several 'quick' checks that I was able to use to make sure we were on track." *TacoTuesday*, a male participant, considered that as one of the best applications of Geometry in real life.

Another female participant, *Nemo*, mentioned, "I used Geometry the other day when I was trying to center my television that is mounted on the wall. Similar to the picture frame, if I just found the midpoint between two endpoints then I would know where to place the middle of my television." *Giggles*, a female participant supported this idea, as she stated:

> I remember last summer my dad was putting in this fake tile floor and he had to measure out everything ahead of time to buy the correct amount of tile pieces. Then he had to cut and fit everything together. Even hanging a picture so it is straight involves Geometry.

Interest on Geometry. A number of participants discussed their interest and enjoyment of Geometry. One male participant, *TacoTuesday,* mentioned, "I loved Geometry in High School. So far I don't think I have run into a math subject that didn't agree with me or me with it." While another female participant, *Giggles*, mentioned:

> I have always loved Geometry because it is math that you can visualize and even hold in your hand. It helps to learn concepts through hands-on activities so you can see why things work the way they do rather than just being told about certain abstract concepts.

Another female participant, *Justin*, mentioned:

> The reason I like [Geometry] is because there is always a set of ways (steps) to do a problem, and generally you always get one answer that you can double check and see if you are right. When it comes to proofs, there are many ways to attempt a problem. I like to have a set of ways of attempting a problem.

Difficulties in Geometry. Some participants discussed difficulties inherent in teaching-learning Geometry, including personal reflections and potential ways to minimize these difficulties. One female participant, *Jane Doe,* raised the topic as follows:

> I have heard many students say that Geometry was the hardest math course that they had to take. Many times students are great at algebra but have trouble understanding Geometry. Did any of you experience this? And if so, is there any specific topic or section that you are most nervous to teach? Was there one area that you really struggled with?

Jane Doe went on to say, "When I took Geometry I struggled with proofs. It was my first experience with that kind of problem solving and it took me a while to understand how to do it." While another female participant, *Justin,* mentioned:

> I think I was one of these struggling students that over achieved in Calculus and Algebra; and had my biggest struggles with Geometry and Trigonometry. Now that I am older, I have a better understanding for it, and definitely do not have a fear of teaching it with the exception of proofs.

Teaching-Learning Geometry. Some participants discussed their personal experience and opinions of teaching-learning strategies in Geometry. One female participant, *Justin,* mentioned, "I think when I teach Geometry, I will definitely try to create real life applications and use multiple strategies with my students to hopefully prevent more students from being lost." Another female participant, *Winnifred,* mentioned, "Creating real life applications for any math class is the most important thing a teacher can do to help students understand the material." While another female participant, *Sam,* presented her personal thoughts as follows, "I think the

self-discovery approach in the context of a group activity, followed by teacher-led instruction would help enhance the learning of all students including ESL students or students who have learning difficulties." Another male participant, *Indiana,* elaborated:

> Explaining a real life situation where what we are learning that day could be used will help not only them but other students who hear the conversation that this work is not in vain. In addition, having thoughtful problems to solve that involve real life situations using the lessons of the week will reiterate my statements throughout the week that the lesson is worth understanding.

Hands-on Activities. A number of participants discussed various hands-on activities for teaching-learning Geometry. They also presented their views regarding how to create and use hands-on activities. One female participant, *MathTeach,* raised the topic as follows:

> How many of you are planning on using more hands-on techniques for lessons rather than textbook work? What do you think is gained by hands on lesson planning? How will it help your students grasp the concepts you are teaching? What kinds of lessons have you already thought of that incorporate this type of lesson?

While another female participant, *John Wayne,* gave anecdotal evidence stating her personal experience in developing and using hands-on activities, as she stated:

> I developed a few lessons last semester that are hands on. One was a math bingo game that was pretty cool. I had different bingo cards that were passed out to all the students. Then I randomly pulled an equation and the students had to find the missing variable. The answer was somewhere on their bingo card. The process was continued until someone gets a bingo. It's great for review.

