Prospective U.S. Mathematics Teachers' Engagement in Hand-held Cellular Devices and Web 2.0 Activities and their Perception of Using these Technologies for Teaching-Learning Purposes

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***Abstract*- This paper presents quantitative and qualitative data that examine the prospective U.S. mathematics teachers' engagement in the use of the Internet, hand-held cellular devices, and Web 2.0 activities and their perception of using these technologies for the teaching and learning of Euclidean geometry and other mathematics courses. The study revealed that prospective mathematics teachers in the U.S. have massive engagement in accessing the Internet and Web 2.0-based activities through cellular and handheld mobile devices as well as in their self-reported skills in using Internet, without any significant differences based on their gender. Prospective mathematics teachers experienced numerous advantages and a few minor problems of the blogging activity as a supportive tool in the Euclidean Geometry course. They found blogs a supportive and useful tool for collaborative teaching and learning purposes. Thus, they suggest that blogs and other Web 2.0 tools should be incorporated in the middle and high school mathematics education curricula.**

Keywords- Blog; Euclidean Geometry; Mathematics Education; Preservice Teachers; Web 2.0 Technology

I. INTRODUCTION

The acceleration of laptop, smartphone, tablet PC, and similar handheld mobile devices has resulted in a rapid growth of Internet users. As technology progresses, the cost of using the Internet through cellular devices is decreasing, and the number of Internet users will continue to increase. Even in developing and newly industrialized countries the number of mobile phone users is growing fast and Internet access through cellular devices is becoming cheap, easy, and popular. According to International Data Corporation's (IDC) Digital Marketplace Model and Forecast, in 2008 roughly 40% of all Internet users worldwide had mobile Internet access which was about 1.5 billion. By the end of 2012, the number of worldwide mobile devices accessing the Internet was predicted to be more than 3 billion, including PCs, mobile phones, and online videogame consoles [1]. By the end of 2010, wireless broadband subscriptions in the Organization for Economic Co-operation and Development (OECD) countries had exceeded half a billion [2]. According to another prediction by Juniper Research, the number of subscribers using mobile Internet services will rise to 1.7 billion worldwide by 2013; Internet access by mobile phones will represent around 50% of the total Internet usage [3].

Thus, it is likely that, within a couple of years, the number of mobile Internet users will overtake fixed Internet users [4]. This prediction is supported by a recent California survey that finds that 55-56% of California residents are more likely to go online from their desktop or laptop computers, whereas 40% connect to the Internet from their cell phones – that number was 19% in 2008 and 26% in 2009. According to a statistical study of Online Schools [5], reported by DigitalBuzzBlog [6], as in 2011, there were over 500 million Facebook users worldwide; over 50% of them logged on to Facebook every day; and every Facebook user had about 130 friends on average. The report states that 48% of 18-34 year olds check Facebook when they wake up, with 28% doing so before even getting out of bed. Almost 72% of all U.S. Internet users access Facebook. Additionally, 70% of the populations of Facebook users reside outside of the U.S.

As information technology becomes more prevalent, improvements are being developed to help nations work interactively under a global network. If we look back at the information technology of only a few years ago, we notice several things that are available now such as: iPhones, iPads, iPods, tablets, etc. were not previously available. The number of worldwide Internet users surpassed 2.1 billion on March 2011; up from 1.2 billion in 2006; 430 million in 2000 and only 45 million in 1995 [7]. The number of worldwide Internet users in 2011 represented about one-third of world population (30.2%) up from 16.6%, about half of this percentage in 2006. Thus, it is likely that within a few years more than two thirds of the world population will have a mobile device with a high speed Internet connection; and soon, the number of mobile Internet users will overtake fixed Internet users [4]. The remainder of this paper provides a brief review of the U.S. young generation's engagement on cellular devices and Web 2.0-based activities; the effect of web 2.0 technology on teaching-learning mathematics in the united states followed by the methodology and findings of the current study, which justifies these trends. The paper concludes with a

discussion and conclusions regarding the feasibility of using blog and other Web 2.0 technologies in the teaching and learning of mathematics and their inclusion in the mathematics education curricula.

