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Technological Pedagogical Content Knowledge in Teacher Preparation: Impact of Coaching Professional Development and Mobile Devices

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This presentation explores the process of change for a teacher preparation program as it attempted to teach pre-service teachers how to integrate new technologies into instruction in elementary schools. The aim was to impact the instruction of preservice and inservice teachers in a way that would reach their current students.

To become fully literate in today's world students must become proficient in new literacies and 21^{st} century skills (IRA, May 2009). Elementary teachers in the 21^{st} century need to have a deep understanding of new technologies and how they can be integrated into learning, however, the fast pace of technological innovation and social change makes it hard for educators to stay abreast of new developments and to integrate them into effective classroom instruction. At the same pre-service teachers sometimes lack the pedagogical knowledge required to integrate technology effectively into the existing curriculum.

This project attempted to create a long-term partnership between teacher education programs, universities and school districts to create a generation of teachers who will be effective and confident using new technologies to prepare their students to participate and lead in the global society.

Theoretical Framework

Developing Teacher Knowledge

Teacher education prepares preservice teachers with knowledge in subject matter and pedagogy. Knowledge of subject matter content includes facts, concepts, theories and procedures teachers will need to know in order to convey learning to their students. Pedagogy knowledge consists of a variety of methods to explain concepts, with frameworks to organize and connect ideas to help students apply new learning to their existing knowledge. Shulman (1987) suggested that teachers must also know how students generally understand their subjects, and areas that they consistently misunderstand. They, then, can anticipate these misunderstandings and know how to deal with them when they arise. This concept he called Pedagogical Content Knowledge. Teachers who possess Pedagogical Content Knowledge know the most useful forms of representation for the concepts they teach; the most powerful analogies to help students connect with classroom content.

As technology becomes ubiquitous and integrated into teaching and learning, Koehler and Mishra (2009) argue that the most effective teaching takes place at the continuously changing intersection of three areas of teacher knowledge: content, pedagogy, and technology. They add Technological Knowledge as a third important component in planning effective learning experiences. Koehler et al. (2011) defined Technological Knowledge as knowing about print and digital technologies including how to operate, install, remove, create, and archive information. They called this framework for viewing effective teaching Technological Pedagogical Content Knowledge (TPACK; Mishra & Koehler, 2006). True technology integration takes place when a teacher is able to effectively connect these three components to create in-depth learning for students. While teacher education has taught content knowledge and pedagogical knowledge for many years, the technology component is still emerging in university courses and elementary classrooms in which field experiences are situated (Ertmer & Ottenbreit-Leftwich, 2010). It is in this TPACK framework that serves as a foundation for this study.

Professional Development in Technology Integration

Much professional development begins by focusing on demonstrating to teachers how to use various types of technology. These teachers then begin their planning with a technology component which they attempt to use resulting in “technology for technology’s sake” (Borsheim, Merritt, & Reed, 2008). This is where much of the work stops. The next step developmentally is when teachers begin to use new technology to replace an existing technology or practice. The last step developmentally is when a teacher understands each TPACK component and focuses on the dynamic intersection of the three areas of teacher knowledge, where technology transforms teaching and learning processes in new and innovative ways (Mishra & Koehler, 2006).

Apple (2004) found that effective professional development can assist teachers in becoming experts at new literacies integration with deliberate practice accompanied by specific feedback from a mentor. The study recognizes that teachers begin technology integration at different stages and advance at a different paces. “This evolution refers not to teachers’ progression through a set of technology skills, but rather describes their way of thinking and acting when it comes to integrating technology into their teaching” (Apple Education, 2004, n.p.). This process of planning for effective technology integration involves teachers’ abilities to overlap their content, pedagogy, and technology knowledge.

Coaching for teacher efficacy. A recent study explored the effects of yearlong professional development with coaching on teachers’ efficacy for teaching literacy as well as their collective school efficacy to affect student performance (Cantrell & Hughes, 2008). In addition, it examined connections between teacher efficacy and implementation of content literacy strategies. Teachers were visited monthly by a coach to provide support as teachers implemented literacy strategies they learned in a more traditional professional development. In addition, coaches corresponded via email and phone at the request of teachers between meetings. Results showed significant growth in teachers’ literacy efficacy and general teaching efficacy; the authors conclude that coaching and collaboration were two key factors in this growth.