A male participant, *TacoTuesday,* mentioned, "I like hands on learning." A female participant, *Winnifred,* mentioned, "I absolutely love hands on learning. I think I will use it as much as I possibly can when I start teaching." Another female participant, *Twoqayl,* supported this idea as she mentioned, "I do think that hands-on learning is important though, it'll solidify their knowledge and give them confidence. I plan on using a lot of hands-on techniques in my classroom." Another female participant, *John Wayne,* mentioned, "Not all people can learn from lecture, there are many people who learn through hands on experiences. Hands on activities help students visualize the concept they are trying to learn."

Drill and Kill Methods. Some participants discussed the advantages and disadvantages of using drill and kill methods. One male participant, *Heron,* broached the topic as follows:

> I have an interesting conundrum. My practicum teacher is a proponent of the 'drill and kill' school of instruction. Pretty much every day, from bell to bell, he's working problems. The students take notes or do assignments from worksheets, with more problems. The notebooks are checked and graded frequently, along with homework. The busyness of his class seems to be a major component of his behavior management. Any thought?

A female participant, *Wally,* supported this method by stating, "I too like the traditional 'drill and kill' technique. I was able to learn with that method and enjoy it. In turn, I was successful and now want to teach math." Another female participant, *Twoqayl,* stated, "Personally, I think a lot

of drill work is necessary and beneficial. I think it's an important life skill to get used to as well as being a good way to practice."

However, some participants presented negative views of drill and kill methods. As one male participant, *Razor,* stated:

> After doing research for other classes I discovered that students that are taught using this method lack a deep, comprehensive understanding of the subject matter. Even if it raised test scores, it fails to help students truly grasp the key concepts. It may have worked for some of us but in general it does nothing but help students pass tests. I think that teachers who want to raise test scores must promote deep conceptual understanding of the subject matter. Getting practice in math does not need to be drill and kill.

Using Formula Sheets. Some participants discussed the importance of and their experience in using formula sheets for mathematics courses. One male participant, *Razor,* mentioned, "I was required by my Geometry teacher to have a small notebook to write all the formulas, proofs, postulates etc. It made it very easy to reference while working on practice problems." A female participant, *Scooter,* elaborated:

> [In] one of our required education classes I created a 'formula sheet' rubric, which the students filled out each time a different formula were given. On that sheet, students fill out the name of the formula, where is it found (chapter or page in the book), the actual formula itself, an example of how it is used, and when and why we use it. Through this sheet, I believe students are given the opportunity to practically apply the math they are learning and discover why we use it.

Some female participants (e.g., Pythagoras, Sam) supported this idea. *Pythagoras* stated, "Scooter, I really like your idea of the formula sheet with all the different sections for students to write in…." While a male participant, *Ricky Martin,* stated:

> I understand the argument that learning the formulas first makes it easier to figure out the word problems. But I still think there is something to be said for trying to get the students to 'discover' the formulas on their own by giving them time to work with a real life scenario. This way, they not only learn the formulas, but they also get comfortable figuring out the formulas as they need them in life. Not just memorizing.

Creating Lesson Plans. Some participants discussed the importance of creating lesson plans and the strategies needed to do so in teaching Geometry. One female participant, *Jane Doe,* mentioned, "Creating lesson plans is the best way to not get overwhelmed. And as you become a more experienced teacher, the grading and planning will get easier." Another female participant, *Pythagoras,* elaborated:

> Lesson plans are supposed to be your best friend. They help you stay on track and make sure everything is getting done as planned. You may not even use an entire lesson plan but rather a guideline for the day to help you get through.

Test Creation Strategies. Most of the participants discussed test creation strategies. One female participant, *Wally,* raised the issue as follows:

> Because we were given the question creation assignment, I have been thinking about the most effective way to create testing questions for students. Is it better to create questions directly based on homework assignments or should they be more challenging and

> combine multiple concepts or should they prepare them for standardized tests? Obviously, we can choose to combine the three, but are there advantages to one vs. another? Thought?

