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Chapter 7 - Teaching Emerging Technologies to Pre-Service Teacher Candidates

Michael McVey
Eastern Michigan University, mmcvey@emich.edu

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TEACHING EMERGING TECHNOLOGIES TO PRE-SERVICE TEACHER CANDIDATES

Michael McVey
Department of Teacher Education
Eastern Michigan University

BACKGROUND

Nationwide, in roughly one third of university training programs for teachers, pre-service teacher candidates are required to take a course to learn how to teach effectively with technology. Many of the computer applications they learn are required for improving productivity, both for themselves and for their students. These applications include word processing, spreadsheets, and presentation software, which one would hope are a standard feature in today's classrooms. In addition to these tools and applications, appearing in classrooms is a new class of emerging technologies generally known as Web 2.0 applications. These web-based applications are freely available, highly interactive, but despite their potential to transform schools and teaching, they are not yet widely used. Consequently, their application to classroom teaching is more potential than practice.

My question, as a scholar of teaching and learning, is whether we could more effectively introduce teacher candidates to an interactive affordance, for example, a small-scale social networking application, by placing the tool into the context of personal experiences and the individual need of the student teacher. The ultimate evidence of effective teaching would be that pre-service teacher candidates are able to demonstrate convincingly a robust understanding of its potential as a tool for instruction. Understanding the potential for a tool beyond how it works in isolation is important for pre-service teacher candidates since it may be a year or two (or longer) before they actually have the opportunity to put the tool to use in their own classrooms. During that time, the tool may have transformed with technological improvements or the shifting dynamics of the market place although its function may remain relatively the same.

In order to assess this depth of understanding of a small-scale social networking application as an aid to the practice of teaching, I took two groups of students and asked an open-ended question about the potential for using the tool in their teaching practice. I then performed a qualitative analysis of their responses. In one group, there was no learning activity to place the tool into a personal context. Meanwhile, in another group, students engaged in a learning activity in which actively used the tool for their own personal use. I assessed their understanding of the potential of the tool as an aid to classroom teaching by constructing a typology for categorizing their responses to the open-ended survey question.

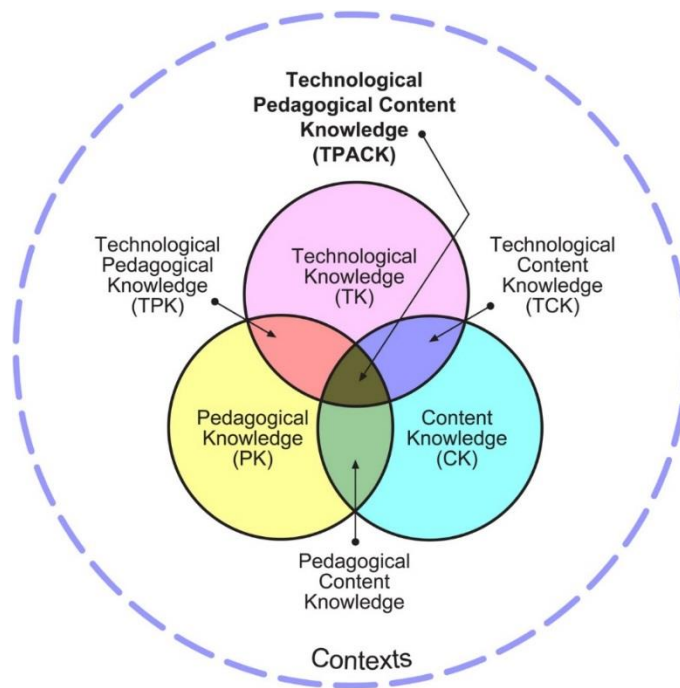
THE QUESTION

Does the engagement of teacher candidates with a learning activity that places a small-scale social networking application into the context of their personal experiences lead to a deeper understanding of the potential uses of the tool in classroom practice?