Vogt and Shearer (2011) propose a continuum of teacher support through six coaching models. These models provide a framework for the technology integration/digital literacy coaches that schools need as technology demands increase. An instructional coach can help build collaboration, new ideas, and energy as long as high-stakes evaluation is not required. Coaches report that teachers will not come to them with questions if it makes them look like they are not competent. “If my evaluator is going to look at my portfolio, you can be sure I will only include documentation that is positive. I don’t want to look bad” (Kelley, Gray, Reid, & Craig, 2010, p. 281). Coaching can also happen continuously in the classroom as teachers coach one another, students, while students coach one another and teachers (Friedrich & Wilson, 2011), especially regarding new literacies integration where student teachers and students may have grown up as digital natives in contrast to the cooperating teacher who perhaps did not.

Studies (e.g., Matsumura, 2010) show that coaching leads to higher quality implementation of reform practices, as coaches can often support teachers to implement new methods by helping them negotiate the technical challenges encountered. In contrast, one study found that coaching did not have an additional impact on teacher practice beyond the other professional development (Garet et al., 2008). However, very few studies examine the evolving role of coach as it applies to technology integration. This deficit may change as states continue to adopt the Common Core and other state standards. North Carolina recently joined the Partnership for 21st Century Skills and created a mission statement, goals, and new standards including “every middle school will have a digital literacy coach and every high school will have a digital learning advisor” (Walser, 2011).

Research Questions

1. How does professional development in technology integration impact teacher practice and self efficacy in technology integration?
2. How does integrated support for technology integration impact pre-service teachers’ technological pedagogical content knowledge (TPACK)?
3. How is collaboration in technology integration enacted between a student teacher and cooperating teacher dyad in an elementary classroom when supported by a coach?
4. How do students in these classrooms use technology in learning?

Methods

Setting and Participants

The study took place in a large Midwestern public school district where many student teachers from a large Midwestern public university complete their student teaching experience. A technology conference for student teachers and cooperating teachers was offered at the university (Trainin & Friedrich, 2012). The study encompassed two years with preservice and inservice teachers participating in pre- and post-surveys and a conference in 2011 and 2013, and one semester of coaching in 2012 as noted in Figure 1.