A male participant, *Ricky Martin,* presented his thought as follows:

> I guess it depends on what kind of test you are conducting. If it's a regular test for a grade, I don't think the questions should be harder than the homework/ classwork that they've seen. I think the time to pose more challenging questions is during class and homework. During tests, I think the questions should be as straightforward as possible, just to make it a fair assessment of the students.

While another female participant, *Scooter,* supported this as she elaborated:

> I also agree with Ricky Martin: Test questions should be a fair assessment and should be straightforward. There are a lot of students who get test anxiety and just can't seem to perform well on tests. However, we still want to challenge our students, so allowing them to experiment with more abstract problems would be beneficial to do as a class or with partners so that they are able to think through the problems together, using what they've learned from the material.

A number of male and female participants agreed with *Ricky Martin*'s thought. As one female participant, *MathTeach,* stated, "I agree with what you are saying. Maybe a challenge question could be considered for extra credit." Another female participant, *Scooter,* supported this as she stated, "I agree, challenge questions for extra credit is a great idea." A male participant, *Reynold,* agreed with this idea as he stated, "Making test questions simple doesn't help the students at all. Expose students to some challenging questions and they will be able to approach the other questions with confidence."

Some female participants (e.g., Eamesor, MathTeach) agreed that tests should be based on homework assignments. *Eamesor* stated, "I definitely agree with how beneficial it is to be tested on something that we have actually worked with." *MathTeach* stated her personal experience as follows:

> I am currently in Calc 2 and my teacher creates test questions based on the homework assignments. This is beneficial to me, as a student, because it is easy to know what to study. I also believe that it makes her job easier by creating less work.

Another female participant, *Fertis McCertis,* presented a different thought as she stated:

> I think that the best math tests are the ones with a multiple choice section as well as a free response section. The multiple choice section would feature questions that are more calculation driven and the free response would feature questions that had more steps and could be more easily graded on a partial credit curriculum.

Grading Policy. Many participants discussed grading policies that teachers use to assess students' tests and assignments. The participants recommended that math teachers should use rubrics during the grading process. One female participant, *Jane Doe,* raised the issue as follows, "Should a [math] teacher award full-point on the assignments if students do the problems right but make simple math errors or should teachers only grade according to getting the right

answers?" Participants considered this to be an important topic, as a number of participants joined in the discussion. One male participant, *Walter Sobchok,* mentioned, "This is a million dollar question." Most of the participants presented their views on partial credit for partially correct solutions based on students' understanding and presentation of the content on tests and assignments. While another male participant, *Heron,* mentioned, "I think it's a mistake to award full points for work that doesn't lead to a correct answer, but I think it's a bigger mistake to give a zero to a student who clearly understood the method and analysis required for a problem." Another male participant, *Walter Sobchok,* mentioned, "Personally, I am all for partial credit if a student shows a solid understanding of the concepts and methods, but simply misses the correct answer due a computational error."

One female participant, *Eamesor,* mentioned, "I actually think that teachers should give partial credit. Make it clear that you have to show your work, or if you do not have to show work make it a simple multiple choice answer and have the question worth less points. Another female participant, *John Wayne,* stated, "I think partial credit should be given for showing correct work but obtaining the wrong answer…" While some male participants (e.g., TheDude53, Heron, Walter Sobchok) agreed that it is really difficult for math teachers to grade students' tests and assignments identically; and they agreed that the grading system depends of the teachers' skill and expertise. *TheDude53* mentioned, "I think math is one of those subjects that are hard to grade because you know what you are looking for compared to someone else." *Heron* mentioned, "I think a tougher question is how much credit I should give for a correct answer, with no work shown." Another male participant, *Walter Sobchok,* mentioned, "The amount of zero/partial/full credit will vary from teacher to teacher depending on his/her belief system on the matter."

