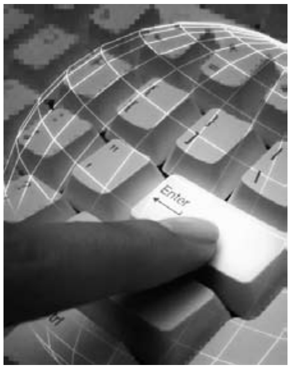

Developing Pedagogical Technology Integration Content Knowledge in Preservice Teachers: A Case Study Approach

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Abstract

This research examined the effects of case-based instructional strategies on the development of Pedagogical Technology Integration Content Knowledge (PTICK) in alternative teacher preparation students. The study was part of the Crossroads Project funded by the Preparing Tomorrow's Teachers for Using Technology (PT3) grant from the United States Department of Education. Thirty-three students completed a six-week course in technology integration in teaching methods at a large Southeastern university. Content analysis was used to examine student data: case responses, case reflections, and course reflections. Although there were mixed responses to the case analysis process, findings indicated that as the semester progressed the preservice teachers began to display an understanding of integrated concepts of PTICK and valued learning from the group case discussions.

Purpose and Theoretical Framework

According to Shulman and Shulman (2004), accomplished teachers are those who belong to a professional community, possess a vision, have motivation to act, know what to teach and how to teach it, and reflect and learn from experience. Teaching is a complex, intellectual process involving the application of learning theories, design principles, communication channels, and decision-making processes to solve ill-structured problems. Shulman (1987) proposed that there are seven categories of knowledge that underscore teachers' knowledge base for effective teaching: content, pedagogical, curriculum and pedagogical content knowledge (PCK), in addition to knowledge of learners, educational contexts, and educational purposes. Of these, PCK is perhaps the most influential in redesigning teacher education courses and programs (see NCATE Unit Standards). According to Shulman (1986), pedagogical content knowledge (PCK) is a specific category of knowledge "which goes beyond knowledge of subject matter per se to the dimension of subject matter knowledge for teaching" (p.9). It is the teachers' ability to identify learning difficulties and students' misconception combined with the fluidity to transform subject matter using "the most powerful analogies, illustrations, examples, explanations, and demonstrations—in a word, the ways of representing and formulating the subject that makes it comprehensible for others" (Shulman, 1986, p. 9).

Literature on pedagogical content knowledge (PCK) has included research from elementary preservice teacher education to college professors (Foss & Kleinsasser, 1996; Mishra & Koehler, 2006; van Driel, Verlopp, & de Vos, 1998). This research has been conducted in various content areas, yet common themes have evolved to view PCK as a way of knowing. The major components of PCK culminate into knowledge of their subject matter, their students, the instructional strategies adopted, and the context in which instruction occurs. Also evidenced is the importance of the teachers' own purpose for teaching, and the role that their own personal beliefs play in the interpretation and evaluation of knowledge. This way of knowing is unique to teachers when they can take an aspect of subject matter and transform their way of understanding it into a format of instruction in which their students can understand (Fernandez-Balboa & Stiehl, 1995). Hence, PCK should not be looked at as a fixed body of knowledge. Rather, it should be seen as the acquisition of knowledge of teaching which develops through reflection and application in an iterative manner.

The research community has explored the dimensions of PCK and reconceptualized it in a variety of ways (Barnett & Hodson, 2001; Cochran, DeRuiter, & King, 1993; Gess-Newsome & Lederman, 1999; Loughran, Mulhall, & Berry, 2004; van Driel, Verloop, & DeVos, 1998). Only recently has the field of Instructional Technology begun to conceptualize PCK as it relates to technology integration (Mishra & Koehler, 2006; Guerrero, 2005; Margerum-Leys & Marx, 2004; Pierson, 2001). As a means to better identify "true technology integration," Pierson (2001) used the concept of PCK along with technology knowledge, which she defined as "basic technology competency … [and] an understanding of the unique characteristics of particular types of technologies that would lend themselves to particular aspects of the teaching and learning process" (p.427). She characterized technological-pedagogical-content-knowledge (TPCK) as the intersection of knowledge in the areas of content, pedagogy, technological and pedagogical content. Koehler and Mishra's (2005; Mishra & Koehler, 2006) framework also includes technological pedagogical knowledge (TPK) and technological content knowledge (TCK). They argue that "true" technology integration involves "understanding and negotiating the relationships" (Koehler & Mishra, 2005, p. 134) between content, technology and pedagogy and the subsequent interplay made between these three components of knowledge to make PCK, TPK, TCK and Technological Pedagogical Content Knowledge (TPCK).