LITERATURE REVIEW

As with any new technological affordance that might improve pedagogical practice, both K-12 and Higher Education, there is a clear need to provide training in the use of the tool or software application (Hughes, 2004). The larger issue is not whether the instructor knows how to use the tool but whether the instructor knows when to use the tool and in what context. Mishra and Kohler modeled this overlap of teaching skills, technology skills, and content area expertise as TPACK or Technology Pedagogical Content Knowledge (Mishra & Koehler, 2006; Shulman, 1987). Using the TPACK model (Figure 1) such a tools training would naturally focus on Technological Knowledge, or TK (Pryor & Bitter, 2008).

FIGURE 1: TECHNOLOGICAL PEDAGOGICAL CONTENT KNOWLEDGE SOURCE: MISHRA, P., AND M. J. KOEHLER. 2006. TECHNOLOGICAL PEDAGOGICAL CONTENT KNOWLEDGE: A FRAMEWORK FOR INTEGRATING TECHNOLOGY IN TEACHER KNOWLEDGE. TEACHERS COLLEGE RECORD 108 (6):1017-1054.



Margaret Niess summarized the issue of when to use technology in terms similar to the Technology Content Pedagogy Knowledge model and reminds teacher preparation faculty that the introduction of technology requires careful consideration of how technology can impact student interaction with the subject matter (Niess, 2008). The higher level of thinking to which these courses should aspire is to have students evaluate the technologies and tools in light of the teaching situation in which they hope to find themselves.

In order to teach the use of a new tool or application to pre-service teacher candidates, instructors employ strategies based in the science of learning. With this in mind, I looked to the literature for help in designing a learning activity that would engage students with any new type of technology. Halpern and Hakel (2003) listed ten basic principles faculty members would do well to address if they were teaching for long-term transfer of knowledge rather than just teaching for short-term retention. Several of the principles are readily accessible to teaching new educational technologies in a way that encourages long-term transfer of knowledge. These principles include: 1) having students take knowledge in one format and reconfigure it into another, 2) relying on previous knowledge students bring to the class, 3) avoiding lectures unless basic recognition is the goal, and 4) actively engaging students in the learning process.

Yilmaz (2008) gathered together many of these principles and explained their roots concluding that the pedagogical philosophy of constructivism has deep implications for pedagogical theory and research. Many of these same principles of constructivist thinking were integral to literature about teaching in the classroom. Brooks & Brooks (1993) enumerated five pillars on which constructivist classrooms are based: (1) posing problems of emerging relevance to learners; (2) structuring learning around primary concepts; (3) seeking and valuing students' points of view; (4) adapting curricula to address students' suppositions; and (5) assessing student learning in the context of teaching.

In the design of an effective learning activity to draw students into a deeper understanding of a new technology, these principles all have intense value to the research and inform the creation of learning tasks for students. Colleagues at a comparable institution adopted pedagogy from Holmes and Gardner (2006) called *communal constructivism* (as cited in Wetzel, Foulger, & Williams, 2008). In this approach, students work together to construct their own understandings. Their pedagogical approach suggests that students should work in small groups in order to encourage discussion of the rationale and design for the creation of a small-scale social network. I decided the activity would have the option of teams of two.

One of the most important goals in teaching a new tool or application to pre-service teacher candidates is the eventual adoption of that tool into the practice of teaching. In thinking of its introduction into the practice of teaching, it is helpful, in the context of this paper, to consider the process of adoption. One model that has been widespread in professional development is CBAM, the Concerns Based Adoption Model (Hall & Hord, 1987). Change is a process and "depending on the personal make-up, knowledge, and experience, each person perceives and mentally contends with a given issue differently; thus there are different kinds of concerns" (p. 59). This model applies to the process of the teaching of new tools and applications. The concerns model identifies and provides ways to assess seven stages of concern. The stages have major implications for professional development as they point out the importance of knowing where people are and addressing the questions they are asking while they are asking them. This model also suggests the importance of paying attention to implementation for several years as early concerns can be resolved making room for later ones to emerge. According to the model, teachers need to have their self-concerns addressed before they are ready to attend hands-on workshops. As an instructor, I can provide some background knowledge about the affordances surrounding the tool through either direct instruction or other self-paced methods. This model, though, does not entirely fit the way pre-service teacher candidates interact with and use these tools.