Word Problems. Some participants discussed the importance of understanding and solving word problems in Geometry and other mathematics courses and the difficulties involved in this process. One male participant, *Walter Sobchok,* raised the issue as follows:

> Students' greatest struggles generally come with word problems and how to generate and formulate given the information they are presented. Given that this is the case, how could we expect our students to process the information and generate the formulas without prior experience simply processing the number problems and gaining that grasp of how the formulas work?

A female participant, *Scooter,* supported this issue by stating:

> I agree word problems are the most challenging for students, even for me. So, I think presenting the students with a real life situation and/or word problem in the beginning of the lecture, but not revealing necessarily how to solve it until the end will keep their interest, challenge them to find connections between the math/formulas and real-life situations, and provide clarity on how the math is applied and how to carry out applications.

While some participants presented their views that some textbooks have made the issue critical by presenting word problems in the wrong place in exercise and problem sets. *Ricky Martin,* a male participant stated, "In every math textbook I've ever had, the chapter starts out with the

numbers, and word problems don't come about till the very end." He suggested that "word problems should be at the front of each chapter–learn context first, then there is a reason to learn the formulas." However, some participants presented different views. One female participant, *Pythagoras,* stated:

> I think the reason the chapters start out with numbers and lead into word problems is because the formulas and numbers are what your main lesson is, not necessarily the word problem. I just think it would be difficult to change the order of the textbook. If 'every math textbook' you have looked at is organized the same it must be working somehow.

Another female participant, *Winnifred,* supported this view by stating:

> Another problem I would have with giving word problems first is, what about the students who do not speak English fluently? If they cannot read the question properly, you cannot expect them to give you the right answer unless someone translated for them. With number problems and formulas first, they might be able to scan a problem and pull out the important numbers and deduct where that number goes in the formula.

Career Plan. Many participants discussed their career plans and their ambition of achieving higher degrees and becoming math teachers. One female participant, *Mathgirl,* mentioned, "I personally want to earn a master's degree. Not for the pay benefit, however, for the chance to move into teaching college math." Another female participant, *Justin,* agreed with *Mathgirl* and stated:

> I agree with Mathgirl. I also want to get my Master's and then hopefully PhD in Math, so that I can teach at a university level. It's not for the extra income, it's just for the simple fact that I want to try teaching high school and college and see which I like better. I think after doing so many years of high school, I might be ready to move on and actually teach to those students who ENJOY math and choose to take it, rather than just fulfilling a requirement.

A male participant, *Reynold,* agreed with *Justin* and stated:

> I completely agree. I doubt any of us are going into teaching with money being the first thing they expect. I'm doing it to make some kind of impact on the students and because I enjoy math. I also would like to continue on and get a masters and perhaps a PhD, not necessarily for the job advancement or money, but because I would like to continue developing my own understanding in something I have a passion for.

While another male participant, *Walter Sobchok,* explained the fact elaborately as follows:

> I think a lot of it depends upon your personal aspirations moving forward in your career. If you are content with teaching at the secondary level for the duration of your career, then there may not be much incentive to further your education for any reason other than for your own self-satisfaction. Likewise, if you would like to pursue teaching at the college level, then furthering your mathematical education would prove to be a worthwhile venture. I think it comes down to each individual's personal goals and desires. However, I do agree that there is no incentive provided for teachers to further their education and remain in the secondary teaching field.

Payment and Benefits. Some of the participants discussed math teachers' salaries and benefits compared to their degree and responsibilities. One female participant, *Nemo,* raised the topic as follows, "I thought of an interesting topic that was brought up in my education class regarding

the future of all teachers. It is amazing to me that they are considering making the pay scale equal for people with all different educational backgrounds." While a male participant, *Walter Sobchok,* agreed with *Nemo* as he stated, "I do agree that there is no incentive provided for teachers to further their education and remain in the secondary teaching field."

Some participants expressed their frustration regarding this issue, as one male participant, *Heron,* stated, "Why is it that in all American organizations I can think of, managers/administrators get paid some multiple of what a worker directly involved in the production of goods and services can hope for?" Another female participant, *Twoqayl,* stated:

> In this economy, there is a large amount of people who are 'overqualified' for most jobs and are therefore not being hired. If what you say comes to fruition I think that there would, indeed, be very little incentive to go further into one's education to get higher degrees.

