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Assessing a Technology Infusion Approach in a Teacher Preparation Program

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In this study, we examined the benefits of preparing teacher candidates (TCs) to integrate technology into their future teaching by infusing technology integration instruction into program methods courses. We surveyed 237 TCs who rated perceptions of their technology integration skills, general preparation, self-efficacy for teaching, and so on. Results indicated TCs believed they were as well prepared to integrate technology as they were prepared to teach in general. Qualitative data provided information on how they had used technology during student teaching and how they intended to use technology in their future classrooms. In conclusion, technology integration was successfully taught in technology-infused methods courses, but we must continue to improve this technology-infused methods course instruction and instructors to more fully achieve our goals of sound technology integration by all TCs.

Keywords: teacher candidates; technology integration; technology-infused methods courses

INTRODUCTION & BACKGROUND

The purpose of this study was to examine the benefits of an approach within our teacher preparation program in which technology was infused in general teacher methods courses as a way to prepare teacher candidates to integrate technology into their future teaching. In the study, we explored the following research questions: After completion of student teaching, to what extent did teacher candidates (TCs) perceive their preparation to integrate technology as compared to other facets/components of their teacher preparation program? How did TCs integrate technology into their student teaching? How will TCs use technology in their own classrooms in the future? What advice do they have for improving technology-infused courses in the teacher preparation program?

CONTEXT

The leaders in our teacher preparation program were advised by principals and superintendents who hired our graduates that they required too much on-the-job training to do their jobs well. Consequently, we proceeded to add a semester of student teaching so

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that student teaching would become a full year of supervised experience. As a result, of the added student teaching requirement, we eliminated several previously required courses, including the stand-alone technology course. To make up for the absence of the stand-alone tech course, we began to use a new strategy that purposely infused technology-integration assignments, objectives, and lessons into methods courses, and aligned the courses to the International Society for Technology in Education Standards for Teachers (ISTE-T). By fall 2015, a total of 16 methods courses across five programs had been infused with technology and aligned to the ISTE-T. A team of action researchers has continuously investigated the progress of this approach.

Compared to the previous stand-alone course, which was taught by faculty who were selected for their educational technology expertise, the infusion approach placed the responsibility of teaching technology integration on instructors who were hired for their knowledge and expertise in teaching content methods, and who had varying, though generally quite limited, technology capabilities. The new model required that these instructors become skilled and confident so they could deliver the course with fidelity with respect to the technology goals. Training faculty members and instructors was a critical component to the success of the new model.

INTERVENTION: PROFESSIONAL DEVELOPMENT SPECIFIC TO TEACHER EDUCATORS

During the first year of the effort, two tenets of professional development (PD) were particularly relevant to this study. First, the complexity of the tasks expected of participants and their prior backgrounds provided a basis for determining the amount and type of PD needed. Second, successful PD leaders offered various modes of delivery of training as well as different levels of training (Speck & Knipe, 2005). Technology infusion specialists were responsible for training the instructors and providing on-going support. They and the course instructors communicated regularly about the support needed for implementation of the new technology-infused courses. Given the range in technology integration know-how, confidence, and skill level of the faculty members and instructors teaching the tech-infused courses, the technology infusion specialists offered a wide range of professional development opportunities, including face-to-face workshops and planning sessions, just-in-time training through e-mail exchanges and phone communications, in-class modeling, co-teaching, and on-going dialogue among tech-infused faculty members and instructors through a social media group. All instructors of the technology-infused methods courses were invited to participate in the professional development offerings. Additionally, all instructors used the standard syllabus for their course, which included technology-infused objectives and assignments.

THEORETICAL FRAMEWORK AND RELATED RESEARCH

Mishra and Koehler's Technological Pedagogical Content Knowledge (TPACK) framework undergirded our technology infusion and research efforts (Koehler & Mishra, 2008; Mishra & Koehler, 2006). The TPACK framework has its roots in work by Shulman (1986) who suggested that good teaching involves blending content and pedagogical knowledge; Mishra and Koehler extended the model to incorporate technological knowledge. The TPACK framework suggested that the integration of technology required teachers to have strong content knowledge (CK), pedagogical knowledge (PK), and technology knowledge (TK). Further, they needed to seamlessly weave these knowledge bases together as they developed pedagogical content knowledge (PCK), technological content knowledge (TCK), and technological pedagogical knowledge (TPK), as well as technological pedagogical content knowledge (TPACK).