Students do not necessarily form an opinion after they gain some background but, rather, compare the use of this tool against their own prior experience with similar tools and applications. For pre-service teacher candidates in technology training, instructors can only hope to provide students with a knowledge base about a collection of tools that they could possibly use. Their potential for use depends on a variety of factors including: 1) the grade level, 2) the subject matter, 3) the availability of computers, 4) the availability of appropriate software, 5) students' access to the technology, 6) the skill level of the students, and 7) administrative support. This latter is especially important for emerging applications involving social networking.

The point at which students use the tools comes long after they have left their educational technology class behind. If they remember to consider any particular tool, it must be readily apparent to the classroom teacher as valuable, useable, and practical based on all of the factors noted earlier.

Many factors can influence the opinions new teachers have of new tools and applications and these factors can affect the likelihood and rate of the adoption of innovations. These factors are trialability, observability, complexity, relative advantage, and compatibility (Wolff, 2008). At their most simplified, each asks a question about the tool or application: Trialability: Can teachers try it out? Observability: Can they see it in action? Complexity: Is it understandable? Relative advantage: Is it an improvement over previous practice? Compatibility: Does it fit with the user's skill levels? Rogers (2003) suggested that too radical a shift from current beliefs or practices might reduce the likelihood of adoption.

The problem in applying any innovation model to practice for pre-service teacher candidates is that there is a substantial period between when they first gain background knowledge about the tool or application and when they can first assess its potential to amplify their practice. In addition to the issues that challenge any new teacher, Zhao et al. (2002) note that interrelated factors such as general technology proficiency, pedagogical perspective, and social awareness can also be factors that affect the adoption of new technologies. Zhao et al. (2002) suggest that the greater the distance from current pedagogical practice, the less chance of them adopting the innovation.

It is my contention that it is the decision maker's *perception* of the distance between the innovation and current practice that effective contextualization can influence. For example, setting up a small-scale social network may be difficult to align with a pre-service teacher candidate's impression of the role of the teacher. However, when framed within the context of commonly understood social groupings such as church/synagogue/mosque groups, teams, clubs, causes, and family events, the idea of the small-scale social network is arguably more understandable and applicable to teaching practice. Teacher candidates can easily understand such social groupings as evidenced by their planning of their own social networks. These created-groups appear to lead to a reduction of the perceived distance between practice and innovation and reduce barriers to adoption.

METHOD

To be successful at a basic level, courses introducing the teaching applications of technology teach the way tools work. For example, teachers should know how to enter and manipulate data in a spreadsheet program. Ambitious technology training courses may teach not only how to use the tool but when to use it. Knowing when to use a technological affordance requires a deep level of understanding of both content and pedagogy. Student can use a spreadsheet program to create a weekly schedule, technically speaking, but there are better applications available for making a calendar. There are far more student-engaging uses for a spreadsheet program than creating a static table.

For this study, I demonstrated to two groups of students in a face-to-face class how to join a small-scale social networking site designed for our class where they could post their own images, provide self-introductions, engage in conversations with each other, and listen to podcasts I had produced for them. In one group, I neither elaborated upon the tool nor provided training, and I used only the slimmest of contextualization to orient my students to its use. In the following semester, I repeated the same procedure but intervened with a learning activity based upon literature from practitioners experienced in using emerging technologies in Higher Education (Reynard, 2008). The intervention, the learning activity, I designed for this study was designed to place the small-scale social network into a personal context with an assignment where students had consider a potential audience for the tool and create a social network of their own.

The source of data to demonstrate how students perceived the importance of the tool was an optional post-course survey containing an open-ended question about the effectiveness of the tool and its applicability

to the teaching profession. I removed grading as a possibly confounding factor with an explanation that there would be a non-graded survey at the end of the semester. In the invitation to participate, I told students there was no connection between their honest opinion about small-scale social networking and their grade. In fact, I would not receive the results until after the semester was over. As well, strict confidentiality was enforced.