However, some participants did have a positive hope regarding their salary and benefits. As one male participant, *Batman,* stated, "I think that eventually a new type of incentive system will come along and when it does people will do what they need to do in order to qualify for it."

Self-Motivation. With relevance to payment and benefits, a number of participants discussed their opinion on how to motivate themselves to achieve higher degrees in mathematics. One female participant, *Nemo,* raised the topic as follows:

> It seems as though getting a Master's [degree] will not be worth it due to the fact that they may not be paying us more? How are teachers going to be motivated to further their education if there is no increase in pay?

A male participant, *Batman,* mentioned:

> The question really depends on what kind of incentives they put in its place. If you get a pay increase based on how your students do on tests you might want to learn more effective ways to teach. I agree that if they take away the pay increases for having a higher degree it will decrease the number of people seeking higher degrees.

Some other participants supported this discussion. One female participant, *Nemo,* mentioned:

> I completely agree with your statement. For some students the teacher is all they have in life in terms of guidance and motivation. It is our jobs as teachers to help every student achieve. Yes, it does take work from the student, but if we give up on them then how will do our jobs. We are the adults and we must remember what it's like to be students. If we give them respect and show them that they care, hopefully they will take our classes seriously and work hard to do well.

Professionalism. A significant number of participants discussed professionalism. They raised the issue of bringing a teacher's personal problems into the classroom and presented their views on how to keep a teacher's personal issues out of the school environment. One female participant, *Winnifred,* raised the topic as follows:

> I was recently talking with a friend about her practicum experience and how horrible her lead teacher is. She was describing to me how the teacher is going through some serious life issues and then claims certain students just cannot be helped by anyone and that they will never make it in life. I guess what I want to know is: How can a teacher keep his/her

> self from letting their personal life affect how they treat their students and prevent oneself from becoming overwhelmed? Is there really a student who is hopeless?

Many participants agreed that as human beings it might be difficult for many teachers to keep their personal and professional lives separate from one another. Another female participant, *John Wayne,* stated, "Teachers are human just like everybody else. So they have their good days and their bad days. However, teachers still work in a professional working environment and they should not let their personal issues clash with work."

Some participants presented their personal experience and anecdotal evidence regarding how to maintain professionalism. As one male participant, *Walter Sobchok,* mentioned, "It's simple enough to say that we just need to keep our personal and professional lives separate from one another. However, one must remember that we are still human." Another female participant, *Pythagoras,* supported this view as follows:

> Walter Sobchok, I agree with you completely. As the 'professional' you have to check your problems at the door and try to do the best for your students any way you can and not let your personal problems get the best of you and cloud your judgment as a teacher.

A female participant, *John Wayne,* presented her personal thought as she stated:

> When I am having a really bad day and need to go to work. I take a breath and say to myself, there is nothing I can do about it right now so just go to work and do your job. If I let myself think about my problems at work my work performance goes down.

However, many agreed that it is really tough to put aside real life situations while in the workplace. Thus, they suggested making a balance as much as possible. One female participant, *Jane Doe,* stated, "Putting aside your personal life when you enter the classroom is not necessarily the best thing to do and is not the easiest thing to do either. Making a balance is better." Some participants suggested high school teachers should be careful in using social media. As one female participant, *Jane Doe,* noted, "high school students are old enough to realize when you aren't having the best day." While another female participant, *John Wayne,* suggested that, "teachers should … not let any student become your friend on Facebook. When you become a teacher you are a professional and should not post stupid status updates."

Overloaded Homework. A number of participants discussed their experiences and opinions related to students' problems with homework assignments. One male participant, *TheDude53,* mentioned:

> One thing that I have noticed when I am helping my little cousin doing his math homework is that some of the problems on the homework don't really go with the notes that he had taken in class. I think if a teacher is going to assign a problem on homework and not give some kind of an example of how to solve it that they are actually hurting the kids.