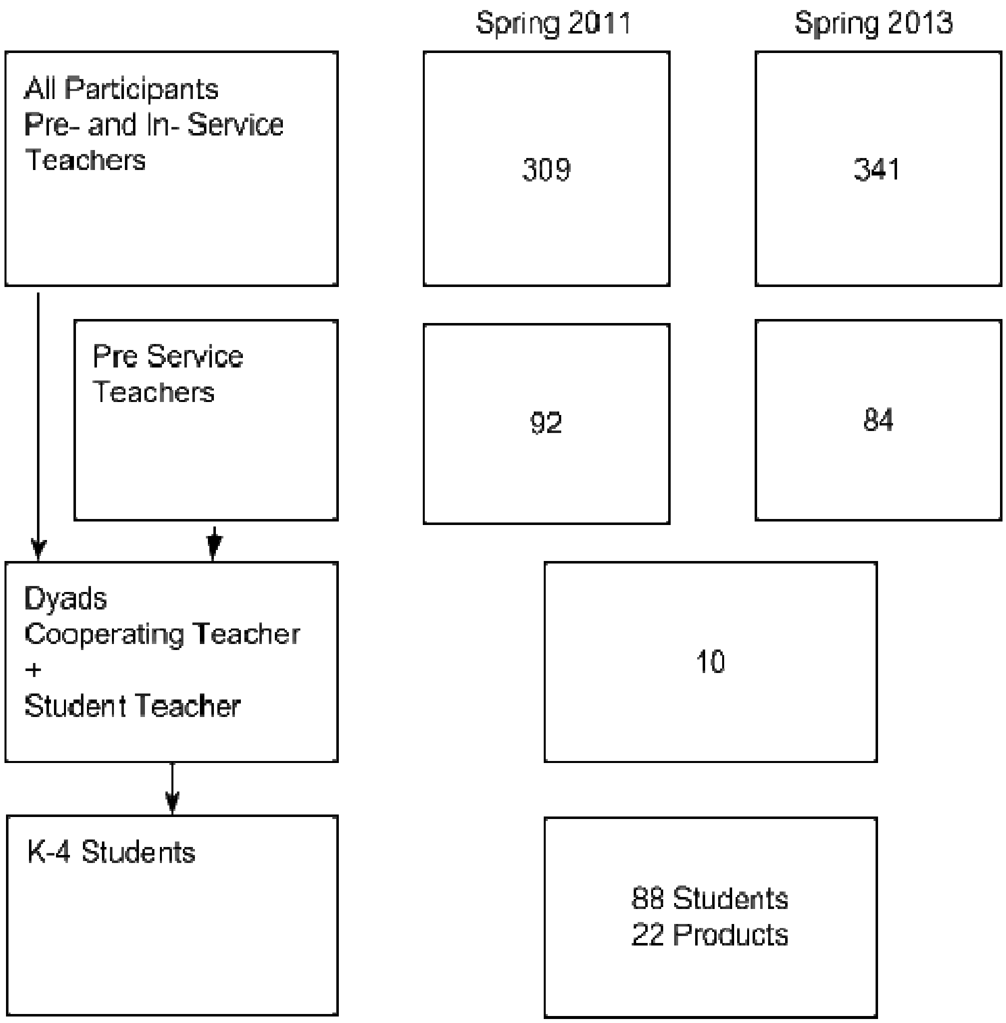

Figure 1. Participant flow chart following all groups of participants throughout the study.

Quantitative study. All project participants were invited to participate in a pre/post survey assessing the impact of the project on technology integration in schools. In spring 2011 we had 309 respondents to the survey, in spring 2013 there were 341 respondents to the survey.

Pre-service teachers in the Elementary Teacher Education Program were surveyed to examine the impact of instruction in technology integration. The measurement occurred during student teaching, the exit point from the program. There were 92 responses to the pre-Technology Integration Survey in 2011and 84 in spring 2013.

Qualitative study. Following the conference, criterion purposive sampling (Miles & Huberman, 1994) was used to select student teacher/cooperating teacher dyads where both indicated an interest in participating in further collaboration to integrate technology (see Tables 1 and 2).

Table 1.

Cooperating Teacher Demographics

Teacher	Gender	Ethnicity	Age	Years of Teaching Experience	Self-Rated Technology Ability for Teaching	Self-Rated Interest in Technology
James	Male	Caucasian	29	6	4	5
Maya	Female	African-American	51	27	3	4
Morgan	Female	Caucasian	30	8	3	5
Anna	Female	Caucasian	39	17	3	5
Julia	Female	Caucasian	30	8	3	5

Table 2.

Student Teacher Demographics

Student Teacher	Gender	Ethnicity	Age	Student Type	Self-Rated Technology Ability for Teaching	Self-Rated Interest in Technology for Teaching
Mikayla	Female	Caucasian	34	Masters	2	2
Lauren	Female	Caucasian	30	Masters	1	3
Sarah	Female	Caucasian	22	Undergraduate	2	3
William	Male	Caucasian	22	Undergraduate	5	5
Angela	Female	Caucasian	22	Undergraduate	3	5

To gain understanding of the process of integration used by dyads working with a coach in elementary classrooms, a collective case study (Stake, 1995; Yin, 2003) was used to provide detail about different contexts in which this process takes place and for interpretation of multiple forms of data for patterns to arise. Five cases were purposefully included at four different elementary schools in the district. Each case was explored individually before any comparisons between cases were made (Stake, 2000).

Mixed Methods Design

The overall design for the study follows a mixed-method design as noted in Figure 2. A large sample was used for the quantitative study followed by case study to examine cause-effect and change at the micro level. Finally student products were examined to show impact on student achievement, a feature often missing from studies of professional development.