DEVELOPMENT OF AN ASSIGNMENT

The absence of a contextualizing framework risks making emerging technologies appear to be irrelevant to the sequence of skills taught. I introduced the small-scale social networking application by way of a brief online video explaining where it fit against the larger backdrop of large-scale social networks such as Facebook and MySpace. I briefly demonstrated the potential benefits of engaging with the tool to learn its use and to assess its potential impact as an aid to pedagogy.

In my class, previous exposure to small-scale social networking applications was limited, at best, and I engaged students only by asking them to join a network I had set up for the class and upload an image of themselves. The course needed an assignment, a learning activity, which would develop a deeper understanding of how the application worked and provide an opportunity to evaluate its potential. Several colleagues had a suggestion that was the simplest of plans, “Just have them make one.” The result was an activity that was engaging and students could accomplish in a single class period.

In this assignment, this learning activity, students had to design their own small-scale social network for a group, real or imagined. The description of the group they were to embed on the site should explain their goals for the network. They used Ning.com to develop a free site. Accomplishing this task required them to learn the mechanics of creating such a site, but also required students to begin thinking about the potential for these applications. After accomplishing the task, students should have enough background to evaluate the application.

THE ASSIGNMENT

In the first phase of the assignment, which occurred in the first week of the semester, students had to join a previously created small-scale social network that I had designed for class use. This task involved creating an account, answering simple questions on a profile including the grade level they hoped to teach and subject area of greatest interest to them. Students had the option of uploading images of themselves or images that reflected their personalities or interests.

In the second phase of the assignment, which occurred in the sixth week of the semester, students engaged in a general discussion about social networks in an attempt to contextualize the application. This part of the discussion was open ended. During this phase, I led the class in a discussion about the definition of social networks and types with which students were familiar. Most of those known social networks included the more commonly known ones such as Facebook and MySpace. Students were encouraged to discuss what sort of activities participants engaged in when visiting the network. Toward the end of the discussion, I used a technique developed by Edward De Bono (Segal, Chipman, & Glasser, 1985) known as “Plus, Minus, Interesting” in which students had to generate positive and negative aspects of social networking sites. Additionally, I relegated comments that were neither positive nor negative to the column labeled ‘interesting.’ This part of the assignment drew attention to both the instructional potential as well as safety issues related to social networking.

In the third, and final, phase of the assignment immediately following the discussion, students created their own small-scale social network using a free service of Ning.com. The instructor demonstrated social networks as exemplars (McVey, 2008) including one designed for a school field trip (McVey, 2008)(Figure 2), one designed for a family ice-skating gathering, and one designed as part of a course.

Immediately prior to creating their networks, students brainstormed about possible networks they might create. Possibilities that arose through the brainstorming included: 1) classrooms, 2) church / synagogue / mosque groups, 3) student trips, 4) family activities, and 5) clubs or teams. Students targeted their networks for use by: 1) family, 2) students, 3) students' parents, 4) friends, and 5) strangers with common interests. They had thirty minutes to create their network during class time with the instructor offering support and answering technical questions as they arose.

The networks that students created varied widely in content. Among the favorites of colleagues who observed this project was one devoted to new soup recipes (Figure 3), another devoted to fans of a particular automobile, and at least two designed to help students' families plan for a reunion. One of the family sites had over twenty subscribers after only a week and is still active while many of the others are no longer in use.