In related work, Niess and her colleagues (Niess, 2011; Niess et al., 2009) examined the development of TPACK among in-service teachers. They suggested the development of TPACK took place when technology was introduced alongside content, to enhance content instruction. This approach resulted in thoughtful, measured integration of technology with content that included five steps. First, teachers recognized (knew about) the alignment of technology with content, but did not yet integrate technology into teaching content. Second, teachers accepted (were persuaded about) the use of technology for teaching specific content. Third, they adapted (made a decision about) technology to assist in teaching a content area. Fourth, teachers explored (implemented), that is, actively integrated technology into teaching. Fifth, teachers advanced (confirmed) their use of technology integration by evaluating the results of their integration efforts. Additional research evidence suggested in-service teachers acquired TPACK knowledge through unique pathways where, at any point in time, they focused on one area more closely than another (Krauskopf, Foulger, & Williams, 2017).

The development of technology integration skills has also been explored in TCs. For example, Bell, Maeng, and Binns (2013) investigated pre-service, science TCs' use of technology during student teaching. Results showed TCs integrated technology into their reform-based science instruction and used technology to teach process skills, support inquiry, and facilitate student engagement. TCs claimed program components such as modeling by instructors, peer collaboration, and feedback and reflection after teaching lessons facilitated their integration of technology during student teaching.

Mouza, Nandakumar, Yilmaz Ozden, and Karchmer-Klein (2017) carried out a longitudinal study to examine how TPACK knowledge was affected when TCs participated in an integrated technology instructional approach. In this approach, TCs participated simultaneously in methods courses, a two-credit education technology course, and a field experience during their junior or senior years after they had taken a 1-credit educational technology tools course during their freshman year. TPACK knowledge grew over the course of their preparation, but an unusual pattern occurred in many of the scores. Scores for TK, TCK, TPK, and TPACK were significantly less at the beginning of the second course than they were at the conclusion of the first course. The authors suggested the decreases resulted because TCs did not have occasions to "observe, practice, or model effective integration of content, pedagogy, and technology during their undergraduate content instruction (general studies courses)" (Mouza et al., 2017, p. 15). Moreover, TCs became adept at using technology to facilitate student understanding of content. Finally, Mouza et al. found TCs *adapted and explored* uses of technology throughout instruction, which was consistent with stages 3 and 4 of Niess' (2011) work.

In an earlier study, Buss, Wetzel, Foulger, and Lindsey (2015) conducted comparisons of the two TC groups, stand-alone course TCs vs. technology-infused course TCs, before and after the course(s). We found that both groups generally improved their overall TPACK scores. However, there were differences between the two types of courses such that:

- TK and TPK grew at faster rates in the stand-alone course;
- CK and PK developed at faster rates in the technology-infused courses; whereas,
- TPACK showed no differences in growth rates between the two approaches.

As one might expect, we found the stand-alone class, which had a stronger emphasis on learning new technologies and was led by experts in technology in education, better developed technologically related indices, TK and TPK. On the other hand, the technology-infused methods courses, led by subject-matter experts who had a strong emphasis on the course content and pedagogy along with technology, fostered more rapid development of content knowledge (CK) and pedagogical knowledge (PK) (Buss et al., 2015).

Although these data provided immediate information about learning of TPACK skills, we were interested in examining how adequately these tech-infused, technology integration skills were exhibited later in the program and how these skills compared with other skills developed during the teacher preparation program. Thus, the following four research questions (RQ) guided the conduct of this study.

RQ 1: To what extent did TCs perceive their preparation to integrate technology into their instruction as compared to other facets/components they learned during the teacher preparation program?

RQ 2: How did TCs implement technology integration during student teaching?

RQ 3: How did TCs intend to integrate technology into their future classrooms?

RQ 4: What advice did TCs have for improving technology-infused courses?

METHOD

PARTICIPANTS

In all, 237 undergraduate students who were finishing the teacher preparation program completed an online survey. Of these students, 79.6% were female and 20.4% were male. With respect to ethnicity, the following percentages were obtained: 61.3% Caucasian, 27.2% Hispanic, 3.8% Asian, 2.6% African American, 2.6% two or more ethnic groups, 1.7% Hawaiian and Pacific Islander, and 0.4% American Indian. These students came from programs such as early childhood, elementary, secondary, special, and English language learner education.

