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We Innovate: The Role of Collaboration in Exploring New Technologies

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Pre-service teachers faced an old problem with new possible solutions by working collaboratively to learn new technologies and changed the way they react to new tools. This approach required students to explore technologies independent of instructors—with peers in small groups. Instructors believe the learning activities implemented in this project to facilitate learning new technology are better aligned with professional development realities of their students' future profession. The old problem with the "inability to keep up with all the new technologies" and the new teaching strategy of "collaborative learning communities" prompted the development of the *Innovations Mini-Teach* course project. Through focus groups, an end-of-semester course effectiveness survey, and analysis of students' final products, this study showed that collaboration can be a superior method for helping pre-service students independently learn about the innovative technology tools that may be helpful to them as teachers, explore a professional development model that could support them in their future teaching careers, and most importantly see themselves as future innovators. Finally, students in focus groups indicated their class wiki, which archived each group's consequential knowledge, would continue to support them to become teacher-leaders of technology integration.

Efforts to equalize access to educational technology tools for PreK-12 classrooms in the United States have begun to pay off (Trotter, 2007). This is good news for teacher preparation programs because now, for the first time, instructors are more confident that their graduating teachers will be placed in classrooms with adequate access to technology. But now that the national average in the United States is 3.8 students to each computer (Wells, Lewis & Greene, 2006), teacher preparation programs have begun to realize a new layer of concerns. The added access and the rapid development of Web-based tools (e.g., Google Earth, social bookmarking, wikis), makes keeping up with the growing list of technology choices difficult for teacher preparation programs. To prepare for technology-infused classrooms, pre-service teachers must embrace the idea of continually availing themselves to any technologies with possibilities of "enabling students to learn subject matter more deeply and with more curiosity than without the technology" (Hughes, 2004, p. 346).

With these circumstances in mind, teacher preparation programs are challenged to (a) accommodate the current skillset of pre-service teachers who, at varying levels, are underexposed to technology tools and uses, while assuring minimal technology competencies upon exit from their courses (Albee, 2003); (b) prepare pre-service teachers to use the wide and changing range of technologies supportive to their curricular area (Flores, Knaupp, Middleton, & Staley, 2002; Hughes, 2004); and (c) instill a driving desire in pre-service students to stay updated with respect to technology and its meaningful integration in their future classrooms (Williams, Foulger, & Wetzel, 2008). Forward-thinking programs should offer technology integration content to students in a way that "fosters among the students a sense of ownership for their learning … as both protagonists and authors of knowledge-building activities rather than simply as conscripted information-processors with regard to the ideas of acknowledged experts in the field" (Ball & Wells, 2006, p. 192).

Three instructors of educational technology in a teacher education college at a large urban university in the United States were faced with this dilemma. When analyzing their current curriculum and reflecting about possible refinements, the instructors felt adding another dimension to their course would be necessary—one that would help students "carry on" with learning about and implementing educational technology after the completion of the course. This could only happen if students developed attitudes and beliefs necessary for continued exploration of, and responsiveness to, new technologies and their potential application to 21st century teaching and learning environments. Instructors hoped they could begin to support these lofty goals through one innovative course project.

Theoretical Framework

Pre-service students seldom understand that, as an integral part of their job, PreK-12 teachers in the United States are mandated by recertification requirements to participate in ongoing professional development activities. Effective professional development processes help teachers to "be pro-active, be able to anticipate situations and continuously update their knowledge to address new situations" (Pillay, 1997, p. 122). This includes the challenges associated with staying updated with new technologies, thinking creatively about potential uses

in teaching and learning processes, and adopting new pedagogical approaches where new learning tools allow.

Although opportunities for individualized professional development are increasing for in-service teachers, "there are sound educational advantages in group learning that mark this type of professional development as superior. Groups can become a powerful way of encouraging individuals to feats they could never manage on their own" (J. Rogers, 2001, p. 54). Small, self-directed groups have been known to provide (a) a more supportive environment, (b) the creation of challenges unavailable in isolated learning situations, (c) the construction of more complex cognitive structures due to the representation of a variety of experiences, and (d) a dynamic force that can lead to the creation of a community of practice as it draws its members in (A. Rogers, 2002). Through participation in common experiences, group members may not only grow to have common knowledge but will also develop a set of shared beliefs central to their work (e.g., Lave & Wenger, 1991; Wenger, 1998; Wenger, McDermott, & Snyder, 2002). This characteristic is more likely if group members participate in intensive and extensive interactions (Bar-Tal, 1990). These beliefs "provide the epistemic basis that unites group members into one entity, serve as a foundation for group formation, and form a bond for the group's continuous existence" (Bar-Tal, 2000, p.35). Yet, a sense of community does not magically happen; instead, it evolves through successful attempts whereby "interacting collaboratively, all participants' strengths can be maximized, their weaknesses can be minimized, and the result will be better for all" (Friend & Cook, 2002, p. 13). Institutions that realize and support these complexities can sustain a culture that embraces change and refuses to stagnate (Adey, 2004).