A number of participants believe that many teachers give homework without teaching the appropriate material in class. One female participant, *Eamesor,* noted:

> Lately, I've been helping my younger family members with their math homework & I've noticed that they tend to throw in a question that the kids have to learn how to do them. They come to me saying 'I don't understand this question', me countering with 'Did you learn this in class?', and they always respond 'No.'

Many participants believe that assigning more homework without teaching the material in class can overwhelm young students. Thus, they recommended that teachers should assign less homework to their students. However, some participants discussed assigning less homework as a means of saving time in the grading process. As another female participant, *Winnifred*, noted, "Do you assign less homework so you have less grading to do?" Another female participant, *Mathgirl*, very harshly criticized this as follows:

> Assigning less homework is not an option either, especially in math. If this teacher is that overwhelmed, she could apply for a teacher aid or take a leave of absence. I honestly think this teacher needs to take some time off to remember why he/she wanted to teach in the first place; and if they cannot remember, then maybe they need to find a new job!

Use of Smart Board. A number of participants discussed the advantages and importance of using advanced technology such as a smart board in Geometry and other mathematics classes. One female participant, *Nemo,* raised the issue as follows:

> I have worked with smart boards in my middle school practicum. I actually used it for one of my lessons. I think that it provides engagement for the students but sometimes I felt that is was hard to fit all of my notes on a single page. You are able to flip between pages, but it is still hard to go back and forth sometimes. Does anyone feel that even when a teacher is using a board it is hard to keep your back to your students when you are writing? I also prefer an overhead [projector] so that I am able to visualize the entire class at all times. Any more thought?

Another female participant, *Winnifred*, presented her thoughts of some advantages of using a smart board in the classrooms. As she stated:

> One of the things I like about the smart board is you can save your notes, whether hand written or typed, and you can also use templates on it that the textbooks have given you. It also has an undo [option] in case you erase something you didn't mean to whereas on the white board once it's erased it's gone for good. I've talked with teachers who save their daily notes and sometimes email them to students who are absent because a classmates notes are not always accurate.

While a male participant, *Batman*, stated:

> I think that one of the major benefits of smart boards, especially for Geometry, is the ability to insert specific shapes. I know that when I personally draw on the board it can get a little sloppy cramped if I did not draw a diagram big enough or something like that. So I think being able to insert shapes and manipulate them the way you want helps your notes look more professional and easy to understand. I know when I was in school and even now if the diagram is drawn poorly I have a harder time making sense of it so that is why I think it is so beneficial to be able to do that.

Math Jokes. Some participants discussed math jokes and mathematical fallacies and presented their views of sharing these with their students. A male participant, *TacoTuesday,* mentioned a website http://xkcd.com/ that presents a lot of math jokes and comics. One female participant, *Scooter,* raised the topic as follows:

> I [have] this idea of sharing a riddle or math joke with my students every morning or at least every Friday. With that said, I need more jokes. So, does anybody have any good math riddles or jokes they would like to share?

Another female participant, *Wally*, presented a math joke that her math teacher told in class.

> 'I'm going to prove that the number 2 is odd…'
> List of prime numbers: 2, 3, 5, 7, 11, 13, 17, 19, etc…
> '2 is the only even prime number… isn't that odd?'
> It's silly, but it made me smile!

Mathematics Websites. The participants visited and mentioned a number of websites and applets suitable for teaching and learning mathematics. Some of the websites they mentioned are: http://khanacademy.org, http://www.mathimp.org, http://www.metacafe.com/, http://wolframalpha.com, http://www.learner.org/. They also encouraged other participants to visit and use these websites by discussing their beneficial features. One male participant, *Indiana*, mentioned https://www.sites.google.com/site/missnickellshomepage/honors-geometry as a well-organized thoughtful use of a webpage for a math class. While a female participant, *John Wayne*, mentioned, "I just checked out the khanacademy.org website and it was really cool. That website really does have the answers to almost everything." While another male participant, *Erdos*, supported this by stating, "Websites like the Khan Academy, Stanford's Home Page, and TED [Technology, Entertainment and Design] all provide online instruction to students in a way which is informal, direct, and, most importantly, personal…."