In contrast, the authors of this paper feel that preservice teachers need not only procedural, conceptual and pedagogical content knowledge but also reflective and community knowledge as well, specifically that related to technology integration: pedagogical technology integration content knowledge (PTICK). PTICK contains five dimensions: technical procedural knowledge (knowing about and being able to operate the technology), technology integration conceptual knowledge (integrated concepts, principles, strategies and ideas behind effective uses of technology for teaching and learning), pedagogical content knowledge (knowledge and ability to transform subject matter content for learners' needs), reflective knowledge (metacognitive abilities to reflect, problem-solve and learn from experiences), and community knowledge (knowledge of local and school community, ability to develop a classroom community as well as participate in a professional learning community).

Field experiences during the preservice teachers' education program often provide a context in which to develop these skills. However, these opportunities may not be available to students until later in their course work, as was the situation in this study, and opportunities to integrate technology into their teaching may be limited by a variety of factors in their field placements. The purpose of this study was to explore how using cases promotes the development of PTICK.

Using Cases in Teacher Preparation

One way to mediate the "theory to practice gap" and promote the development of PTICK is to infuse teacher and technology courses with a problem-centered approach via cases. Problem-centered instruction encompasses many forms: problem-based, case-based, action, project-based, question- or issue-based learning and goal-based scenarios (Duffy & Cunningham, 1996; Jonassen, 2000). More than 20 years ago, Shulman (1986) advocated the use of cases in teacher education in order to develop pedagogical content knowledge. Recently, Daehler and Shinohara (2001) explored how science teaching cases integrated with both content and pedagogy could deepen 18 elementary science teachers' content knowledge and PCK. Their results indicated that in two thirds of the case discussions, the teachers built upon both their content knowledge and pedagogical reasoning; however, the depth of the teachers' PCK conversations within their groups was correlated to the level of content knowledge they possessed.

Lundberg (1999) reviewed research on using cases with preservice teachers and summarized three effects that case methods had on preservice teachers' knowledge about teaching and learning. According to Lundberg, case analysis and discussions 1) created theoretical and practical knowledge; 2) improved reasoning ability and promoted metacognition; and 3) increased awareness of preservice teachers' beliefs and values, which in turn enhanced epistemological growth. Angeli (2004) examined the effects of cased-based learning on 100 second-year early childhood preservice teachers' beliefs about the pedagogical uses of ICT in the classroom. While the students initially had negative beliefs, eventually the use of cases effected their beliefs about the pedagogical uses of ICT in the classroom in a positive manner. In preservice teacher preparation, case-based pedagogy has been used to teach preservice teachers a variety of skills from adapting instruction for limited English proficient students with disabilities (Andrews, 2002); to reflecting on instructional practices through multi-media cases (Hewitt, Pedretti, Bencze, Vaillancourt, & Yoon, 2003); to exploring biases and beliefs related to race, gender and culture (Shulman, 1992); to developing formal and practical knowledge (Lundeberg & Scheurman, 1997). Nevertheless, although the use of case-based learning is well documented, less is written about research on the use of case-based learning as an instructional strategy for promoting technology integration.

Guiding Questions

- What role do case discussions play in the development of PTICK?
- What role do case analyses and case reflections play in the development of PTICK?

Methods

This research used a variety of qualitative methods within the context of an exploratory multi-case study. As suggested by Yin (2003), the case study design is an appropriate way to investigate the causal links and the context relating to an intervention. It is also useful when there is little or no control over the behavioral events. The units of analysis are each of the two sections of IT 7360, *Technology for Educators*.

Participant Selection and Context

The participants in this study were enrolled in a 45-hour, four semester intensive alternative teacher education program. Originally developed in the math and science content fields, these alternative preparation programs are still referred to by an acronym of their original name, *Teacher Education Environments in Math and Science*, or TEEMS. Currently, students may complete the alternative preparation program in English, mathematics, science, social studies, or middle childhood education. According to their program requirements, both the English TEEMS and Science TEEMS students already had an undergraduate degree or the equivalent hours in their content field, and passed a rigorous selection and interview process for admission.