A. U.S. Young Generation's Engagement on Cellular Devices and Web 2.0 Technologies

Due to the advancement of social networks young students have changed their lifestyles radically. They are growing up with new technologies and spending their time surrounded by and using computers, laptops, videogames, digital music players, webcams, cell phones, and many other toys and tools of the digital age [8]. Prenksy [9] calls these young students *digital natives* and Roberts [8] calls them *net generation* students. However, *web generation* sounds more appropriate as Web 2.0 applications are integral parts of their lives. Use of Web 2.0 technologies has pushed them one step ahead [9].

These web generation students are most likely arriving in high schools, colleges, and universities already having firsthand experience with multitasking operations in blog, podcast, tweeting, and other Web 2.0 applications, which are one step ahead of traditional voice and text messaging, and emailing. Web 2.0 tools provide today's students with new outlets for global interaction. These tools allow web generation students to post their own views on public forums that are accessible from anywhere, anytime, with a computer or handheld cellular device with an Internet connection. These technologically advanced students are ready for Web 2.0-based learning to be delivered on a flexible learning schedule that is not tied to a classroom setting in which time and location are constrained. Thus, there is a concern regarding whether or not web generation students can be fully satisfied with the traditional education system, which was designed before Web 2.0 technologies emerged.

According to a 2009 Pew Internet & American Life Project survey, 56% of adult Americans had Internet access by wireless means, such as a laptop, mobile device, game console, or MP3 player; and about one-third of Americans (32%) had used a cell phone or smartphone to access the Internet for emailing, instant messaging, or information-seeking. Thirty seven percent of Internet users aged 18-24 use Twitter or another service, up from 19% in December 2008 [10]. A survey by the Public Policy Institute of California [11] found that by the first half of 2011, 52% of Californians had used social networking sites; that number was 26% in 2008. Older, less-educated, and lower-income Californians, along with Latinos, are less likely than others to participate in most of these activities. According to Mark Baldassare, president and CEO of PPIC, "The growing use of cell phones for accessing the Internet is changing the way Californians relate to work, and this trend also has promised for reducing the digital divide" [12] (p. 3).

Research shows that young students spend more time on computer, Internet, and mobile phone using than any other age group, with most of that time spent on social network sites [13]. A 2007 nationwide survey conducted by the U.S. National School Boards Association finds young students from age 9 to 17 reported spending at least nine hours per week online on social networking and other websites, a time almost equal to the ten hours per week spent watching television [14]. The study found that young students actively contribute to their own content on the social networking sites. Ninety-six percent of students surveyed said that they were familiar with using Web 2.0 or opening source resources. Seventy-one percent of students were reported using these resources almost every day; and 50% of them said they used Web 2.0 applications to get help in completing their homework [14]. The study also found that 76% of parents believe that social networking helps to strengthen their children's reading, writing, and social skills.

Teens spend more time on the Internet gaming, instant-messaging, file and photo sharing, and social communicating than on studying or information searching [15, 16]. They participate in Web 2.0-based activities as authors and consumers of content from file sharing to online gaming and writing on blogs [17-19]. One survey showed that about 35% of all teens do blogging, 54% post photos online, 19% post videos, 39% share their own artistic creations online, 26% remix content, 27% maintain personal web pages, and 28% have their own blogs [20]. Clark et al. [15] found that young students surf about 30 social networking sites. Most use these sites in and out of school for social communication; only a few, however, use them for academic purposes. This might be because schools or students are unaware of the educational advantages of using social-networking sites and social-networking tools. Young students enjoy the benefits of getting multiple resources from the Web [21].

Text messaging, playing online games, downloading music, audio, video, and accessing news, sports, financial or credit information have already become the most common activities among mobile Internet users worldwide [1]. Participation in social networking is becoming very popular among teen Internet users through personal computer or cellular devices [7]. A growing number of kids are using social networking sites. According to two surveys released in 2009 by Pew Internet Research, 38% of respondents aged 12 to 14 claimed to have an online profile; while 61% of those from ages 12 to 17 claimed to use social networks; 42% of them daily [22]. Once on the Internet, teen users are most likely to spend their time on newly emerging Web 2.0 activities, such as watching user-generated videos, reading and posting blogs, and participating in social networks rather than traditional *Web 1.0* activities [1]. The IDC expects that, over the next few years, making online purchases, participating in online communities, and creating blogs will be the fastest growing applications among teen Internet users [23].