Most teacher preparation entities recognize the value of professional collaboration. Particular to the state where this research took place, two of the nine proficiencies in the professional teacher standards embed collaboration as an important teacher skill. One standard relates to the ability of special education teachers to work with other professionals and parents to create students' individualized education programs. The other pertains to the role of collaboration in supporting general education teachers to work with colleagues, parents, the community, and other agencies to help students meet the academic standards and transition from school to work or post-secondary education.

In a university setting, instructors who help students organize themselves in ways that allow the learners to do the learning may be able to support the development of collaborative abilities relevant to professional development in students' future careers. Students who participate in these types of experiences report fundamentally different environments founded on synergistic learning, with noticed shifts from being passive recipients of knowledge to feeling empowered, responsible learners who "reclaim a role in their own education" (Holmes, Tangney, FitzGibbon, Savage, & Meehan, 2001). These positive benefits are worthy of attention at the pre-service level for the attainment of course outcomes and possibly for the benefits afforded students past their final exam.

Instructional design by Holmes et al. (2001) couples Vygotsky's work (1978) related to constructivism with elements of social and environmental circumstances with advances in communications technology that blur the line between instructor and student. The resulting model, known as communal constructivism, requires instructors to "build on the knowledge, skills and energy of those at the heart of schooling—the students" (Holmes et al., 2001, p. 3). In a communal constructivism environment, students and teachers work together to develop their own understandings; with great efficiency, the knowledge students generate is meant for their personal benefit and for the benefit of their instructor and other students.

Motivated by personal dissatisfaction of behaviorist, cognitivist, and constructivist ideologies of learning, Siemens takes the practice of adding technology a step further (2005b). The emerging idea, termed connectivism, calculates for the depth of understanding that occurs when learners are immersed in experiences, yet recognizes that with the amount of knowledge available in today's world, it is not possible for learners to experience everything. Because of this pressure, they are forced to learn vicariously by forming connections with others (Siemens, 2005a). Technology can allow connections to up-to-date knowledge banks. These personal networks exist through "weak ties" to new information and sometimes equate to survival:

> The starting point of connectivism is the individual. Personal knowledge is comprised of a network, which feeds into organizations and institutions, which in turn feed back into the network, and then continue to provide learning to individuals. This cycle of knowledge development (personal to network to organization) allows learners to remain current in their field through the connections they have formed. (Siemens, 2005, p. 1)

The addition of new technology tools available at the university level has made it possible to create learning environments that capitalize on augmented conversations, sophisticated communication, and collaboration; yet, existing curriculum lags in its ability

to take advantage of these possibilities (Williams et al., 2008).

With understanding of these complexities, adding innovative communications technologies to the university setting is not enough; in addition, instructors in a technology-connected environment must shift their practice to support learners in ways that prompt them to "put their learning back into the community to benefit others, which will promote an evolution of learning and teaching" (Holmes & Gardner, 2006, p. 17). Activities that rely upon peer collaboration and project-based learning, apprenticeships, and publishing of information require a great deal of flexibility and unique assessment methods (Holmes, et al., 2001) on the part of the instructor. Instructors who understand the richness of these types of environments and want to embrace the notion of impacting education on a broader scale must also shift their practice and learn how to support the necessary student functions involved.

The Situation at Hand

The first semester of their teacher preparation program students at the urban university where this study took place were required to complete an educational technology course. The course strives to prepare students to integrate technology with standard PreK-12 curriculum. A historical look shows the course has transformed over the past five years from one where students became proficient with some new technology skills and learned limited theory, to the current course, which attempts to prepare pre-service teachers to be innovative users of technology, promoters of technology integration and creative teaching techniques, and teachers who strive to continually learn about new technology tools.