INSTRUMENTS AND PROCEDURE

The online survey included 48 close-ended, Likert items and three open-ended items. The Likert items assessed five different constructs: (a) teaching efficacy, (b) program preparation factor 1, (c) program preparation factor 2, (d) technology integration, and (e) TAP indicators (National Institute for Excellence in Teaching [NIET], 2012). The teacher efficacy construct was based on scores derived from the 12-item, short version of the Teachers' Sense of Efficacy Scale (TSES; Tschannen-Moran & Woolfolk Hoy, 2001). Examples of items included: "How much can you do to get children to follow classroom rules;" and "To what extent can you provide an alternative explanation or example when students are confused?" Because the TSES was constructed with a 9-point scale, we multiplied scores by .555 to convert it to a 5-point scale, which was used for the other four constructs. The five-point Likert scale used for all other items, but the TSES items ranged from 5 = *Strongly Agree*, 4 = *Agree*, 3 = *Neither Agree nor Disagree*, 2 = *Disagree*, to 1 = *Strongly Disagree*. Program Preparation Factor 1 consisted of 20 items that assessed general preparation in the program. Examples of items included: "How well do you think your teacher preparation program prepared you to teach the concepts, knowledge, and skills of your discipline(s) in ways that enable students to learn?" and "How well do you think your teacher preparation program prepared you to use instructional strategies that promote active student learning?" Program Preparation Factor 2 consisted of three items that assessed preparation for teaching English language learners and working with parents. Examples of items included: "How well do you think your teacher preparation program prepared you to teach in ways that support English language learners?" and "How well do you think your teacher preparation program prepared you to work with parents and families to better understand students and to support their learning?" The technology integration construct consisted of five items that measured students' perceptions of their abilities to integrate technology into instruction. Representative items were: "The questions below are designed to help us gain a better understanding of how technology is integrated into instruction … your ability to use technology as an instructional strategy?" and "The questions below are designed to help us gain a better understanding of how technology is integrated into instruction ...your ability to use technology to teach academic content knowledge?" The final construct was a score that represented how TCs perceived their ability to teach based on eight TAP indicators, which served as the basis for student assessment of skill development throughout the program, but especially during student teaching. Representative items included "How strong was your educational experience in preparing you to perform effectively on the following TAP indicator -- Presenting Informational Content?" and "How strong was your educational experience in preparing you to perform effectively on the following TAP indicator -- Activities and Materials?"

Three open-ended items were relevant to our research efforts. The three items were: "Describe your use of technology infused instruction during your student teaching experience;" "Describe how you hope to use technology infused instruction in your own classroom next year;" and "What advice do you have for the program that would better prepare future students to integrate technology into their classrooms?"

With respect to data collection procedures, students received an email with a link to the survey and were asked to complete the survey. One follow-up email reminder was sent.

RESULTS

INITIAL DATA ANALYSES

Note that the instruments described above were based on the results from several factor analyses, which are described next. Given the large number of participants, we conducted separate factor analyses for the 12 TSES efficacy items, the 26 Program Preparation items, the 5 technology integration items, and the 8 TAP items. Consistent with Tschannen-Moran and Woolfolk Hoy's (2001) findings for pre-service teachers, the 12 TSES efficacy items exhibited one factor. When we factor analyzed the 26 Program Preparation items, results indicated there were two factors--a general program preparation factor (factor 1) and preparation for teaching English language learners and working with parents (factor 2). For the technology integration items, there was one factor and similarly for the TAP indicators there was one factor. We also conducted reliability analyses for these instruments and found very strong reliabilities of .94, .98, .85, .95, and .92, for the TSES efficacy, the Program Preparation Factor 1, the Program Preparation Factor 2, the Technology Integration, and the TAP Indicator scores, respectively.