B. Effect of Web 2.0 Technology on Teaching-Learning Mathematics in the United States

In the United States, technology has been a powerful tool in the mathematics classroom for several decades. Technology is one of the six principles stated in the National Council of Teachers of Mathematics (NCTM)'s Principles and Standards for School Mathematics [25]. The NCTM (2000) recommends 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, to how mathematics is assessed [26]. Technology is playing an increasingly important role in teaching-learning mathematics at all levels in the U.S. U.S. schools and mathematics classrooms are equipped with advanced technological tools including sufficient number of computers, projectors, smart-boards, graphical calculators, etc. [25]. Standalone software, Computer-Based Instruction (CBI), and web-based interactive applets have served to enrich the mathematics classrooms. Mathematical programs or tools that are widely used in U.S. mathematics classrooms include Terrapin Logo, Geometer's Sketchpad, Fathom, My Mathematical Life, Math Arena Advanced, Data Explorer, TI-84 Graphing, and Explorer Calculators [25].

However, unfortunately, technology has not reached its full potential in many mathematics education programs in the United States [27, 28]. Many prospective mathematics teachers' view on the role of technology in mathematics education is not satisfactory [29]. Habre and Grunmeier [29], found that prospective mathematics teachers believe that mathematics teachers should use technology to help teach students mathematics in mathematics classrooms and that mathematics and technology should remain the focus of instruction in mathematics classrooms. However, many of these preservice teachers believe that in many mathematics classrooms technology is used improperly in ways that focus more on the technology than on mathematical understanding or calculation. For instance, in an experiment if students are shown tessellations of a plane using a web-based Java applet many participants may skip the mathematical knowledge behind the tessellation, as a Java applet may not show the mathematical calculation behind it [29].

The use of computers for instructional purposes still lags behind the integration of technology in the corporate world and is not used as frequently or effectively as is needed [26]. Many newly graduated preservice mathematics teachers do not have sufficient experience in the use of computers in teaching-learning processes [28]. In a study conducted by Smith and Shotsberger [30], most preservice mathematics teachers identify technology as important in education; however, due to lack of knowledge, some of them are uncomfortable discussing the specific use of technology for instruction. Over the decade, many preservice mathematics teachers' feeling remain unchanged that they think after graduation they might not be well prepared to teach with technology in their classrooms [31, 32].

Simple Web 2.0 tools such as Blogs, Facebook, Wikis, etc. that allow end 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 such multiuser virtual environments. As Web 2.0 tools and technologies facilitate a relatively quick communicative exchange between individuals who are geographically or temporally distant [33], they could lead to new dimensions that could enhance mathematics education. These simple Web 2.0 tools and technologies can provide tremendous possibilities for building collaborative teaching-learning environments in mathematics education. As a simple Web 2.0 tool, mathematics teachers can use blogs to post announcements for their students and parents; students can build their portfolios and digital diaries; and students can share their reflections with others and plan for new projects. Blogs can be used as the means of obtaining or outsourcing solutions of quizzes, fallacies, and various mathematical problems students need to know to be prepared for competitive tests.

II. METHODOLOGY

This study was intended to investigate prospective U.S. secondary mathematics teachers' engagement on using Internet, handheld cellular devices, and Web 2.0 technologies, and their views of using Web 2.0 technologies for teaching-learning mathematics. It also investigated their opinion of including blogs and/or other Web 2.0 technologies in mathematics education curricula. The investigation was based on a semester-long blogging activity that was included as a supportive teaching-learning tool in a college Euclidean Geometry course offered in a university in the Western United States. The blog was conducted for 12 weeks, as a standard component of this course. The blog can be visited at: http://edsc353fall2011.wordpress.com/.

Twenty-eight prospective high school mathematics teachers enrolled in the college Euclidean Geometry class. All of them willingly participated 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, 1^{st} and 7^{th}, 2^{nd} and 8^{th}, 3^{rd} and 9^{th}, 4^{th} and 10^{th}, 5^{th} and 11^{th}, or 6^{th} and 12^{th}. 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. Each student created a pseudonym to maintain confidentiality throughout the activity. During their 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, also, responsible for submitting a complete solution to one of the eight problems posted during that week.

At the end of the 12-week activity, the researchers collected both quantitative and qualitative data through a survey questionnaire. Validity and reliability of the instrument were measured through appropriate procedures and were found to be authentic and consistent. An electronic copy of the survey instrument can be seen at: http://edsc353fall2011.files.wordpress.com/2012/10/survey_instrument.pdf.