The participants in this study were in the first semester of their programs and enrolled in a six-week summer IT 7360 course designed specifically for their content areas. The first and second authors taught the two sections referred to in this study: one English Education cohort (n = 14) and one Science Education cohort (n= 19). This was the students' first semester in their respective programs. The three-credit-hour course occurred twice per week for three hours. There were more female participants (n = 26) than male (n=7) in the study. Seven women were Black; 19 women were White; seven men were White. Their ages ranged from 23 to 48. Although all the participants had a first degree in a content area, only four had provisional teaching certificates and had completed one year as a classroom teacher at the secondary level. The remaining students had little (substitute teaching or volunteering) to no formal classroom teaching experience. However, the Science Education cohort had more students with substitute teaching experience.

Course Design and Use of Cases: IT7360 Description

The IT 7360, Technology for Educators, incorporates a problem-centered, activity-based approach anchored in authentic and familiar contexts in which teaching and learning with technology occurs (Cognition and Technology Group at Vanderbilt, 1991; Vygotsky, 1978). It supports the National Educational Technology Standards for Teachers (NETS-T) and the Interstate New Teacher Assessment and Support Consortium (INTASC) Standards. The online learning environment can be accessed at http://msit.gsu.edu/IT/Teachers/.

While introducing and reinforcing technology integration skills, the focus of the course is teaching and planning methods for the K–12 technology–enhanced learning environment. Throughout the course, preservice teachers demonstrate their technology integration skills in a variety of activities that focus simultaneously on what they can do with the technology, personally, and their ability to plan for their students' use of technology to meet curriculum requirements. The capstone project is a learning environment portfolio. Preservice students generate a portfolio documenting the design and development of a technology-supported instructional environment that facilitates student learning through student-centered learning activities. Working individually or in small cooperative groupings, students describe a learning environment in which they might be teaching. They develop a unit plan and several lesson plans along with the necessary materials that demonstrate their ability to integrate technology into their selected curriculum appropriately. Problem-based exercises were added to the course in fall 2004 in an effort to provide a problem-solving context for technology integration. Case studies were piloted in summer 2005 in order to better develop pedagogical content knowledge and PTICK for the alternative teacher preparation students.

Role of the Researchers

Five researchers participated in the study. The first author taught a section of English TEEMS; the second author taught the Science TEEMS cohort. In addition to teaching the courses, the roles of the first and second author included acting as primary instruments for gathering, analyzing, and interpreting the data. The third author served as the course designer and coordinator for all sections of IT 7360. In addition to assisting with data interpretation, she also served as a peer debriefer for the researcher-instructors while the course was in session and during data analysis. Her feedback helped to offset the potential of bias as it related to the participants in the study. All three worked as faculty members in Instructional

Technology and had extensive experience teaching technology integration courses. The remaining researchers were doctoral students, one was a high school mathematics teacher pursuing a degree in Teaching and Learning and the other was pursuing a degree in Instructional Technology and worked as the director of the teacher career center for a large university system. They participated in data analysis and interpretation. Neither the course coordinator nor the doctoral students had direct contact with the participants.

Data Collection

Data collection occurred throughout the six-week summer course: June 2005-July 2005. Data sources included three course reflection papers (beginning, middle and end of the semester), four case study responses and four case study reflections.

The participants analyzed selected cases from *Educational Technology in Action: Problem-based Exercises for Technology Integration* (Roblyer, 2004) that best aligned with their content areas. Expectations for case discussions were provided and modeled prior to commencement of data collection as follows: first, participants reviewed assigned cases and individually responded to specific questions from the textbook at the end of each case set. Next, they met online in teams of four to five to discuss the assigned cases. Each team then submitted a group report based on their discussions. Due to overwhelming opposition by the English Education students, group reports were discontinued after Case 1. Finally, each student submitted an individual reflection on each case based on initial responses and group discussions. In addition to one practice case, participants analyzed three more case sets during the course. Except for the practice case (only formative feedback was provided), all others including the reflections were scored and returned to the students.

Data Analysis

The research team used content analysis (Merriam, 1988) to categorize concepts and ideas, which students presented in their case analyses, case reflections, as well as their course reflection papers. Each team member was responsible for analyzing contained datasets in chronological order according to source and instructor: namely all of the case answers, then all of the case reflections and finally all of the course reflection papers. The research team met bi-weekly to discuss analysis and to develop a common codebook. During these meetings, inter-rater reliability was established. After the codebook was created and initial categories developed, the researchers reapplied the codes to the data using a Microsoft Access database. As a means to put the evidence in a preliminary order, reports were generated which tabulated the frequency of different codes by category and by data source.