QUANTITATIVE RESULTS

Analysis Of Data For Research Question 1

A repeated measures analysis of variance (ANOVA) was conducted to assess the extent to which TCs perceived their preparation to integrate technology into their instruction as compared to other facets/components they learned during the teacher preparation program (RQ 1). The repeated measures ANOVA showed there were differences in scores among the five constructs, $F(4, 748) = 31.57$, $p < .001$, $\eta^2 = .144$, which was a large effect size for a within-subjects effect based on Cohen's criteria (Olejnik & Algina, 2000). The means and SDs for the five constructs have been presented in Table 1. Post hoc analyses showed Program Preparation Factor 2 was significantly less than all other constructs, all four *p*s < .001. Moreover, Program Factor 1 and Technology Integration scores were not different from one another, but were significantly less than TAP Indicator, both *p*s < .04, and Teaching Efficacy Scores, both *p*s < .002. Finally, the TAP Indicator and the Teaching

Efficacy scores did not differ from one another. Thus, TCs perceived they were prepared to integrate technology into their instruction to about the same extent as they were prepared in general to teach as measured by the Program Preparation Factor 1 score, but they were less confident about integrating technology as compared to teaching efficacy and performance on TAP measures.

Table 1. *Means and SDs for Five Constructs*

Construct	Mean	SD
Teaching Efficacy from TSES	4.06[a]	0.63
TAP Indicators	4.01[a]	0.81
Program Preparation Factor 1	3.90[b]	0.79
Technology Integration	3.84[b]	0.94
Program Preparation Factor 2	3.52[c]	0.94

Note: Means with the same superscript are not significantly different from one another. Means with different superscripts are significantly different from one another. See text for details.

QUALITATIVE RESULTS

Analysis of Data for Research Question 2

With respect to responses to the first open-ended question, “How did TCs implement technology integration during student teaching?” participants provided responses that were characterized by two themes. The first theme revealed frequency of use. On the other hand, the second theme reflected the nature of use.

Theme 1—frequency of use during student teaching. The frequency of use theme was characterized by participants’ responses that indicated how often they used technology during their student teaching experience. These responses ranged from no or little use to daily use of technology as part of instruction. One respondent wrote, “None - neither of my mentors used much or any technology.” Another claimed, “Very little. The school had very few technology resources.” Although these examples of no or infrequent use were limited, they were included because they portrayed the range of responses. On the other hand, one respondent suggested, “... we used technology every day for almost everything that we did in the classroom.” Another recorded, “I used technology every day in lessons to demonstrate to the students how important it is to have these skills.” A third scribed, “The interactive whiteboards became an integral part of my teaching as I began to use it daily.” Another maintained, “I used it [technology] daily to teach students.” Finally, a fifth respondent noted, “I was in a STEM class that used technology almost every day. I was able to integrate technology frequently.” Moreover, other respondents wrote responses about the frequency of use and indicated they used technology frequently or daily.

Theme 2—nature of use during student teaching. The ‘nature of use’ theme illustrated the ways in which TCs integrated technology into their instruction during student teaching. Broadly speaking, there were four ways TCs employed technology in their classrooms including (a) teacher use, (b) student use--effective, but not transformative, (c) higher level student use, and (d) use of the interactive whiteboard.

By *teacher use*, we meant the TCs used it to create materials or deliver instruction, but there was no mention of student use in their written responses. Thus, one respondent wrote, “PPt [PowerPoint], Prezi.” Another penned, “I used technology for [the] lesson almost daily, but the students didn't use much technology themselves.” A third recorded, “Much use of technology to present instructional content.” A fourth respondent wrote, “I used the resources on line to create my own worksheets." Finally, one participant noted, "I used PowerPoint presentations to teach new concepts to the students."

For *student use--effective, but not transformative*, we concluded students were actively using various kinds of technology, but in more traditional ways such as research, developing presentations, student assessments, supplementary materials, websites, and Google classroom. For example, one respondent indicated, "I used technology during students' unit review sessions, as well as software such as GeoGebra graphing calculator and Desmos to enhance students' understanding." A second scribed, "I have used various technologies, including the document camera, SMART Board, laptops, iPads, LiquidText app, Kahoot!, Socrative, GoFormative, YouTube videos, movies, music, etc." Another logged, "I used various resources such as Quizlet, Zaption and Kahoot!" A fourth respondent penned, "I incorporated the use of Study Island in my classroom during reading using student Chromebooks. I also had students research information about a particular state, and then had them create a PowerPoint presentation to showcase their learning while presenting to the class." Yet another respondent chronicled, "Kahoot!, posting assignments and feedback online, using social media to create character profiles, Google Forms, different apps on the students' iPads." Additionally, another authored, "[I] used tech during an entire unit on invasive species. Students were required to research, then design and build a PowerPoint."