DISCUSSION AND IMPLICATION OF THE STUDY

The study found that participated prospective U.S. secondary mathematics teachers found the blog to be a good forum to openly discuss numerous Geometry related topics. These include issues regarding their personal interest and experience in Geometry and mathematics; use of Geometry and mathematics for real-life purposes; teaching-learning strategies; use and importance of formula sheets, hands-on activities, drill and kill methods, lesson plans, smart board use, and word problems. They also discussed their career plans, interest in becoming a math teacher, and effective ways to maintain professionalism. Thus, it seems that blogs could be used for various purposes. For instance, a mathematics teacher could develop and maintain a blog for his/her course and invite the students to discuss various topics about the course. This kind of virtual platform could enrich their mathematical knowledge and understanding by allowing for the discussion of various mathematical topics: posting of related problems and quizzes; allowing class members to submit online solutions to problems posted by others; and sharing thoughts about creating mathematics problems.

Although, the discussion on this blog did not focus in any specific direction, interestingly, most of the topics were related to the improvement of learning styles and professional development, topics that are often not discussed in the classroom. This result is analogous to Hendron's (2008) argument as he stated that blogs can provide students with the social collaborative edge that they can never experience on paper and in traditional classrooms.

Table 2. Male vs. Female Participants' View Emerged on the Blogging Discussion Board.

Discussion Topics	Male (%)	Female (%)
Geometry in Real-life	3 (25%)	10 (62.5%)
Interest on Geometry	1 (8.33%)	2 (12.5%)
Difficulties in Geometry	1 (8.33%)	2 (12.5%)
Teaching-Learning Geometry	1 (8.33%)	3 (18.75%)
Hands-on Activities	3 (25%)	3 (18.75%)
Drill and Kill Methods	2 (16.67%)	3 (18.75%)
Using Formula Sheets	2 (16.67%)	4 (25%)
Creating Lesson Plans	0	2 (12.5%)
Test Creation Strategies	1 (8.33%)	7 (43.75%)
Grading Policy	6 (50%)	4 (25%)
Word Problems	2 (16.67%)	4 (25%)
Career Plan	2 (16.67%)	2 (12.5%)
Payment and Benefits	3 (25%)	2 (12.5%)
Self-motivation	2 (16.67%)	3 (18.75%)
Professionalism	2 (16.67%)	9 (56.25%)
Overloaded Homework	1 (8.33%)	5 (31.25%)
Use of Smart Board	1 (8.33%)	2 (12.5%)
Math Jokes	1 (8.33%)	2 (12.5%)
Mathematics Websites	2 (16.67%)	1 (6.25%)
Average	1.9 (15.79%)	3.7 (23.02%)

Note. For Male N = 12, Female N = 16

Table 2 provides an analysis of male and female participation rates across the various themes that emerged from the online discussion board. This table indicates that on average more females (23.02%) participated in these online discussion topics than males (15.79%). Further analysis suggests that females were more likely to discuss real-life applications of Geometry, Geometry teaching-learning strategies, test creation strategies, overloading homework, and professionalism. Male participants, on the other hand, tended to discuss grading policy, and payment and benefits. While these observations of the data are interesting, they cannot be considered generalizable due to the small sample size.