Lack of Foundational Technology Skills

Although students complete a foundational technology skills course as a prerequisite to program admission, just five years ago the pre-service teacher technology course largely addressed improving technology skills, partly to expose students to the varieties of technologies they may have access to in their future school and partly to "wow" them with ideas of how technologies can be used with PreK-12 students. For example, during one class activity students were briefed on how to use a digital camera. Then, they were sent out on campus as if they were PreK-12 students to explore the functions of their camera and take a few pictures. They were then instructed on some basic functions of Adobe Photoshop™ and asked to enhance their own pictures (Wilhelm, 2005). At that time, the majority of the students had never used a digital camera, and few if any had been exposed to Photoshop™. In reality, for most students, this was the first time they had been immersed in technology to this extent. Instructors soon noticed that students were enrolling in the teacher education program with more sophisticated technology skills and were interested in learning deeper integration strategies.

Disparity between University Ideals and PreK-12 Settings

A shift in the course occurred when students became discouraged about the future role of technology in their classrooms because they were not seeing examples of technology integration in their field experiences. While some pockets of adequate access to technology were present in local PreK-12 settings, it was difficult to find classroom teachers who were available to model integration strategies presented through course content. The addition of a *Vision Video* project allowed students to stage, film, and edit a visual representation of a future technology-rich learning experience for which they could aspire. Instructors hoped pre-service teachers would hold true to their visions, and that access to PreK-12 classroom technology would increase by the time their students were ready to obtain their first jobs. Students were successful at articulating future uses of technology through the *Vision Video* project; however, their ideas for designing curriculum that integrated technology were limited.

Innovation Overload

The most dramatic change in the course content, and the focus of this study, occurred with the adoption of the *Innovations Mini-Teach* project. This new project was brought about by the surge of new Web-based tools, the increase in access to computer technology, and an increase in peripheral devices (e.g., SmartBoards, digital cameras) more readily available in local PreK-12 classrooms. The educational technology instructors now felt that, within the time limitations of a single course, it would no longer be possible to do justice to the myriad of technology integration tools and techniques. Due to these circumstances, instructors felt it might be helpful to explore ways of preparing students to become the kind of teachers who are capable of learning new technologies and devising uses to enhance specific teaching and learning needs. Instructors developed the assignment on their understanding of the capabilities of collaboration and the assumption that pre-service teachers could rely on each other to research and freely explore new

technology, become expert users, and devise valuable ways to allow technology to enhance student learning.

The topic and instructional design of this project exemplifies the type of learning instructors feel is conducive to helping pre-service teachers prepare for their future 21st century classrooms. When they become practicing teachers, they will be responsible for the development of a unique set of K-12 student behaviors that is critical to students' success in the 21st century as outlined by the *National Educational Technology Standards for Students*. These include creativity and innovation; communication and collaboration; research and information fluency; critical thinking, problem solving, and decision making; digital citizenship; and technology operations and concepts (International Society for Technology in Education, 2007). The *Innovations Mini-Teach* project aligns to the ideals presented in these standards in order for pre-service teachers to become better prepared to meet the needs of their future students.

The course-specific goal of the *Innovations Mini-Teach* project was to acquaint students with new and evolving technologies in an atmosphere where they could help each other to learn their assigned technology, better understand how technology can be integrated, and contribute to their collection of teaching ideas and materials via the class wiki. Success would be dependent upon the many facets of collaboration by small groups (2-4 students) who worked toward the following project outcomes:

- To learn one innovative technology and its possible classroom application(s)
- To learn to work together taking advantage of each others strengths
- To design and deliver instruction (of their innovative technology)
- To collect usable resources for future class assignments and possible use as a teacher
- To learn from peers about other innovative technologies and their possible classroom applications
- To use a class wiki to archive and disseminate innovation resources beyond the future of the course

Instructors anticipate innovations topics will change each semester to accommodate the skillset and teaching needs of any given student group as well as any new developments in technology tools. During the semester of this study, students of the three instructors investigated over twenty-five different innovation topics, including wikis, blogs, Smartboards, podcasting, Google Earth, and Social Bookmarking.

Instructors were cognizant about supporting student teams and provided class time for groups to create a contract delineating responsibilities and establish a timeframe for each step they foresaw. Additionally, instructors coached individuals and groups at varying degrees on an as-needed basis during and outside of class meetings. The majority of the group preparation was expected to take place outside of class time and independent of direct instructor involvement.