As this paper depicts outcomes of the following two research questions only, it deals with only a portion of the entire survey questionnaire as shown in the Appendix.

(i) *What are prospective secondary mathematics teachers' perceived experiences of using Internet, hand-held cellular devices, and Web 2.0 activities?*

(ii) *What are prospective secondary mathematics teachers' views on the advantages and disadvantages of the blogging activity and including blogs and/or other Web 2.0 technologies in mathematics education curricula?*

Prior to collecting data, permission was sought from the Institutional Review Board (IRB) of the university where the study was conducted. Participants' consent was taken through an assent form, prescribed by the university. Additionally, an information script describing the purpose of the survey was read aloud to the class members, who 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 class members who agreed to participate completed the survey in the absence of the researchers. Thus, the researchers did not have any control on the participants' responses. All 28 class members who attended class regularly and participated in the blogging activity participated in the survey.

Descriptive statistics indicates that twelve (42.86%) of the participants were male, and 16 (57.14%) were female. 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. The participants were asked to state the approximate average total time spent on the Internet per week in hours for all purposes. The mean, median, and range of these responses were 22.43, 20.50, and 55 hours respectively, with a standard deviation of 10.823 hours.

III. FINDINGS

To answer the first research question, *what are prospective secondary mathematics teachers' perceived experiences of using Internet, hand-held cellular devices, and Web 2.0 activities?* The participants were asked a number of quantitative questions, items, 1-7 of the survey instrument (see in the appendix). These items pertain to participants' use of Smartphones or Internet connected handheld cellular devices to access the Internet; their self-reported skills in using the Internet in terms of sending or receiving emails, browsing webpages, searching information, reading news on the Internet, etc.; their interest/engagement in Web 2.0 applications such as: blogs, facebook, podcasts, twitter, wikis, etc.; and their experience in blogging prior to participating in this activity.

Nine (75%) of the male and eleven (68.8%) of the female participants – in total 20 (71.4%) of the 28 participants reported that they used smartphones or Internet connected handheld cellular devices to access the Internet. Only three (25%) of the male and five (31.2%) of the female participants – in total eight (28.6%) of the 28 participants reported that they did not use smartphones or Internet connected handheld cellular devices to access the Internet (Table I).

TABLE I GENDER * USE OF SMARTPHONE* INTERNET SKILLS CROSS TABULATION

Gender	Use a Smartphone	Do Not use a Smartphone
Male	9 (75.0%)	3 (25.0%)
Female	11 (68.8%)	5 (31.2%)
Total	20 (71.4%)	8 (28.6%)

Ten (83.3%) of the male and ten (62.5%) of the female participants – in total 20 (71.4%) of the 28 participants reported that they had excellent skills in using the Internet for sending or receiving emails, browsing webpages, searching information, and reading news on the Internet, etc.; the remaining two (16.7%) male and six (36.5%) female participants reported that they had good skills in these areas. No one reported average or poor skills in using the Internet (Table II). The study did not find any significant difference between male and female participants' trend of using smartphones as well as in their self-reported skills in using Internet in terms of sending or receiving emails, browsing webpages, searching information, reading news on the Web.

TABLE II GENDER * INTERNET SKILLS CROSS TABULATION

Gender	Excellent	Good	Average	Total
Male	10 (83.3%)	2 (16.7%)	0	12 (100.0%)
Female	10 (62.5%)	6 (37.5%)	0	16 (100.0%)
Total	20 (71.4%)	8 (28.6%)	0	28 (100.0%)

Six (50%) of the male and eight (50%) of the female participants – in total 14 (50%) of the 28 participants reported very much interest/engagement in Web 2.0 applications such as: blogs, facebook, podcasts, twitter, wikis, etc. The remaining 50% of the male and 50% of the female participants reported average interest/engagement in Web 2.0 applications such as: blogs, facebook, podcasts, twitter, wikis, etc. No one reported little interest/engagement in these Web 2.0 applications (Table III).