The use of the online discussion board in this study can be deemed effective and appropriate as witnessed by the important issues raised by the participants that might otherwise have never been addressed. Discussing these topics on the blog allowed these preservice teachers with an opportunity to present their opinions on these matters, consider the perceptions of others, and arrive at a reasoned conclusion. As mentioned above many of these topics related to teaching and learning techniques, career goals, and professional development. These observations are somewhat analogous to Shihab's (2008) findings and recommendations regarding the use of blog and discussion board in an English Learning class, as he found:

> Teachers report that blogs helped students share ideas and opinions on the topics being studied in class and have improved learning in the English classroom. Students recommend that blogs be used in various school subjects, especially subjects that require sharing of information and opinions. In addition to sharing ideas on discussion boards, blogs may serve as personalized spaces for students to write their own thoughts and experiences in an organized way. It provided an organized paperless track of all student discussion. (p. 93)

The results of this study suggest that preservice mathematics teachers found the blog to be a good forum to openly discuss numerous Geometry related topics. These include issues regarding their personal interest and experience in Geometry and mathematics; use of Geometry and mathematics for real-life purposes; teaching-learning strategies; use and importance of formula sheets, hands-on activities, kill and drill methods, lesson plans, smart board use, and word problems. They also discussed their career plan, interest of becoming math teacher and effective ways to maintain professionalism. Thus, other mathematics teacher should consider developing and maintaining a blog in his/her class and invite the students to discuss various topics about the class. This kind of virtual platform could enrich the mathematical knowledge and understanding of students by allowing for the discussion of various mathematical topics: posting of related problems and quizzes; allowing class members to submit online solutions to problems posted by others; and sharing thoughts about creating mathematics problems.

Finally, and most notably, the findings of this study should provide encouragement to students and classroom teachers who have not previously experienced blogging to share their voices and perspectives on an open and public forum. This opportunity will allow individuals who do not get a chance to publish their perspectives in typical print media to have an outlet for sharing their ideas. Further, this study suggests that using blogs could, provide an effective opportunity for students who are involved in the process of learning and understanding mathematics. The relatively low cost of using blogs makes then a strong alternative for teachers and students who cannot afford costly mathematical software or Web-based applications. As more students participate in online discussion on various mathematical topics and take the opportunity to publish their voice on the open forum, the depth and breadth of their mathematical understanding should expand.

CONCLUSIONS

This study revealed that prospective U.S. secondary mathematics teachers are willing to actively participate in an open and public forum on which they can discuss issues of interest to them and present their personal views and experiences without hesitation. Students, teachers, and researchers from various corners of the world who love and practice mathematics could be invited to participate in similar online discussions on the blog to share their research findings and problem solving techniques. Thus, blogs have the potential to allow mathematics students and teachers to share their voices and perspectives in a public forum.

Not only did this study provide justification for using blogs as a supportive teaching-learning tool in a college Euclidean Geometry course, it, also, uncovered a variety of ideas for further

research in these fields. For instance, the findings of this study provided a great opportunity for students and classroom teachers who had not previously experienced blogging to share their voices and perspectives on an open and public forum. This opportunity allowed individuals who did not get a chance to publish their perspectives in typical print media to have an outlet for sharing their ideas.

Furthermore, this study suggests that using blogs could provide an effective opportunity for students who are involved in the process of learning and understanding mathematics. The relative low cost of using blogs can provide a strong alternative for those teachers and students who cannot afford costly mathematical software or Web-based applications. As more students participate in online discussion on various mathematics topics and take the opportunity to publish their voice on the open forum, the depth and breadth of their mathematics study should expand.

Thus, the researchers strongly believe that this study provides evidence that blogs and other Web 2.0 technologies could provide an important avenue for fostering the teaching and learning of mathematics in today's technologically advanced society. Most teachers from the middle school to the college level have enough computing knowledge to create and maintain academic or personal blogs on a suitable server free of cost. Those who don't could be trained to do so in a few hours. Blogging activities similar to those discussed in this study could be utilized as is or with modification in the teaching of all areas of mathematics at almost any grade level. Educators need to capitalize on the proliferation of technology and the fascination of students with the interactive features of emerging Web 2.0 applications to motivate their students and, in turn, improve their academic performance.

However, due to the major limitation that the study was conducted in a single course with only 28 students, these findings cannot be claimed as generalizable. Thus, the researcher of this study suggests that prospective researchers investigate the use of blog and other Web 2.0 technologies in larger courses and/or by considering different aspects of the blog.

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