With respect to *student use--higher level*, we meant technology was being used in a more innovative manner in the classroom such as use of tools for collaboration, use of online activities, creative tools, and video recording of student activity for feedback. For example, one respondent noted, "Using recording devices to document students' dancing. They are able to watch how they move and correct what needs to be fixed." Another scribed, "Video recording of professional dancers helps [students] visualize what a good example is. Video recording of students allows students to see that how dance movement feels." A third respondent wrote about creativity and collaboration when she logged, "I did an entire unit on Dilations (8th-grade math) which incorporated a technology infusion project for all students. We spent half of the day for two weeks working on these creative collaborative projects, and an entire day presenting them to the class. It was absolutely wonderful to see the students come to life with their creativity and technological skills." A fourth participant chronicled, "All bell work and exit tickets are online on Google Classroom. [I] also use interactive activities online." Another scribed, "I would have students use Google Drive to save their documents, collaborate on writing papers and editing, and sharing presentations with me. I also used Nearpod.com in order to move slides on students' computer screens and ask questions throughout the presentation."

Finally, the most frequent response offered by many TCs indicated they used *interactive whiteboards* as part of their technology integration during student teaching. For example, one TC responded, "I used the SMART Board most of the time." Another noted, "I was able to incorporate SMART Board lessons into most of my lessons." A third penned, " I used a SMART Board along with videos to engage my students." Another respondent authored, "SMART Boards and document cameras were used." A fifth wrote, "I used the SMART Board with different activities." Another responded, "I've had the opportunity to teach using SMART Boards. Using them to teach, rather than an overhead allows me to be more present [*sic, involved*] in the students' learning process[es] as well as incorporate videos and other interactive activities."

Analysis of Data for Research Question 3

For the next open-ended, research question, "How did TCs intend to integrate technology into their future classrooms?" participants provided responses that revealed the same two themes. The first theme reflected frequency of use, whereas, the second theme indicated the nature of use.

Theme 1—projected frequency of use. Again, some respondents provided written responses indicating the frequency of integration of technology. For example, one TC documented, "I plan to use technology as much as possible in my classroom next year." Another wrote, "I hope to use technology as much as I got to use it for my student teaching." Yet, another responded, "I'll use technology almost every day!" A fourth respondent penned, "I plan to use it a lot throughout my first year of teaching and even further, I believe wholeheartedly that technology is essential to learning." Finally, a fifth recorded, "I want to integrate technology into my classroom any chance I can."

Theme 2—projected nature of use. A few of the projected use of technology responses again reflected *teacher use* of technology, although these were quite limited. Nevertheless, one respondent wrote, "I will use iPads … and a projector for instruction." Another suggested, "I would use it in the same way [presenting information]." A third scribed, "I want to find a classroom management system that utilizes technology and something I can carry around and monitor with." Another chronicled, "I plan to use technology next year to make … lesson plans and use it to make IEP's for students if I am teaching in a special education classroom." A fifth penned, "I really only want to use PowerPoints. I don't mind if students use their devices to do some research, but other than that I am not a fan of technology in the classroom."

In terms of projected use, respondents offered a very large number of responses that reflected routine, *effective, but non-transformative use* of technology. For instance, one respondent logged, "I hope to use technology with students individually (such as Chromebooks, Plickers etc.) as well as whole group." Another noted, "I want to use the SMART Board and student computers. I want to incorporate technology into math using virtual manipulatives and I want the students to practice typing." A third chronicled, "I would love to continue using technology in my own classroom. I will do so by having students use them to research, take quizzes, submit assignments and practice their typing skills." A fourth respondent documented, "There will be projects that require technology use; I can clarify concepts with videos and reinforce/review information with online games (i.e. Kahoot!)." A fifth scribed, "I will be using a lot of the same technology in my own classroom to help supplement my students' learning, but to also help provide accommodations to my students who need help. Technology allows me to help my students with visual and audio assistance, which can help bring clarity to any topic or piece of literature." Finally, another wrote, "My students next year will also have laptops and I will use them in daily aspects of research, assignments, and assessing."