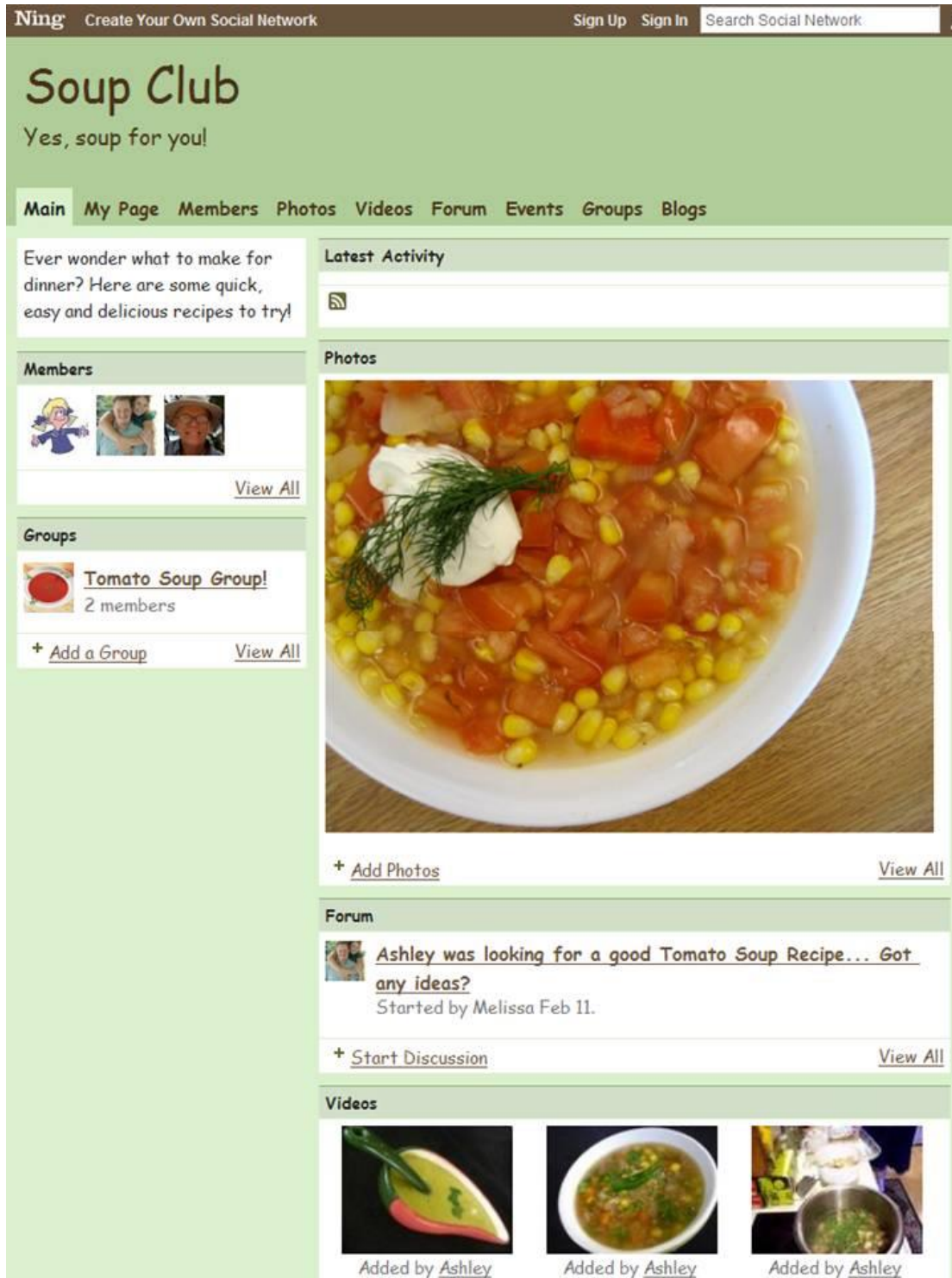
FIGURE 2: SOCIAL NETWORKS AS EXEMPLARS: SCHOOL FIELD TRIP

The screenshot shows a Ning social network page for a school field trip. The page title is "DC Trip 2008" and the group is "McVey Middle School - DC Team". The navigation menu includes "Main", "Invite", "My Page", "Members", "Photos", "Videos", "Forum", "Groups", "Blogs", and "Manage".