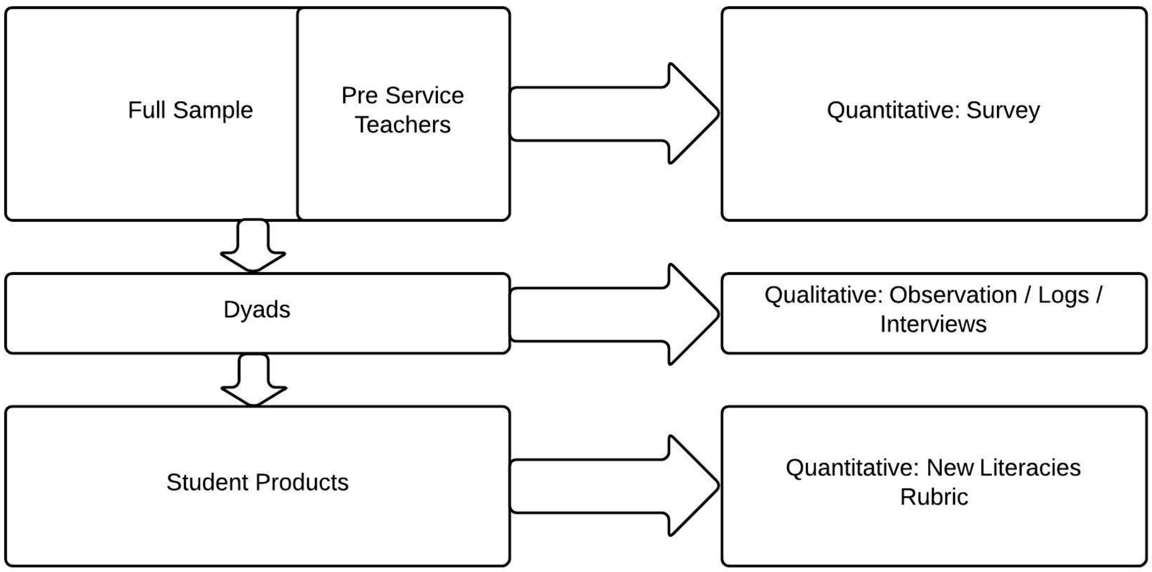

Figure 2. Mixed methods study design.

Coaching Procedures

The coaching format involved meeting with each student teacher/cooperating teacher dyad individually in their classroom for one hour each week over the semester. We provided each dyad one iPad for the semester, and through coaching shared apps with teaching ideas, taught features of iPads, answered questions, provided feedback, and held them accountable. The coach came into each classroom four times during the semester to observe and sometimes assist with technology integration. Teachers and student teachers each completed a weekly online log noting their use of technology for teaching and student learning and goals for the coming week, allowing for personalized weekly coaching meetings. While these procedures may seem to change the student teaching dynamic by introducing new practices, in effect, these practices (device and coaching) were made universal in the program the following year.

Instruments

Online survey of technology integration. Online surveys of technology integration were conducted in spring 2011 and repeated in spring 2013. The Survey included four main sections. In the first section, students reported on their self-efficacy in using technology. This section had ten items including “I can learn new technologies easily” and negative ones such as “I often need help getting my technology going.” In the second section students reported about their competence in designing and teaching technology-integrated lessons and the frequency of such lessons. In the third section students reported which university classes modeled technology integration most effectively. And in the fourth section students were asked to respond in writing describing the most effective lesson. The self-efficacy survey was highly reliable and included only one factor. Self-efficacy was high with a mean score of 3.8 out of 5 possible. The highest confidence items were “I can learn new technologies easily” (4.16) and “I have the technical skills I need to teach well” (4.07). The lowest item was “Colleagues often ask me to help them with technology” (3.37) which is still a positive response and may have more to do with students being inexperienced in teaching. Reliability of the survey coefficient alpha was .84.

Online survey of knowledge for preservice teachers. The Technology Integration Survey was developed in spring 2011 and implemented in fall 2011. A second round of surveys was conducted in spring 2013 to show the impact on student teachers in the programs. There were 92 responses to the pre-Technology Integration Survey in 2011. There were 84 responses to the post-Technology Integration Survey in 2013. Reliability of the survey coefficient alpha was .96.

Interviews and observations. Coaching of five student teacher/cooperating teacher dyads was conducted in fall 2012. Eighteen one-hour observations were conducted in classrooms. Ten half-hour interviews were conducted with student teachers and cooperating teachers separately and five interviews were conducted together in dyads, for a total of fifteen interviews. Forty one-hour weekly coaching visits were conducted with dyads over the semester. Overall, more than 65 contact hours were invested into the interview and observation phase of coaching.

Student products. Dyads evaluated student technology projects (n=22) using Student Technology Product Rubrics for grades K-1, 2-3, and 4-5. These rubrics were developed to measure student use of technology based on the six International Society for Technology in Education (ISTE, 2008) areas: Creativity and Innovation, Communication and Collaboration, Research and Information Fluency, Critical Thinking, Problem Solving, and Decision Making, Digital Citizenship, and Technology Operations and Concepts. These ISTE standards are overlapped with Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects (2010) for ease of scoring. Inter-rater agreement for each of the six ISTE areas was .80 or higher.

