**Mathematics Teachers' Engagement and View on Using Web 2.0 Technologies for Teaching and Learning Purposes**

**Abstract:** This paper presents quantitative and qualitative data that examines the perceptions and experiences of prospective mathematics teachers regarding the use of the Internet, Web 2.0 activities, and hand-held cellular devices. Their recommendations related to using blogs and/or other Web 2.0 technologies for the teaching and learning of Euclidean geometry and other mathematics courses are provided. The data shows that approximately three quarters of these prospective mathematics teachers used smartphones or Internet connected handheld cellular devices and about 93% were used to using a number of Web 2.0 activities. Prospective mathematics teachers found blogs to be a supportive tool for collaborative teaching and learning purposes; and they highly recommended using blogs and other Web 2.0 tools for these purposes.

**Introduction**

The acceleration of iPhone and Smartphone 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 (IDC CEMA Telecommunications Newsletter, 2008). By the end of 2010, wireless broadband subscriptions in the Organization for Economic Co-operation and Development (OECD) countries exceeded half a billion (TelecomPaper, 2011).

Thus, it is likely that, within a couple of years, the number of mobile Internet users will overtake fixed Internet users (Ingram, 2010). 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. 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 (Internet World Stats, 2011). 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. The remainder of this paper provides a brief review of young students’ trends on smartphones and social networks, and presents 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.

Young Students’ Trends on Smartphones and Social Networks

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 is spent on social network sites (Lenhart, 2009). A 2007 nationwide survey conducted by the U.S. National School Boards Association finds that young students from ages 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 (National School Boards Association, 2007). 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 open source resources. Seventy-one percent of students 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 (National School Boards Association, 2007). The study also found that 76% of parents believe that social networking helps to strengthen their children’s reading, writing, and social skills.

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 age 18-24 use Twitter or another service, up from 19% in December 2008 (Pew Internet, 2009). A survey by the Public Policy Institute of California (2011) found that by the first half of 2011, 52% of Californians 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 promise for reducing the digital divide” (Baldassare, Bonner, Petek, & Shrestha, 2011) (p. 3).

Teens spend more time on the Internet gaming, instant-messaging, file and photo sharing, and social communicating than on studying or information searching (Clark, Logan, Luckin, Mee, & Oliver, 2009; Selouani & Hamam, 2007). They participate in Web 2.0-based activities as authors and consumers of content from file sharing to online gaming and writing on blogs (Boyd, 2007; Lenhart & Madden, 2009; Richardson, 2006). 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 (IDC CEMA Telecommunications Newsletter, 2008). Participation in social networking is becoming very popular among teen Internet users through personal computer or cellular devices (Internet World Stats, 2011). A growing number of kids are using social networking sites. According to two surveys released in 2009 by Pew Internet Research, 38% of respondents ages 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 (CNN Tech, 2009). 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 (IDC CEMA Telecommunications Newsletter, 2008). 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 (Kairer, 2009).

**Methodology**

Due to the page limitation of this paper, a detailed methodology of the study cannot be presented here. Briefly, this study 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. 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.

Quantitative and qualitative data were collected using a survey questionnaire developed by the researchers to answer the following research questions:

1. *What are prospective secondary mathematics teachers’ perceived experiences of using Internet, Web 2.0 activities, hand-held cellular devices?*
2. *What are prospective secondary mathematics teachers’ views on including blogs and/or other Web 2.0 technologies for teaching-learning of mathematics curricula?*

Prior to collecting data, permission was sought from the Institutional Review Board (IRB) of the university where the study was conducted; and all standard procedures were maintained. All 28 class members who attended class regularly and participated in the blogging activity participated in the survey. Descriptive statistics indicate 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.

**Findings**

To answer the first research question, the participants were asked a number of quantitative questions, items, 1-7 of the survey instrument, as shown 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 (Table 1).

| Table 1  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. No one reported average or poor skills in using the Internet. 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. No one reported little interest/engagement in these Web 2.0 applications. (Table 2)

| Table 2  Gender \* Engagement in Social Networking 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 3).

| Table 3  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 an open-ended question: *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 this 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.

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 utilized correctly, it can be such a useful tool.” Another participant noted: “Yes. Because it is engaging for students it is also good practice to use technology within mathematics.” 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.” 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.”

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).

**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. 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.

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.

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.

**Conclusions**

This study suggests that blogs could be a vehicle to improve the teaching and learning of mathematics 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 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 Internet, 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. 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?

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