The culminating knowledge gained from each group was published by students in a class wiki, which was available to students after the semester's end. The project was worth 10% of students' course grade and was based on wiki content and a 15-30 minute final modeling or hands-on experience provided for classmates during an assigned class session. Ultimately, instructors hoped their students would gain long-term benefits spanning beyond the scope of the semester, including an increased interest and ability to adopt new technologies as future teachers, and an understanding that professional development that relies on collaboration might be a necessary component of their future profession (Foulger, 2005). Instructors also hoped that they could support collaborative student groups through a purposefully-created investigation where students would support each other and simultaneously learn a great deal from the inquiry process (Coghlan & Brannick, 2001).

Instructor researchers sought to investigate the process, perceptions, and outcomes of students after their experience with the *Innovations Mini-Teach* project. With the hypothesis that PreK-12 teachers who collaborate with other technology-using teachers have more potential to learn new technology and use it in ways to address student learning, instructor researchers wanted to understand how they could support the development of pre-service teachers' collaboration skills through a classroom assignment that relied on learning with and for peers (Holmes, et al., 2001). Instructors felt they needed a stronger understanding of the influences on students as they worked collaboratively to become experts, document their knowledge, and showcase to peers their assigned innovative technology and its application to 21st century classrooms. Through a focus on collaborative influences, instructors would also be able to make calculated modifications to the project so they could be more certain to support the intended long-term goal: that students would value the ability of collaboration as a superior method for ongoing refinement of their teaching, and that as future teachers they would engage in professional development experiences that would involve being connected with their peers. Specifically, three research

questions central to the elements of collaboration were investigated:

1. What value did collaboration add to the ability of students to learn new technology?
2. What obstacles inhibited students' collaboration abilities?
3. What are students' perceptions about how collaborative skills may affect use of innovations in their future teaching?

Method

Focus Groups

Focus group methodology (Krueger, 1998) was used to gather student perceptions at the end of the project. To assure focus group subjects represented differing viewpoints, students in six of the sections of the required educational technology course (n=126) taught by three separate instructors were questioned as to whether "this assignment should remain in the syllabus for next year" and to ascertain their availability to attend a focus group session meant to help their instructors improve the project for future semesters. Thirty percent the students strongly agreed, 45% agreed, 15% disagreed, and 5% strongly disagreed. Seventy-five percent of the students surveyed were available and agreed to be in the pool of students for a focus group to take place outside of class time. Next, a faculty member not associated with the study used the questionnaire responses to select student participants and form focus groups. A purposeful sampling technique known as maximum variation sampling (Patton, 2001) was used to invite students with a wide range of variation on their perception of the project. Students were then invited to a focus group discussion. The resulting four focus groups were comprised of students equally representing each of the six courses. Due to the fact that very few students strongly disagreed or disagreed with the usefulness of the assignment, compounded by some students' conflicting schedules, the percentage of students who were adverse about the project were less represented in the focus groups than in the full population.

Four focus groups were set up at different times. Each focus group had 4-8 students (total of 24 students) and was led by a faculty member familiar with the assignment but not the students' instructor of record. Two focus groups were comprised of primarily elementary education, one of secondary education, and one of early childhood majors.

The focus groups were conducted based on methods described by Krueger (1998) and served as the initial source of data for the study. Digital audio files of focus group discussions, each lasting approximately 60 minutes, were recorded and converted to text. As recommended by Krueger (1998), the group leaders posed an initial question to allow each participant to become acquainted with the topic, recollect their thoughts, and listen to their colleagues. Participants were asked to introduce themselves to the others and to explain their *Innovations Mini-Teach* experience. This was followed by a set of questions that each pre-service teacher addressed. Example questions included (a) What is your impression of the *Innovations Mini-Teach* activity?, (b) What are the important elements?, (c) How did you learn to use the innovation?, (d) Is this type of project worthwhile during the first semester in your teacher preparation program?, (e) Did you face any obstacles in preparing your project and presentation?, (f) Are there elements that could be reduced or eliminated?, and (g) What suggestions do you have? Additional follow-up questions occurred naturally to clarify answers and build on the responses.