OPTIC. We used the Observation Protocol for Technology in the Classroom (OPTIC, 2004) to observe eighteen lessons in five classrooms over a six-week period to measure the variety of technology integration pedagogy focusing on elements of student learning: (a) independent choice, (b) involvement in planning, (c) ethical behavior, (d) effective use of technologies, (e) focus on objectives, (f) technology embedded in curriculum, (g) problem solving and higher order thinking, (h) engagement, and (i) uses of technology for activities that could not otherwise be easily done. I selected the OPTIC because it provides criteria to describe effective technology integration, with the clearest description of the intersection of content, pedagogy, and technology in the TPACK model that focuses on student-centered learning. This rubric was developed to evaluate the use of technology in classrooms because of a lack of clarity in defining innovative technology integration. The focus of the rubric is on how teachers empower student use of technology to do things that they could not do easily without the technology, compared to technology use as a replacement of traditional instruction, such as completing a worksheet online.

Results

Quantity and Quality of Teacher Integration

We used the Technology Integration Survey to examine teachers' ability to integrate technology in their teaching. Confidence in integrating technology in lessons was fairly high in all areas. Literacy and Math had somewhat higher frequency and confidence (see Table 2). The opportunity to teach in Math and in Literacy is considerably more frequent in schools which may explain why teachers and students have more confidence in using technology in these areas. Practice does increase efficacy.

Table 2

Efficacy and Frequency of Technology Integration by Subject

	Efficacy (1-5) 1=Highly Ineffective 5=Highly Effective	Frequency (1-4) 1=Never 4=In All Lessons
Literacy	3.95 (.87)	2.40 (.62)
Math	3.91 (1.0)	2.50 (.79)
Science	3.74 (.86)	2.10 (.71)
Social Studies	3.71 (.91)	2.10 (.74)

Growth in Technology Use in Preservice Teachers

One of the main thrusts of this grant is to improve the ability of future teachers ability to integrate technology into their lesson. Using the results of the Technology Pedagogical Content Knowledge survey it is clear that students graduating in 2013 are better equipped to integrate technology. The effect size is very large for most areas and a bit lower for science and social studies lessons. The lower results for science and social studies may be a result of fewer opportunities to teach in these areas regardless of technology needs. The full results are in Table 3 below. The average effect size is 2.09 a large effect size in line with our goals but considerably beyond expectations. This positive result is a clear indication that the approach of improving the quality of technology integration in Teacher Education, hand in hand with changes in technology integration in schools had a multiplicative effect on outcomes!

Table 3

Technology Integration by Cohort

	Elementary Graduates 2011 Mean (SD)	Elementary Graduates 2013 Mean (SD)	Effect Size
Literacy & Technology	1.79 (.74)	3.95 (.87)	2.48
Math & Technology	1.75 (.62)	3.91 (1.02)	2.12
Science & Technology	2.11 (.89)	3.74 (.86)	1.92
Social Studies and Technology	2.04 (.98)	3.71 (.91)	1.84

The Coaching Perspective: Supporting Teachers and Student Teachers

To respond to a call for more active and educative mentoring for student teachers and the classroom teachers who mentor them (Caroll, 2007; Margolis, 2007), this innovative model for preservice teacher education revolves around the support of a coach during student teaching following a provided technology conference. In the role of coach, I was able to mentor and support both the classroom teacher and student teacher in the area of technology integration across the curriculum while holding them accountable for implementing.

Results in Table 4 show that overall primary classrooms have lower mean scores than intermediate grades. For both primary and intermediate the highest scores were in the areas of Ethical Practice, On-Task behavior, Engagement, and Embedded Tech Skills. (1) When observed, students were using technology responsibly and safely especially when using the Internet to locate information. In one lesson a teacher taught digital citizenship using the district poster as a guide for students. (2) Students were on task, focused on the intended curricular objectives of the lesson. One teacher challenged his students to create a video demonstrating their process of working three math problems. Students focused on the task of solving the problems and went beyond to explain their thinking process by recording their voice in the video. (3) Most students were highly engaged in the use of technology to learn. For example students were creating eBooks using the iPad provided to the dyad during coaching. (4) And finally, teachers embedded specific technology skills within the context of the core curriculum so students learned these additional 21st century skills right along with lesson objectives.