The main content area includes:

- A text box with the message: "This is the social network for all families of students going on the Grade 8 Field Trip to Washington DC this summer."
- A "Rick's Blog - On the Road" section with two photos: one of a person pointing at a wall and another of a group of people in a field.
- A "Vietnam Memorial" blog post with the text: "Wow, today we visited the Vietnam War memorial. I have seen pictures of it before, but I was impressed with how many names there were on the wall. It was a real moving experience. Most of the time so far on this trip, my friends and I have been joking around non stop, but that changed when we came into the area. We all, without saying it to each other, knew this place deserved our respect. As we walked closer, we saw several booths with people wanting support to find POWs. We talked to one of them and they explained how there are still, right now, American troops being held. As we continued to approach, the silence was very noticeable. There was a statue to recognize the soldiers that fought in the war that made me stare in amazement. We then went on to walk along the wall. We saw a couple of people doing pencil rubbings of names from the wall. It made me think of who that person..."
- A "Photos" section with a large photo of a person walking in a field with many American flags.
- A "Forum" section with three discussion topics: "Representing Our School and Staying In Touch", "Food", and "D.C. Memoirs Blogged".
- A "Podcasts from the road by McVey" section with five reports: "Report from DC - Marine One?", "Report from DC - Just back from the White House", "Report from DC - Arriving at the Kennedy Center", "Report from DC - The Drive in to DC", and "Report from DC - Just Arrived at BWI".

FIGURE 3: SOCIAL NETWORK AS EXEMPLARS: NEW SOUP RECIPES



DATA ANALYSIS

I conducted a content analysis of the responses to the open-ended question, “What is your perception of the value of a small-scale social networking tool for teachers?” Through the content analysis, I sought to examine trends and patterns of commentary about these networks in relation to teaching. I overlooked issues related to the relative weighting of words and sought instead to capture commonly referring concepts in the texts by relying on emergent coding. The emergent coding helped me to develop a typology suitable for *a priori* coding at the end of the semester in which I made interventions. I narrowed and simplified the categories during this process to the point that there was a maximization of mutual exclusivity and exhaustiveness (Weber, 1990).

There were 84 subjects surveyed, 40 in the Control Group and 44 in the Intervention Group. There were 19 respondents in the Control Group and 22 in the Intervention Group. Of the responses to the survey, both Control and Intervention, all of them were positive either in their tone or directly employed words from a lexical set of positive terms including ‘vital,’ ‘valuable,’ ‘exceptional’ ‘useful,’ ‘beneficial,’ and ‘helpful.’ Those responses not directly employing these adjectives referred to positive benefits from small-scale social networks.

FAMILIARITY WITH SOCIAL NETWORKING

In both groups, the discussion of Social Networking demonstrated general familiarity with a number of the widely available social networking sites available including Facebook, MySpace, Black Planet, LinkedIn, Hi5 and CarDomain.

In the guided discussion, where students were to comment on positive, negative, and interesting aspects of social networking in general, students noted the following *Positive* elements: 1) finding old friends, 2) interacting with peers, 3) connecting with people around the world, 4) cross cultural potential, and 5) connecting with people of shared interest. The potential for interactions that might be of value to them, as teachers, was noteworthy. Students noted the following *Negative* elements to social networking: 1) the potential for stalking, 2) the potential for cyber-bullying, 3) the potential for the invasion of privacy, 4) the potential loss of employment, which is of increasing relevance for new teachers, and 5) the time consuming aspect of being active in such sites. Students noted at least one *Interesting* element to social networking that did not fall easily into either Positive or Negative categories which was the potential for using the sites as an online scrapbook.

ANALYSIS OF THEMES

Ten separate response types emerged from the content analysis (Table 1). Those types, in decreasing frequency of incidence, were: Improvement of Teacher-Student Interaction (19 instances), Improvement of Teacher-Parent Interaction (13), General Pedagogical Application (15), Collaboration Activities (8), Bridging Distance (7), Productivity Improvement (6), Ease of use (3), Concern for Safety (2), Concern for Buy In (2), and Concern for Proper Training (2).