Data Analysis

After the focus group audio files were transcribed, instructor researchers analyzed student responses using HyperRESEARCH Qualitative Analysis Tool v. 2.8 (Researchware, 2007). This process began by reading and rereading transcriptions of the focus groups. Guided by the research questions, the three faculty researchers worked together to collaboratively code one of the transcribed focus group discussions. Codes were continually revised through triangulation of other data sources and then categorized to help researchers identify emergent themes. During that process, a common set of categories and associated codes was established. Next, each researcher individually coded the remaining transcribed focus group sessions. To maximize inter-rater reliability, meetings were held in which researchers came to agreement on how each individual unit of thought would be coded. As the analysis progressed, researchers continued to revise the coding system as needed to reflect the various sources of evidence related to students' experiences. Of the final 28 codes, the 12 codes used for this study related to collaboration fell in the following categories: collaboration effectiveness, learning strategies, long-term effects, and advice.

Other Data Sources

Students' innovation projects and data from an end-of-course questionnaire administered to students were used to substantiate student focus group data and confirm the trustworthiness (Lincoln & Guba, 1985) of the results. The end-of-semester questionnaire distributed to all pre-service teachers in each section of the Technology Integration course provided feedback

regarding individual experiences during the course, and specifically inquired about the *Innovations Mini-Teach* project. This was administered electronically using a Web-based questionnaire tool (SurveyMonkey.com, 2007). Thirty-five Likert Scale questions were used to collect general feedback regarding course assignments and activities, and six open-ended questions targeted the *Innovations Mini-Teach* project: (a) What did you like most about the *Innovations Mini-Teach* project?, (b) What did you like least about the *Innovations Mini-Teach* project?, (c) Do you plan to use any of the technologies presented during the *Innovations Mini-Teach* project?, (d) Which technologies will you use?, (e) Briefly, how do you plan to use them in your classroom?

Finally, each group's wiki was examined to determine the information and resources provided by the innovation groups as well as any areas emphasized or lacking. Required elements included a description of the innovation, resources to learn to use the innovation, teacher uses/resources, and PreK-12 classroom uses/resources. (The complete set of innovations topics, focus group questions, end-of-course questionnaire, and wiki examples can be viewed at http://www.west.asu.edu/tfoulger/Innovations).

Results and Discussion

Results were constructed with primary consideration given to focus group data. Other artifacts representative of the entire student population participating in the *Innovations Mini-Teach* project were used to substantiate focus group data, including the class wikis, group presentations, and the end-of-course effectiveness survey data. Instructors are in agreement that the results reported herein hold true for the general student population.

The results section is organized following the three research questions: (1) What value did collaboration add to the ability of students to learn new technology?, (2) What obstacles inhibited students' collaboration abilities?, and (3) What are students' perceptions about how collaborative skills may affect use of innovations in their future teaching? The complex and overlapping themes represented in the data will be reported using verbatim quotes to describe the essence of the students' experiences as related to each of the three research questions. A focused discussion follows the results within each research question section.

What Value Did Collaboration Add to the Ability of Students to Learn New Technology?

Since the instructors assigned students to groups and topics, the process of creating presentations with unfamiliar peers mandated that group members quickly coalesce, coordinate efforts to research and learn the innovation, and prepare the final presentation. Students in successful groups realized that they, and/or their group members, needed to exercise certain skills that were not normally necessary for individualized work. Groups used a combination of meetings and email to complete the project.

Proactively, instructors attempted to take measures that would support group success (e.g., planning contracts). But, given that the majority of group processing needed to take place outside of class meetings, they also communicated willingness to support individual groups as needs arose. Students reported that the small groups instructors created (2-4 students) allowed group autonomy to "define the terms as far as when and how" they would interact to achieve their desired outcomes. Students reported they recognized the benefits in quickly "getting to know each other." All focus group participants reported that collaboration supported them because the project wouldn't "take that much time because of a group."

All groups completed a group contract, approved by their instructor. Students noted that some element of leadership appeared to be necessary for them to successfully delegate responsibilities, establish a timeline, attempt to equalize the workload, and in general commit to a process that would lead to a final presentation meeting their standards. This student noticed how a calendar with process checks positively affected group commitment:

> We used a time-line to schedule -- "ok you do research on this part and the other members work on the other part" so it was easy - everything was in a time-line. Every day it was like scheduled, so that's what it was like.