Three areas where both primary and intermediate classrooms scored lowest were Choice, Planning, and Collaboration. In each of these areas the maximum score was 3 out of a possible 5. This shows that the teachers in most of these classrooms are choosing the technologies and uses to meet learning objectives, with little involvement by students in the selection process.

Table 4

Observation Protocol for Technology in the Classroom Descriptive Statistics

	Primary	Intermediate	Overall	Max
Teacher Design				
Tech Skills Embedded	3.89	4.83	4.27	5
Effective Use	3.88	4.0	3.93	5
Developmentally Appropriate	3.11	4.5	3.67	5
Value Added	2.45	3.00	2.65	5
Student Behavior				
Ethical Practice	5.00	4.67	4.83	5
On Task	4.56	4.83	4.67	5
Engagement	3.55	4.33	3.82	5
Problem Solving	2.40	3.50	2.81	5
Collaboration	2.14	2.67	2.38	3
Planning	1.20	1.67	1.38	3
Choice	1.10	1.40	1.20	3
Overall Score	2.80	3.61	3.09	4.27

Examples of Integration

The second grade teacher, Anna, decided to work with one student at a time to create an ebook as a way to allow each student to use the iPad in writing. She did this concurrently as her student teacher taught guided reading during the literacy period. We observed her working with several students to create eBooks. At first Anna held the iPad and found pictures, allowing the student to select the one they wanted to use on a particular page. She had them say their story aloud into a "voice to text" app that typed it out for them. Then they edited it together before cutting and pasting into the eBook app and then publishing. Once Anna learned how to use the features of the program well she made a paradigm shift and put the device into the hands of the students. She needed to feel comfortable herself before she was ready to become a facilitator and allow the student to be the creator.

Julia, the kindergarten teacher, checked out a laptop cart to bring into her room for the first time so each student could work hands-on using a computer. This was a goal she set for herself to accomplish during the semester, and with the collaborative help of the student teacher, coach, and para they taught kindergarteners how to log in, use jump codes to locate websites, cut and paste, open multiple tabs, conduct a Google image search, and type to create a multimedia presentation. Julia now views these new literacies skills as basic skills she will teach her kindergarteners each year along with the traditional skills of counting and writing their name. Students completed this presentation over four days, and logging in took less time each progressive day allowing more time for actually creating the online slides. Students learned the processes involved in creating, which proved to be even more important that the products that were scored.

James, the fourth grade teacher, began using a screencasting app himself to "flip" his math classroom sending a Tweet when the math video was posted and they could access it from home. Parents and students viewed the video to learn the process, practiced a problem with online feedback, then created two problems of their own to bring to class the next day. The student-made projects represented a paradigm shift for James as he placed each student on a laptop and had them complete math examples using the screencast app and then post them to their class Edmodo site. Students became the creators of the videos, learning new literacies skills along with math skills, preparing them for the 21st century.

Student Technology Projects

Dyads evaluated student technology projects using the Student Technology Product Rubrics for grades K-1 (n=2), grades 2-3 (n=6), and grades 4-5 (n=14). The rubric framework overlays technology standards from ISTE (2008) and the Common Core State Standards (2010). Dyads selected projects that displayed their students' best use of technology during the semester. (a) Three literacy projects were submitted demonstrating kindergarten students' ability to conduct a Google image search, copy and paste a selected image, and type text onto a PowerPoint slide to practice new literacies skills along with word family patterns. (b) Seven math projects demonstrated a variety of students using the Educreations screencast app to work math problems, explaining their reasoning metacognitively. (c)Twelve writing projects showed the diversity of digital stories, eBooks and personal essays created and published by students.

Each standard was measured on a scale of 1 to 3 to indicate student use of technology with 1 indicating *emerging,* 2 *proficient,* and 3 *exceptional*; zero was used to indicate that the standard was not present. The technology standards where students scored highest included *creativity and innovation* for using varying features to create original work, *digital citizenship* for taking online safety precautions with a positive attitude, and *technology operations and concepts* for correctly using the available technology. The standard that was least used in the submitted projects was *research and information fluency* followed by *communication and collaboration*.