What was particularly noteworthy about this list was that there was not a single response, in either group, that was negative in tone toward small-scale social networks as a part of classroom practice.

TABLE 1: TEN SEPARATE RESPONSE TYPES

Theme	Control (n = 19)		Intervention (n = 22)		Difference in Percent
	Frequency	Percent	Frequency	Percent	
Teacher-Student Interaction	7	37	12	55	+ 18
Teacher-Parent Interaction	1	5	12	55	+ 50
Pedagogical Application	6	32	9	41	- 9
Collaboration Activities	3	16	5	23	+ 7
Bridging Distance	3	16	4	18	+ 2
Productivity Improvement	5	26	1	5	- 21
Ease of use	1	5	2	9	+ 4
Concern for Safety	0	0	2	9	+ 9
Concern for Buy In	2	11	0	0	- 11
Concern for Proper Training	0	0	2	9	+ 9
Total	28		49		

EXAMPLES OF ANALYSIS

To exemplify the way we analyzed the responses, here are two typical responses from the Intervention Group. I have included markups to the text.

*I think that it's a quick **[Productivity Improvement]** and easy **[Ease of Use]** way for school staff and faculty to keep in contact with each other **[Bridging Distance]**, as well as with students **[Teacher-Student Interaction]** and parents **[Teacher-Parent Interaction]**. I would use a network like this in my elementary classroom to begin teaching children "netiquette" and other ways to use the internet properly **[Pedagogical Application]**. It is a tool, not a playground, and I think that is very important for children to understand.*

The other was similar.

*I think small-scale social networking has the potential to be extremely beneficial for teachers and students **[Pedagogical Application]**. This type of networking creates a bond in the classroom **[Teacher-Student Interaction]** that can really influence students' experience in school positively.*

COMPARISON OF THE GROUPS

For the most part, within one to three references to any particular theme, the differences are not particularly pronounced except in a few interesting instances. The respondents in the Intervention Group made 18 percent more references to Teacher-Student interaction and 50 percent more references to Teacher-Parent interaction. One significant difference in the other direction was the 20 percent fewer references to Productivity

Issues in the Intervention Group. My feeling is that students who are more engaged with the creation of social networks understand that these networks are much less like a productivity tool than those with less understanding of their use.

When grouping comments related to teaching, specifically Teacher-Parent Interaction, Teacher-Student Interaction, Pedagogical Applications, Bridging of Distances, and Collaboration Activities, there was a profound increase in the number of comments in the intervention group. In fact, there was an increase of almost double the general number of teaching related comments from one semester to the next. This clearly demonstrated an increased sense of how this application could have an impact on teaching practice. Student respondents also saw the potential of the application to their lives and learning at university, specifically in collaborative projects.

DISCUSSION

There appears to be an educational benefit to tying a new computer application to the direct and personal experience of pre-service teacher candidates. That revelation is far from remarkable, but what this study in teaching and learning did was to draw attention to a problem in the training of pre-service teacher candidates. Students who learn a new tool or application at the mid-point in their training program may not have the opportunity to apply their learning to a classroom setting for a minimum of one to two years, by which point a great deal may have changed. The software may have evolved, possibly becoming more acceptable in teaching situations, more user-friendly, or more robust with additional features for classroom use.

With social networking tools still on the cusp of standard classroom practice, an early exposure to an emerging tool such as small-scale social networking may improve the confidence and self-efficacy of teachers regarding other applications as well. To address such a question would require a longitudinal study. In the meantime, my own practice is changing because of this study. In the future, I will work to do more than introduce emerging tools but will try to find ways to connect them to the existing personal needs and interests of my students in order for the tools to have a more lasting impact on their future practice.

For my colleagues in Higher Education, I hope this project makes some larger suggestions about how we seek to engage students to learn tools and applications they may not put to use until later in their career. Connecting novel tools and applications to a core understanding and to the way we, as educators, are helping them to think and see the world, is one of the challenges of the profession. With each pass at the task, and with each new class of students, I am finding myself, in my profession as a teacher, spiraling upward toward this goal.

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