Instructors used a technology questionnaire to help distribute students who were technology experts among groups (available at http://southwestscreensavers.com/innovate). Because of this, group membership represented a range of general exposure to technology. About half of the groups had members who were "Pretty Good" or "A Pro" with the assigned innovation before the groups commenced. Almost all students felt that having an expert in their group supported their ability to learn about the innovation. One student noticed her technology inefficiencies, but quickly realized that the varying skillsets within her group made it possible for her to be successful:

> They had us fill out a survey type thing about what topics we know a lot about and which you don't and then they paired you up with someone that maybe knew a little more - or if you knew more then you'd be paired up with someone who knew a

> little less. I thought it was a neat idea because I learned a lot about handhelds…from the girl I was working with, so I thought that was a neat way to do it.

Another group also assigned to handhelds operated in a different manner. This group did not have a member who was a noted expert, but its members used their overall expertise to tackle learning the new technology:

> Ours was hand-helds and the PDAs and so we were able to go downstairs in the Educational Library, and we [borrowed] a whole box of the hand-held PDAs and so everyone got one and then we'd walk through little steps of what you can do, like inputting data into them and we used - we had graphing calculators too, so we brought like little websites, we just pulled them up but we didn't really use 'Google' or anything, ours was just kind of like, "ok well I know how to use a calculator" and she knew how to use a PDA, so we just kinda like collaborated on it and just used each other, so it was pretty easy - I was surprised.

Even though instructors created a situation where students felt a high sense of accountability to one another, students agreed they felt comfortable helping each other through learning their assigned technology. Even cross-group collaboration was initiated by students and occurred informally outside of class. Similarly, both instructors and students noted this effect during in-class presentations:

> Like I said, my partner and I, we knew what we were doing fairly well, but as far as like feeling like unprepared, it wasn't even a factor because everyone in the classroom was so willing and you know there to help you through it, if they knew something about it. Then they'll … raise their hand and they'll share it with you so it's kind of, as far as being prepared, I think just having something that we fooled around with, … made it a lot easier to know what you were doing while you were up there. You didn't have to worry about something not working with a website or something, so we felt fairly prepared for our presentation.

Eighty percent of the students participating in focus groups enjoyed the collaboration, appreciated the benefits it offered, and felt that working with a partner allowed for maximum success because they could wholeheartedly "try to help as much as they could" without feeling like they needed to know everything. All students understood that in some way collaboration enhanced their learning opportunities through the abundance of hands-on exploration and research with their group members, direct learning and other in-class experiences provided by other groups, and ongoing access to the class wiki where collaboration could occur even after the semester's end.

The evidence suggests that pre-service teachers valued the collaboration element of the *Innovations Mini-Teach* project. Instructors successfully established an environment conducive to this by requiring peers to learn with and for each other much like Holmes et al. propose (2001) within the communal constructivism framework. The student community was supported through instructor-created project materials and outlined processes and the availability of the instructor outside of class meetings. This "supported freedom" gave students the opportunity to practice their collaborative skills in a mandated, yet scaffolded and safe manner. Upon completion of their work, students viewed the collaboration element as a very significant factor that allowed them to (a) learn about their assigned innovation in depth, (b) gain a breadth of knowledge about the other innovations shared, and (c) delve deeper without worry of temporal or physical barriers via the ongoing collaborative capability provided by the class wiki. This accomplishment would have been impossible had students not relied on each other.

What Obstacles Inhibited Students' Collaboration Abilities?

Instructors expected difficulties with group dynamics and provided proactive measures meant to support productive group processes to the extent they could, including detailed project materials, clear expectations, the willingness to coach individuals or full groups when needed, and by presenting the first innovation to the class as a model. Yet, some students in the focus groups shared problems they encountered related to inter-group dynamics stemming from communication problems. Ten percent of the focus group students reported problems significant enough that their work was hindered or they were forced to work by themselves (e.g., partner dropped the course, major problems at home). Another ten percent had lesser problems that were handled by the students themselves such as when group members did not follow through on commitments, were not approachable, or did not consistently communicate via email. For example, frustrations arose when schedules didn't permit for convenient meetings outside of class. Although these types of issues were viewed as unavoidable and "kind of an annoyance," they were typically worked out independent of the instructor. When communication broke down over ongoing issues, as it did for two of the students in the

focus groups, group effectiveness was inhibited, but the project was still completed.