Table 5

Technology Project Rubrics Descriptive Statistics

ISTE Standards Measured	# Cases the standard is Not Present	Min	Max	Mean	SD
1. Creativity & Innovation	0	1	3	2.00	.76
2. Communication & Collaboration	3	0	2	1.33	.71
3. Research & Information Fluency	10	0	1	.55	.51
4. Critical Thinking, Problem Solving, & Decision Making	2	0	3	1.43	.73
5. Digital Citizenship	0	1	3	1.80	.50
6. Technology Operations & Concepts	0	1	3	1.77	.69

Discussion

The quantitative results show that teachers in the project had significant use of technology and significant confidence in the integration especially in math and literacy instruction. Student teacher change between the cohort before the integration work started and the first cohort that experienced full integration showed remarkable growth in both efficacy to use technology and the frequency of technology integration in the classroom. The change is a result of three aspects of teaching: improved technology availability in classroom, faculty support and the growth in the technological pedagogical content knowledge.

Working with volunteers in a non-evaluative manner, the coach met with little resistance when adding the technology component to the pedagogical content knowledge of cooperating teachers and their student teachers. The student teaching classroom became an exciting site for inquiry (Cochran-Smith & Lytle, 2009) as both partners became learners together, collaborating to add a new level of technology integration to teaching and student learning. Evaluation of student technology projects showed that devices were put into the hands of students allowing them to demonstrate learning in multimodal ways. Collaboration between classroom teacher and student teacher, with the support of a coach, set these dyads and their students up for success.

Participants reacted favorably to the coaching: purchasing their own iPads, writing grants, and noting paradigm shifts in their teaching philosophies as they incorporated technology into their pedagogical content knowledge. At a time when some school districts are eliminating coaching positions, our research supports previous studies showing that coaching does empower teachers to implement new strategies in teaching (Darling-Hammond & Sykes, 2003; Matsumura, Garnier, & Resnick, 2010); and at a much faster pace than the three to five years many suggest for a paradigm shift.

Dyads who learned apps at the technology conference could ask questions and get teaching suggestions for using them in the classroom from the coach. Observations showed that students were on task, engaged and practicing digital citizenship when using technology. Teachers are teaching technology skills within curricular lessons; this meets needs of time required and computer teachers lost in schools. In addition, teachers chose which technologies students will use rather than provide students with a variety of tools and allowing them to select the one that best allows them to complete the task. Although students helped each other, most projects were completed individually rather than in collaborative groups. These are areas for further research and professional development.

All projects selected by dyads as best examples of students work with technology empowered students to be creators rather than consumers. Each represented a first attempt by teacher, student teacher, and students to use technology devices in this way. Some factors that confounded this process included number of devices available for student use and time to fit the activities into a highly scheduled curriculum and school day. Each dyad had the one iPad1 that we gave them to use for the duration of the study. Throughout the semester student teacher and cooperating teacher collaborated to plan ways to use this one device with students individually, in groups, and whole class. Not all projects asked students to use all six measured technology standards, and many required observation of the process in addition to the product to evaluate. Again, none of these projects were completed collaboratively.

Conclusion

This study shows that it is possible to significantly increase the technological pedagogical content knowledge of pre-service teachers. This positive result is a clear indication that the approach of improving the quality of technology integration in Teacher Education, hand in hand with changes in technology integration in schools, had a multiplicative effect on outcomes!

References

Apple Education. (2004). *The evolution of thought and practice. Technology planning guide: Professional development.* Retrieved from http://www.apple.com/education/planning/profdev/index4.html

Borsheim, C., Merritt, K., & Reed, D. (2008, November-December). Beyond technology for technology's sake: Advancing multiliteracies in the twenty-first century. *Clearing House: A Journal of Educational Strategies, Issues and Ideas, 82(*2), 87-90.

Cantrell, S. C., & Hughes, H. K. (2008). Teacher efficacy and content literacy implementation: An exploration of the effects of extended professional development with coaching. *Journal of Literacy Research, 40,* 95-127

Carroll, D. (2007). Helping teachers become teacher educators. In D. Carroll; H. Featherstone: J. Featherstone; S. Feiman-Nemser; & D. Roosevelt (Eds.), *Transforming teacher education: Reflections from the field* (pp. 181-202). Cambridge, MA:Harvard Education Press.

Cochran-Smith, M., & Lytle, S. (2009). *Inquiry as a stance: Practitioner research in the next generation.* New York: Teachers College Press.

Common Core State Standards. (2010). Common Core State Standards Initiative. Retrieved from http://www.corestandards.org/

Darling-Hammond, L., Hammerness, K., Grossman, P., Rust, F., & Shulman, L. (2005). The design of teacher education programs. In L. Darling-Hammond & J. Bransford (Eds.), *Preparing teachers for a changing world* (pp. 390-441). San Francisco: Jossey Bass.