Again, with regard to projected use, a number of respondents indicated they would be *employing technology with students at a higher level* as illustrated in the following responses. One respondent penned, "I hope to use technology more next year for group collaboration and assessments. I would like to incorporate Google Classroom and Calendar." A second chronicled, "I hope to use technology infused instruction in a purposeful way to supplement learning. I will use it when simulations, videos, and making products are great ways to learn and demonstrate learning." A third briefly noted, "Zipgrade, student blogging, collaborative work use Google Drive." Another scribed, "iPad orchestra, online music notation programs, recording, etc." A fifth logged, "I hope to utilize different types of technology such as WebQuests, Weebly, Edmodo, and other sites that students can use to produce their work and also for me to communicate with them as well." Additionally, another scribed, "I would use the same methods I did this year (Google Drive for documents for collaboration .... Nearpod.com … Padlet and Prezi) and hope to find even more websites to use with them. I hope to also use Remind101 (app) with my students (and maybe parents) next year in order to send reminders to my students."

Finally, with respect to projected use, many respondents indicated they would continue to use the *interactive whiteboards*. For example, one respondent wrote, “Continue SMART Board presentations as well as introduce students to using technology to guide their learning.” Another briefly logged, “The same ones that I've used in my student teaching [SMART Board and SMART Technology],” A third chronicled, “I hope to have a SMART Board.” Another wrote, “using SMART Board.” A fifth respondent penned, “using SMART Board to do a lot of interactive teaching.” Finally, a sixth scribed, “I hope to use the SMART Board a lot more because it helps me provide lots of engaging opportunities for the students’ learning.”

Analysis of Data for Research Question 4

For the final open-ended, research question, “What advice did TC have for improving technology-infused courses?” respondents offered replies that reflected three themes. The first theme indicated they thought instruction and instructors could be improved. A second theme represented the desire for more tools and resources and more practice with the tools. A third theme showed respondents wanted a stronger focus on technology that was available in the schools.

Theme 1—improve instruction and instructors. For the first theme, respondents wrote suggestions that instruction and instructors could be improved. In terms of instruction, one respondent suggested, “I think that the course[s] should have more tips for using SMART Boards.” Another wrote, “I would encourage the college to incorporate a technology class during senior year that goes over tech practices that can be used at different grade levels.” Many other responses with regard to instruction were focused on the idea of including a technology class to augment the technology-infused efforts of the college. For instance, one respondent wrote, “Have a class that primarily goes over different online assessment tools and activities.” Another suggested, “A class that focuses on different kinds of classroom technology would be awesome. I would've really enjoyed a class where different tools and technology could've been used or experimented with.” A third penned, “Have a class that is devoted to technology in education.” Another logged, “Have a specific class on integrating technology, not just learning how to use it ourselves but how to use it with our students.” With respect to instructors, one respondent wrote, “Instructors need to be on the cutting edge themselves, constantly looking for online resources and relevant technologies to implement in the classroom. A lot of the technology instruction I received was ... redundant because the teachers did not anticipate how much knowledge we brought to the table.” A second scribed, “Make sure that the instructors that are teaching the ‘technology infused’ courses are fluent in their use of technology.” A third chronicled, “Make sure that the people teaching [class] know [the technology well].”

Theme 2—learn more tools and provide more practice with those tools. With regard to the second theme, the desire for more tools and resources and more practice with the tools, respondents offered the following suggestions. One respondent wrote, “Having more resources of sites or strategies that we can use in our classrooms.” A second chronicled, “Perhaps introduce us to more gadgets, programs, tools, etc., and actually have us utilize them so that we can learn how to integrate technology more than we already do.” A third scribed, “Provide students with different resources on technology and teach students how they can use the resources.” A fourth suggested, “Show more resources and tools to use with technology.” A fifth respondent noted, “Give lists of different websites and resources for teacher candidates to use.” Finally, a sixth chronicled, “Inform us on more ways to use technology, and teach us how to use the SMART Board to its full effect.”

Theme 3—focus on technology available in schools. In terms of the third theme on utilizing the technology found in the schools, respondents provided the following suggestions. One respondent penned, “Find out what technology classrooms have available in the area and teach how to capitalize on that." A second scribed, "I would just encourage them to ask about the technological devices available at the school to use and get familiar with them." A third respondent chronicled, "Find what resources are available at your school and take advantage of them. Each school uses a slightly different set of technologies." A fourth logged, "See what your classroom has and find a way to incorporate those things in your lessons." Finally, a fifth respondent noted, "Be exposed to technology that the district can offer."