Issues external to the group such as employment responsibilities or other personal pressures and expectations caused some students to commit less time to the process of preparing for their group presentation. Students in groups with members who had limited or inconsistent involvement in the process tended to make attempts to "reach out," but they reported personal frustration over their inability to make progress toward the project's goals. Out of the numerous mini-teach group presentations, two interpersonal situations required instructor intervention. One student talked about being frustrated to the point that she claimed she "didn't know what to do" and ended up preparing for her group's presentation by herself. In the end, she remembered how she gave her partner many opportunities before she "took over the project [because she was] nervous that it wouldn't get done." Although this student felt collaboration actually hindered her, in the end she also recognized her depth of understanding of the innovation and knew her instructor "realized through the presentation that my partner didn't really know what she was talking about….and it ended up showing in our grades."

One student who was very frustrated with her partner's low level of commitment learned some things about herself in the process:

> As I said before, I felt like my partner …. didn't really have the desire to learn how to learn our innovation ... I was more concerned with getting it done so I felt like I took over the project … I was just nervous that it wouldn't get done if I didn't. I don't know that [collaboration benefited me] - it might've hindered me in the sense that I felt bad, 'cuz I did the whole project, but I wasn't sure if it was because of my anal-like control-freak that had to have it done ... it was like the day before until - I couldn't get a hold of [my partner] all weekend long. She was out of town. I emailed and called and nothing, so I assumed I was on my own. So I did pretty much the big chunk of the work.

When one classmate's group member withdrew from the class, the stranded student lacked the confidence to carry on alone and was brought into a new group in the middle of their process. While the new addition impacted the original collaborative working structure, the pre-existing pair adjusted to accommodate the new member. This student describes how her group accommodated this difficult situation:

> We had a third person come in kind of at the last moment, but it worked out pretty well—We decided right away how to divide: one person was gonna – I checked out the PDA and kind of played with it, as well as somebody else, so then the third person looked up information on the Internet and started on our presentation. I think we collaborated pretty well.

For some individuals who felt their technology skills were only basic and they couldn't contribute to the skill building requirement, frustration over inadequacies was apparent, especially if they felt their inadequacies "hindered their partner." This feeling was evident for one student who expressed that she perceived her partner "knew a lot." She assumed the expert partner felt that since she "already knew it [I] should go and figure it out [on my own]."

Although collaboration was poised as an important factor to student success for the *Innovations Mini-Teach* project, evidence suggests that to varying degrees struggles existed for nearly all the groups. However, change theorists who agree the adoption of new practices is greatly supported by collaboration (Bennis & Biederman, 1997; Fullan, 1994; Hall & Hord, 2006) note similar problems: that the social side of innovating can be tricky.

During the *Innovations Mini-Teach* project, faculty viewed struggles as situations that provided learning opportunities for students to develop their interpersonal skills—the same skills faculty felt could support students' professional development processes once they become teachers. By interjecting only when absolutely necessary, and in ways that did not promote a dependency on instructors, instructors were able to help students capitalize on struggles, "make problems their friends," and expand their interpersonal skills in preparation for future involvement in such professional development processes reliant upon collaboration.

What are Students' Perceptions About How Collaborative Skills May Affect Use of Innovations in their Future Teaching?

As students experienced different innovative technologies and listened to their peers illustrate the possible classroom uses for the innovative tools, they began to reflect on whether or how they would use the innovations presented in their future classrooms. The student voices that follow represent many of their peers.

> We covered [our assigned innovation] thoroughly - I think we covered every aspect of it …. I definitely see the value of the projects and definitely see how I would need to know these

> things as I go into my own classroom, but I don't believe that I entirely came away with a full, comprehensive understanding from some of the projects—from some of the presentations.

Even by the end of the semester, one student shared how she furthered her understanding of innovations assigned to other groups via her use of the class wiki; now, she sees the wiki as a place for ongoing sharing among peers with the focus of supporting future classroom use of technology:

> I've actually already been back in there and have been looking through stuff; using stuff for [another assignment]. I went back to the SmartBoard [section] and pulled up some of the lessons that they used to have the kids play around with, so I've already done that. So yeah, I think I will be continually accessing and definitely if I find something that's worth while, I'll put it up there 'cuz any help I can get is great. So I figure everybody else will feel the same way.