Darling-Hammond, L., and G. Sykes. (2003). Wanted: A National Teacher Supply Policy for Education: The Right Way to Meet the 'Highly Qualified Teacher' Challenge. *Educational Policy Analysis Archives, 11*(33). Retrieved from http://epaa.asu.edu/epaa/v11n33

Friedrich, L. A., & Wilson, K. M. (2011, December) *Technology Integration by an Instructional Coach in Two Midwestern Elementary Schools: A Case Study.* Paper presented at the Annual Meeting of the Literacy Research Association, Jacksonville, FL.

Garet, M., Porter, A., Desimone, L., Birman, B., & Yoon, K. S. (2001). What makes professional development effective? Results from a national sample of teachers. *American Education Research Journal, 38*(4), 915-945.

International Reading Association. (2009, May). *New literacies and twenty-first century technologies: A position statement.* Retrieved from www.reading.org.

International Society for Technology in Education. (2008). *National educational technology standards for students* (2nd ed.). Eugene, OR: Author. Retrieved from http://cnets.iste.org/

Kelley, M., Gray, P. D., Reid, D. J., & Craig, C. J. (2010). Within k-12 schools for school reform: What does it take? In N. Lyons (Ed.), *Handbook of reflection and reflective inquiry: Mapping a way of knowing for professional reflective inquiry* (pp 273-298). Springer Science + Business Media.

Koehler, M., & Mishra, P. (2009). What is Technological Pedagogical Content Knowledge (TPCK)? *Contemporary Issues in Technology and Teacher Education, 9(1),* 60-70.

Koehler, M. J., Mishra, P., Bouck, E., DeSchryver, M., Kereluik, K., Shin, T. S., & Wolf, L. G. (2011). Deep-play: Developing TPACK for 21st century teachers. *International Journal of Learning Technology, 6*(2), 146-163.

Margolis, J. (2007). Improving relationships between mentor teachers and student teachers: Engaging in a pedagogy of explicitness. *The New Educator, 3*, 75-94.

Matsumura, L. C., Garnier, H., & Resnick, L. B. (2010). Implementing literacy coaching: The role of school social resources. *Educational Evaluation and Policy Analysis, 32*(2), 249-272. Doi:10.3102/0162237371036374З

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record, 108*(6), 1017-1054
.

Miles, M. B., & Huberman, A. M. (1994, January 12). *Qualitative data analysis: An expanded sourcebook*. Sage.

Observation Protocol for Technology Integration in the Classroom (OPTIC). (2004). Northwest Regional Educational Laboratory. Retrieved from http://www.netc.org/assessing/home/integration.php

Shulman, L. S. (1986, February). Those who understand: Knowledge growth in teaching. *Educational Researcher, 15*(2), 4-14.

Shulman, L. (1987). Knowledge and teaching: Foundations of the new reform. H*arvard Educational Review, 87(*1), 1-21.

Stake, R. E. (1995). *The art of case study research.* Thousand Oaks, CA: SAGE.

Stake, R. E. (2000). Case Studies. In N. K. Denzin, Lincoln, Yvonna S. (Ed.), *Handbook of Qualitative Research second edition* (pp. 134-164). Thousand Oaks, CA: Sage Publications, Inc.

Trainin, G., & Friedrich, L. A. (2012). *Use of new literacies in elementary classrooms today: A partnership to enhance student learning through teacher preparation and professional development.* Improving Teacher Quality State Grant: Nebraska's Coordinating Commission for Postsecondary Education. Retrieved from http://www.ccpe.state.ne.us/PublicDoc/Ccpe/itq/pastrecipients/11_12.pdf

Vogt, B., & Shearer, B. A. (2011). *Reading specialists and literacy coaches in the real world.* Boston, MA: Pearson.

Walser, N. (2011). Teaching twenty-first century skills: What does it look like in practice? In Walser, N. (Ed) (2011). *Spotlight on Technology in Education: Harvard Education Letter Spotlight Series (7)* (pp. 37-46). Cambridge, MA: Harvard Education Press.

Yin, R. K. (2003). *Case study research: Design and methods* (Vol. 5). SAGE.

Zeichner, K. (2010). Rethinking the connections between campus courses and field experiences in college- and university-based teacher education. *Journal of Teacher Education, 61*(1-2), 89-99.