DISCUSSION

Results from the quantitative and qualitative data suggest we have made substantial progress in infusing technology integration into methods courses, which has prepared TC to integrate technology into their instruction. Nevertheless, we still have a ways to go as we improve our efforts with respect to instruction on technology integration. The quantitative data indicate technology integration scores still have room for growth when they are compared with the other scores related to teacher candidate preparation. These data were also confirmed by the qualitative data, which will be explained in more detail below.

With respect to the qualitative data for the first two questions--(a) how TCs used technology during student teaching and (b) how TCs project they will use it during their first year of teaching, results are remarkably similar, which is not surprising. Some respondents indicated they would use it in a teacher-directed fashion to deliver instruction. On the other hand, the majority of respondents wrote about using technology and expecting to use technology in routine, non-transformative ways. Still others claimed they used and intended to use technology in more transformative fashion, albeit the number of these TCs was much smaller.

Taken together, this range of implementations of technology integration reflects various levels of ability and confidence for integrating technology into their teaching situations/futures. Further, we suspect this range of implementations represents a developmental phenomenon that characterizes technology integration more generally. Specifically, TCs with greater technology skills and greater confidence in using technology undoubtedly are more likely to integrate technology into their classrooms for teaching and learning and implement it at higher levels. These levels reflect greater use by students who are also engaging in more sophisticated efforts such as collaboration on documents and writing, creation of collaborative products, and so on. The developmental course of these technology integration abilities appears to be an area warranting additional examination. Thus, for example, some questions might be: What is the developmental course for technology integration? What factors facilitate the development of technology integration? What role does the school environment play in development of technology integration?

The final open-ended question asked students for their recommendations to improve instruction with respect to technology integration and particularly as it was infused into the program. Some respondents indicate we need to improve the preparation of the university instructors to integrate technology into their courses. The syllabi for the various methods courses are clear and complete with course objectives that specify technology integration assignments and activities, but some instructors are not implementing the agreed-upon outcomes as designed. Consequently, it appears likely that some students evaluate their preparation to integrate technology into their teaching lower than their general ability to deliver instruction. On the other hand, we need to keep students' comments and ratings in perspective because they rate their technology integration preparation higher than their ability to relate to parents and meet the needs of second-language learners. The authors view research that focuses on student views of their learning as action research because it reveals areas that we as leaders need to address. Clearly, (a) the selection of instructors and (b) the preparation of the instructors to integrate technology into their courses needs to be addressed. In both cases, we encounter some teacher preparation program cultural problems. First, we make professional development available, but instructors are not required to participate nor do they receive stipends to participate. In pilot projects, we have received grant funding to build a total approach that includes stipends for professional development and the results are promising. Further, although we provide just-in-time professional development, coaching, and classroom demonstrations, we observe that intense periods of training that allow instructors to gain confidence and skills and most importantly transform their total practice by weaving together pedagogy, content, and technology are most effective. For example, the college provides this type of intense training for instructors to use the TAP rubric, which is used to assess TCs' teaching performance on various indicators and instructors must be recertified every three years. Note that the students rated their ability to implement the TAP indicators highly. Second, technology integration is not the primary criteria for selecting instructors; at times instructors are recruited at the last minute to teach the course and these individuals are not adequately prepared to teach within the TPACK framework. In this regard, our technology integration specialists will continue to meet to prepare instructors is so far as possible. In both cases, there is no magic bullet, that is, a once-and-for-all solution. Rather it is the realization that program implementation requires consistent attention over time (Hall & Hord; 2006; Fullan, 2007). Professional development will always be necessary. People change and knowledge changes, particularly with regard to technology and its use in education. Self-assessment with regard to instructional value, particularly with respect to teaching with technology, requires continual attentiveness and support with appropriate resources and thoughtful leaders.

EDUCATIONAL SIGNIFICANCE/IMPLICATIONS

In summary, there are four implications that warrant brief consideration. First, technology integration has been successfully taught in technology-infused methods courses. Clearly, based on the quantitative and qualitative data, TCs developed technology integration skills when those skills were infused in methods courses. Second, although our efforts have achieved some successes, we must continue to improve this technology-infused methods course instruction and instructors to more fully achieve our goals of sound technology integration by all TCs. Third, continuing professional development will be necessary to ensure instructors are facile with the latest educational technology and they can teach it to TCs. Fourth, continued research, especially with respect to the development of technology integration skills and confidence including exploration of factors that influence the development of technology integration will be beneficial as we move toward better preparing teachers to integrate technology into their classroom instruction to facilitate student learning and thinking.

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