In accordance with case study methodologies, (Miles & Huberman, 1994; Yin, 2003) pattern matching within and cross case analyses were used to address the research questions. During each analysis phase, the researchers examined the cases for discrepant evidence and rival themes in order to assure the rigor of the analysis. Triangulation within and between data sources provided a holistic picture of the phenomenon and provided corroborating evidence (Creswell, 1998) as findings emerged. In order to increase reliability, an extensive case study database (Yin, 2003) was established to archive researcher notes, protocols, timelines, artifacts, and coded data.

In case studies, findings are generalizable to the extent that the readers or users find the situations, settings, and people presented to be similar enough to their own. Thus, the researcher has an obligation to provide enough description for case-to-case transfer (Merriam, 1998). It is important to note that the context and setting of this study was limited to a small number of alternative preparation preservice teachers at an urban university. In addition, the relationships that the first and second authors had with the participants might have impacted their behavior. These factors need to be considered when making transferability judgments.

Results

Several trends emerged from data analysis. We organized the results around the tenets of PTICK. Predominate themes in each section are discussed in the following cross-case analysis.

Technical Procedural Knowledge: Becoming Self-Directed Users of Technology

The course reflection papers were intended to reveal preservice teachers' beliefs about technology integration and their ability to integrate technology into their content areas as well as issues related to the course itself. English preservice teachers reported the greatest gains in statements reflecting their self-efficacy, particularly their technical skills; while the preservice science teachers expressed confidence in their technical skills early on. However, as the course progressed, the reflection papers indicated that the participants became more confident in their abilities to integrate technology as well as solve technical problems. NT, an English education TEEMS student, demonstrated this transition between the beginning and end of the course in her final reflection paper:

> I was really nervous about taking IT and felt very inadequate in my computer abilities. I had a vague idea of how technology could be used in the classroom, but more a sense that it should be used (because everyone said so!). After having completed this course, I know that I still have a lot of learning ahead of me, but I feel much more knowledgeable, and able to seek that learning. I feel empowered.

The Science preservice teachers' reflections indicated growth in regard to their understanding that ongoing professional learning and training would be necessary to stay current in procedural knowledge of new technologies. For example, LP wrote: "I plan on regularly taking developmental courses for teachers that specifically address technological use within the classroom." The researchers attribute this awareness to case stories as the characters discussed professional conferences and workshops. Some of the English preservice teachers also indicated that they were becoming more self-directed:

> Because of this course, I am finding myself experimenting with software on my own to learn more. This course has taught me to be self-sufficient and adapt my lessons around what is available, and that is an essential tool. (TF)

Overall, students felt more prepared to use and integrate technology into their future teaching. FK noted that "this course, along with my previous technological background, has prepared me to integrate technology into my lesson plans."

Technology Integration Conceptual Knowledge: Finding Solutions

Conceptual knowledge involves understanding what to do in a given situation and relies on having structured knowledge of procedures, principles, concepts and facts stored in long-term memory (Gess-Newsome, 1999; Reigeluth, 1999). Rich structures of conceptual knowledge are essential when working with ill-structured problems such as teaching (Gess-Newsome, 1999). In essence, technology integration is the application of these knowledge structures to solve an instructional problem using technology as part of the solution.

Examples of the students' growing conceptual knowledge included answers and comments about instructional strategies, planning, assessment, management and student grouping as they related to integrating technology. CG explained how Mia, the main character in Case 2, might use direct instructional strategies with her students:

> In order to introduce e-mail and Internet browser skills, Mia could use a handout with explicit directions about how to use both. She could also walk students through the steps on the handout using a computer that projects onto a large screen … Once students had gone through the handout, she could ask them to send her a 'test' e-mail to make sure that they mastered the skill.

In relation to planning, LC stated: "This case study [2] raised questions of proper preparation and guidance which I had not previously put into words for myself. It made some issues concrete for me in terms of implementation." At other times, the cases provided students with ideas for current class projects or future teaching. MF suggested "… this case [3] analysis gave me some interesting ideas about how to incorporate technology into my future teaching. … [it] encourages me to search the Internet for fun lessons that could also be used to generate serious learning."

Questions at the end of the case exercises frequently asked the students to identify learning outcomes and plan assessments. Thus, it was not surprising that comments about assessment were found in their case analyses and reflections as well as in their discussions. In early case analyses, students were often confused about what to assess and how: "I learned that it is very difficult to assign grades to e-mail projects. I don't know exactly how to assess students when integrating technology. … So how do you judge their engagement with the assignment?" (NC). At this point, they generally suggested more traditional forms of assessment such as quizzes and tests to measure content knowledge but were confused about how to measure affective objectives. However, as the cases advanced and their background knowledge grew, the preservice teachers identified alternative assessment strategies such as rubrics and checklists for technology-related projects along with observation sheets to record student participation and student satisfaction surveys. They also began to display a deeper awareness of the connection between writing performance objectives and assessment items, an aspect that was reiterated in both the course and in the case scenarios.