TABLE III GENDER * ENGAGEMENT IN WEB 2.0-BASED SOCIAL NETWORKS CROSS TABULATION

Gender	Very Much	Average	Little	Total
Male	6(50.0%)	6(50.0%)	0	12(100%)
Female	8(50.0%)	8(50.0%)	0	16(100%)
Total	14(50%)	14(50%)	0	28(100%)

However, only one (8.3%) of the male and one (6.2%) of the female participants – in total 2 (7.1%) of the 28 participants reported that they had very much previous experience in blogging prior to participating in this activity. Six (50%) of the male and eight (50%) of the female participants – in total 14 (50%) of the 28 participants reported that they had average previous experience with blogging; and five (41.7%) of the male and seven (43.8%) of the female participants – in total 12 (42.9%) of the 28 participants reported that they had little previous experience in blogging (Table IV). The study did not find any significant difference between male and female participants' engagement in Web 2.0-based social networking activities as well as their previous experience in using blog, facebook, podcast, twitter, wikis, and other Web 2.0 activities.

TABLE IV GENDER * PREVIOUS EXPERIENCE IN BLOGGING CROSS TABULATION

Gender	Very Much	Average	Little	Total
Male	1(8.3%)	6(50%)	5(41.7%)	12(100%)
Female	1(6.2%)	8(50%)	7(43.8%)	16(100%)
Total	2(7.1%)	14(50.0%)	12(42.9%)	28(100.0%)

To meet the needs of the second research question the participants were asked the following open-ended questions, items 8-10 (see in the Appendix): *What were the advantages of this blogging activity? What were the disadvantages of this blogging activity? Do you recommend the blog and other Web 2.0 technologies to be incorporated in other mathematics courses in the teacher education program and secondary school curricula? Why or why not?*

In response to the first two open-ended questions, participants reported numerous advantages and a few minor problems of the blogging activity as a supportive tool in the Euclidean Geometry course. Participants reported that the use of the blog was: 24/7 accessible; alternative source of solution; collaborative; convenient; enjoyable; encouraging; engaging; source of getting feedback from others; safe and secured; and technology savvy. Participants did not mention any major disadvantage of using the blogging activity, although some of them mentioned a few minor problems as they experienced. One such problem mentioned was that some participants who were first time users of the blog found it difficult to start, and follow the directions. Another problem was that the participants were unable to use mathematical symbols, equations, and construction tools on the blog.

Table V presents an overview of the various themes identified as major advantages and disadvantages/problems of the blogging activity that the participants mainly focused on. The analysis shows that on average male and female participants hold similar views regarding the major advantages and disadvantages/problems of the blogging activity. Although a few more females reported difficulty in blogging and personally disliked the activity, that rate was not much higher than that of the male participants.

In response to the third open ended question, most of the participants found the blog to be an effective supporting tool for teaching and learning Euclidean Geometry and other mathematics classes. One participant noted: "I definitely recommend blogs and Web 2.0 technologies to be implemented in mathematics classrooms. It is an interactive activity outside of class which allows students to apply what they have learned and find errors or alternative solutions on others' work. It was easy, accessible, and effective." Another participant noted: "Yes, definitely. The discussion forum is my favorite. Getting a chance to share ideas with other future teachers is important." Another participant noted: "Absolutely, it is a great and valuable tool for both students and teachers." Another participant noted: "I definitely recommend blogging activities be used in any subject not just math. Using blogging activities like this allows students to work together." Another participant noted: "Yes, as it offers another resource."

Another participant noted: "I would like to use blogging in my math class when I will be a teacher, because I feel that it can be a good learning tool." Another participant noted: "Yes. Students are used to this technology and are excited when they incorporate something they are familiar and skilled with to something they are learning. This technology has so much potential and efficiency, if it is utilized correctly, it can be such a useful tool." Another participant noted: "Yes. Because it is engaging for students and it is also good practice to use technology within mathematics." Another participant noted: "Yes, because it fosters divergent and parallel thought processes and decentralizes the role of the teacher. This was not just an activity." Another participant noted: "A blog can be helpful for students to learn from each other. So yes, I would agree and recommend it."