The class wiki will be available to students through to post graduation as students enter their profession. This being the case, students can have continual access to the information contained therein as needed for future coursework, internship purposes, or future teaching endeavors. When specifically asked if they would use the class wiki in the future, most students hadn't thought of a "never-ending course" before and didn't realize future access to the wiki was possible. Consequently, the idea of using it as a future resource hadn't occurred to them yet; however, when presented with the idea, all forum participants unanimously reported it would be beneficial and that they probably would use it.

> Most of our presenters included like a tutorial, how to use it, and different elements of how to put something, like how to put a Podcast together, how to make an iMovie, or those kind of things - so it might not have been something I grasped right at the time, but if I want to use that innovation, I can go back there and learn it step by step ... a real quick overview.

Two students specifically noted that the innovations presented by peers had already proven useful for the *Vision Video* project (through support available via the wiki about video editing and as a catalyst for ideas of tools and integration strategies) and another predicted that some wiki content could affect future teaching choices as she stated, "I know what I will use, and what maybe I won't use as much, but I know the knowledge is there if I do need it." Another student mentioned that since her group's presentation she had already added information to the wiki related to GPS systems.

Educational change experts (Senge et al., 2000) claim that team learning is a component of an innovative learning system that mandates the development of quality relationships where people learn to work together to learn new ways of teaching. Preparing pre-service teachers with skillsets that are needed for this kind of learning is a complicated task, but evidence suggests this project does indeed support students' beliefs about their plans to use innovations in their future teaching. This is likely because this learning environment mirrors the types of environments that support collaboration where a high value is placed on reflective dialogues and the development of the type of social norms where learning and inquiry permeate everything (Darling-Hammond, 1998; Fullan, 1994). Adopting technology innovations is developmental and ranges from the learning of basic operations to taking on leadership experiences (Hall, 2005). Instructors of the *Innovations Mini-Teach* project are intentionally preparing students to join school cultures as collaborative teachers, empowered problem solvers, and change agents (Darling-Hammond, Bullmaster, & Cobb, 1995).

Implications and Conclusions

Teacher educators have a lot to offer their students as they serve multiple roles including instructor, mentor, facilitator, and model. However, in this study, researchers turned the tables to ask, "What do pre-service teachers have to offer one another, and eventually, to offer their field?" The *Innovations Mini-Teach* project allowed instructors for the first time to capitalize on this power. In contrast to conventional learning approaches, the three involved instructors behaved much like a coach to choose the task and evaluation methods and provide a scaffolded environment, then to step away as they continued to challenge, encourage, give feedback, and help students through weaknesses or struggles (Holmes & Gardner, 2006).

Based on their analysis of student voices, the instructors concluded that students gained high levels of expertise with their assigned innovation and became familiar with the range of innovations covered by their classmates and archived in the class wiki. On another dimension, pre-service teachers took ownership of their own learning. The embedded technology (the class wiki) produced a situation in which the knowledge gained by one group was also owned by others. This unique instructional form was founded on communal constructivism (Holmes et al., 2001) and allowed for both depth and breadth of coverage (Collins, 1996) in a manner that did not tax the students.

Students described long-term gains as well. The reliance on collaboration created a shift for students about how they view themselves as learners. By developing a project that relied on collaborative behaviors (much like professional development processes instructors hope students will encounter in their future teaching), students were able to practice collaborative professional development mirroring effective in-service teachers. Additionally, students were empowered by an innovative social technology tool (the class wiki) that uniquely created a situation in which the course did not have a distinctive end because students could participate in ongoing learning not bound by geography or time limitations.

A possible third long-term effect will need further investigation. Instructors involved in this study wonder about the extent to which students who have participated in the *Innovations Mini-Teach* project will be viewed as technology "experts" at their future schools. If they have the ability to fruitfully collaborate with other teachers, to continue to innovate and share their understandings of technology tools, and to use innovative technologies to support student learning, they could rightfully become teacher leaders with respect to technology integration and innovative practices among their future peers.

This study investigated a superior instructional design model the researchers believe can be applied to learning groups outside the teaching field who are attempting to be more effective in the 21st century world. Learning founded on collaboration and empowered by social networking tools, such as a wiki, should be attempted across disciplines inside and outside the university domain. This model offers insight to any situation in which individual learning cannot equate to group learning and when relying on one another can create a larger knowledge base, more inter-dependency among participants, and an expanded sense of effectiveness.

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