TABLE V MALE VS. FEMALE PARTICIPATION RATES ON MAJOR ADVANTAGES AND DISADVANTAGES/ PROBLEMS OF THE BLOGGING ACTIVITY

Area of View	Theme	Male (%)	Female (%)
Advantages of the blogging activity	24/7 Accessible	4 (33.3%)	3 (18.75%)
	Alternative Source	2 (16.67%)	3 (18.75%)
	Collaborative	1 (8.33%)	2 (12.5%)
	Convenient	2 (16.67%)	1 (6.25%)
	Enjoyable	2 (16.67%)	0
	Encouraging	1 (8.33%)	2 (12.5%)
	Engaging	1 (8.33%)	3 (18.75%)
	Getting Feedback	2 (16.67%)	1 (6.25%)
	Safe and Secured	1 (8.33%)	2 (12.5%)
	Technology Savvy	0	2 (12.5%)
	Average	1.6 13.33%)	1.9(11.88%)

Disadvantages/ Problems of the blogging activity	No Disadvantage	1 (8.33%)	3 (18.75%)
	Difficult for New Bloggers	0	2 (12.5%)
	Difficulty in Using Geometric Notations	0	2 (12.5%)
	Enforcing	1 (8.33%)	1 (6.25%)
	Isolated	1 (8.33%)	2 (12.5%)
	Personal Dislike	0	3 (18.75%)
	Average	0.5 (4.16%)	2.1 (13.54%)
Note. For Male N = 12, Female N = 16			

Another participant noted: "I recommend a blog because it can allow students to interact on a side where a teacher can still oversee what students are doing. Also, the blog can always be updated." Another participant elaborated: "I would recommend the blog because today's students are technology savvy. I think it would work to interest most students. I would only question whether all students have access to a computer to participate in the blog. Not every student has access to be able to participate in." Another participant elaborated: "I think a blog could be useful in the education program to write about our practicum. In high schools, blogs can be used but I'm not too sure how far math, besides geometry obviously. It would be useful to use as a way of tracking student understanding without having an exam. Also it holds students accountable to do work." Another participant noted: "Yes it is a good tool for teachers who are technology savvy."

However, some participants made more careful or cautious comments regarding their recommendation of using Web 2.0 technologies in secondary mathematics and teacher education curricula. One participant noted: "Yes, if students have access [to the Internet], it's a good way to solicit input; however, in low Supplemental Educational Schools (SESs).Any outside computer activity will tend to disadvantage a sizeable fraction of the students." Another participant elaborated: "Yes, but solely for teacher education programs. I personally don't think it would be substantial in a regular mathematics class but having it in a teacher education program it helps us future educators learn from each other."

IV. DISCUSSION AND IMPLICATION

The study found some interesting and fruitful results that might be useful for prospective and inservice mathematics teachers, teacher educators, and researchers. First, the study found that more than 71.4% of the prospective mathematics teachers used smartphones or Internet connected handheld cellular devices to access the Internet. These numbers are almost the same for males and females – 75% vs. 68.8%, respectively. A same percent of them reported that they had excellent skills in using the Internet for sending or receiving emails, browsing webpages, searching information, and reading news on the Internet, etc. No one reported having average or poor skills in using the Internet. All of them reported that their interest/engagement in Web 2.0 applications such as: blogs, facebook, podcasts, twitter, wikis, etc. was at the level of "very much" to "average". No one reported little interest/engagement in Web 2.0 applications. However, only 8.3% of the male and 6.2% of the female participants – in total 7.1% of the participants reported that they had very much previous experience in blogging prior to participating in this activity. About 93% reported that they had average to little previous experience in blogging before participating in this activity. These findings are similar to those of the California survey that found that 55-56% of California residents are more likely to go online from their desktop or laptop computers, whereas 40% connect to the Internet from their cell phones.

The study revealed that participants generally reported massive engagement in accessing the Internet and Web 2.0-based activities through cellular and handheld mobile devices, without any significant differences based on their gender. One implication of these results might be that, professors and teachers who wrongly believe that males are being given an unfair advantage when computers and information technology are incorporated into a class should reconsider this thought. This study suggests that implementing a blogging activity should not provide any advantage to either males or females as some educators may wrongly believe to be the case. Therefore, professors and teachers should feel confident about implementing this type of activity without having to worry about unfairly advantaging male or female students.

Prospective mathematics teachers found blogs to be a supportive tool for collaborative teaching and learning purposes. Additionally, participants had positive attitudes toward a blog and perceived the blog to be effective in the teaching and learning of mathematics. They highly recommended using blogs and other Web 2.0 tools for teaching and learning purposes. One implication of these findings might be that, since undergraduate college students and prospective mathematics teachers responded positively to this activity and perceived it to be effective then there is a good chance that high school and middle school students and/or in-service mathematics teachers might, also, find it beneficial. Thus, middle or high school teachers should consider implementing activities similar to those used in this study in their own classrooms. Further teacher educators should provide instruction to prospective teachers regarding the implementation of blogging activities and encourage prospective teachers to use them in the future. Additionally, curriculum developers and policy makers should use their influence to encourage the inclusion of blogs and or/other Web 2.0 technologies in the middle school, high school, and teacher education mathematics curricula.

Participants reported the collaborative nature of the blog and its ability to be engaging as the most beneficial features of using a blog in a Euclidean Geometry course. These findings are analogous to Shihab's [24] findings:

Web 2.0 tools allowed teachers to be more efficient in establishing a collaborative environment than what was originally

possible in their traditional classrooms. …. With Web 2.0 tools, teachers reported achieving exceptional levels of student engagement. The ease of use and the online nature of these tools allowed all students to interact with almost everyone in the class. . . . Students learned from each other and developed their commentary skills by commenting on each other's blogs. [24, p. 89-90]

The present study indicates that prospective 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 and 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 related to 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.

V. CONCLUSIONS

The acceleration of smartphones and handheld mobile devices; the rapid growth of internet and mobile web usage; the engagement of U.S. young generation' use of Web 2.0 technologies; and the potential use of Web 2.0 technologies for supporting and promoting teaching-learning mathematics, served as the impetus for the researcher to conduct this study. A review of literature revealed that the U.S. young generation including prospective mathematics teachers and students have enormous engagement in accessing the Internet and Web 2.0-based activities through cellular and handheld mobile devices, without any significant differences based on their gender. They study revealed numerous advantages and a few minor problems of the blogging activity as a supportive tool in the Euclidean Geometry course, as prospective mathematics teachers experienced. The participants found blogs to be a supportive and useful tool for collaborative teaching and learning purposes.

The study suggests that blogs and other Web 2.0 tools should be incorporated in the middle and high school mathematics education curricula. The findings of the study also suggest that blogs and other Web 2.0 tools could be utilized to improve the teaching and learning of mathematics, in the United States as well as other developed and developing countries, because in such activities students get more opportunities to communicate and collaborate with the teacher and with their peers. As more students engage in online discussions of various mathematical topics and participate in open forums, the depth and breadth of their mathematical understanding should expand. Further, the study suggests that blogs, wikis, and similar Web 2.0 tools might provide a great opportunity for students and classroom teachers to share their voices in an open and public forum, providing an opportunity for individuals who do not typically get a chance to publish their perspectives to have an outlet for their ideas. These potential advantages combined with the relatively low cost of using blogs suggest that blogs may provide a strong alternative for teachers and students who cannot afford costly mathematical software or Web-based applications.

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Appendix: Survey Instrument

Please fill out this questionnaire based on your perceptions of the blogging activity in the course, EDSC 353: Teaching Secondary Geometry, in the fall semester of 2011.

I. Demographic Information

1. Please indicate your gender: □ Male □ Female

2. Please state your age: _____ years.

II. Experience in using Internet and Web 2.0 Applications

3. Do you use a Smartphone or Internet connected cell handheld device to get access to the Internet?

□ Yes □ No □ I do not use a cell phone

4. How much total time do you spend per week on the Internet for all purposes? _____ hours.

5. How do you rate your skills in using the Internet in terms of sending or receiving emails, browsing webpages, searching information, reading news on the Web, etc.?

□ Excellent □ Good □ Fair

6. How do you rate your interest/engagement in Web 2.0 applications such as: blog, Facebook, podcast, twitter, wikis, etc.?

□ Very Much □ Average □ Very Little

7. Before participating in this activity how much experience in blogging did you have?

□ Very Much □ Average □ Very Little

III. Open Ended Question

8. What were the advantages of this blogging activity?

_____
_____
_____
_____
_____
_____
_____

9. What were the disadvantages of this blogging activity?

_____
_____
_____
_____
_____
_____

10. Do you recommend the blog and other Web 2.0 technologies to be incorporated in other mathematics courses in the teacher education program and secondary school curricula? Why or why not?

_____
_____
_____
_____
_____
_____