The case analysis process provided a point of reference for reflection on future problems and an opportunity to build their technology integration conceptual knowledge. FI's comment on Case 1 captures the general sentiment: "…they help me to formulate what I am thinking and to imagine what I will do in that situation."

Pedagogical Content Knowledge: Making Connections

As the semester progressed, participants made references to their content knowledge (physics, earth science, grammar, literature, etc.) in their responses. They drew connections between the technology course, science or English content courses and instructional methods courses. Trends in the data showed that there was a tendency in both the case responses and reflections on their discussions to make reference to pedagogical knowledge. Terms frequently used in technology and instructional methods courses emerged in the case responses and reflections, especially after the semester midpoint. For instance, constructivist/constructivism, cooperative grouping, directed learning, and inquiry-based learning models appeared frequently in the responses and reflections. KL noted in his Case 2 reflection:

> Using the constructivist or inquiry-based model, the students need to work through the software on their own in order to construct their own knowledge …. As a guide or facilitator, you are taking your learners in a carefully planned out direction. You keep them on task and moving along in the process, but they are in charge of their own learning within the framework planned out by you. This is the role of the teacher in a constructivist model.

Another student noted, "My group interaction helped me clarify my understanding of the distinction between directed and inquiry-based learning."

Some students demonstrated their ability to take content knowledge and their growing pedagogical knowledge to transform it into pedagogical content knowledge. For example, one English TEEMS student recognizes the students' difficulty with the English literature content and proposes instructional solutions to promote student engagement as noted in his Case 3 analysis:

> Sabine and Deetrich have trouble introducing Shakespeare to their classes because of the language disconnects and historical remove from present day. To get their students to read and discuss the plays, they need to get them interested in the subject. By designing an interactive program with a scavenger hunt to set the stage, they can engage the students in active learning. (LC)

Reflective Knowledge: Reflecting-on and for-Practice

Void of their own teaching experiences, the cases and group discussions provided a context for the preservice teachers to reflect upon and make meaning of the problems, solutions, and new information associated with the cases and to indicate how they might handle the situations presented by the characters. For example, one preservice teacher wrote in his reflection that his group came up with multiple solutions to a problem presented in case 1:

> We had two ideas on how Qing (the case character) could change the demo to keep his better students from dominating. He could make it more individual and have each student work through the demo at his or her pace. Or, he could try to organize the discussion better by having students raise their hands before speaking. This would allow him to call on his more reluctant students and encourage them to participate. (KF)

Others delighted in thinking about teaching with technology in their own classrooms having gained ideas from the case as in this example: "I could use the methods of a Web-based activity that employs e-mail *and* an Internet search" (KS). He went on to describe in detail how he would implement the activity in his own way.

Community Knowledge: Forming Communities of Practice

Community knowledge includes what Grossman (as cited in Guerrero, 2005) calls knowledge of context: understanding the school, community, and state contexts in which the teacher teaches. Barriers to technology integration were an aspect of school community that the preservice teachers discussed in their case and course reflection papers. Some voiced concerns about both teacher and student access to technology in their future classrooms and often cited this as a possible barrier to their technology integration. One English preservice teacher wrote:

> What would really help me would be the physical technology. I'm still not sold that all of the technology is going to be available to me in the classroom, and I really think that my students' access is going to be limited….I have to go with my past experiences and I'd say that it is unlikely that I will be able to implement even half of what I've learned. (BL)

On the other hand, a couple of preservice teachers suggested that they would seek out positions where technology was more plentiful:

> It is difficult to predict what technology a school will have available. I think that this will be a factor in my job search. In other words, all things being equal, I will choose a school with greater technological resources available over one with less. (MD)

Community knowledge also suggests that teachers understand the importance of and participate in communities of practice. A substantial increase in the necessity and promotion of professional interaction was noted in the Science cohort. SI went from stating in her initial reflection that "technology can also be used as a communication tool" to a more robust understanding of the importance of community. In her final reflection she wrote: "… I think it is important to join professional organizations; they provide workshops and other resources that can aid in the knowledge of technology advancement." Others came to realize the value of their peers. One preservice teacher aptly characterized the sentiment that many of the participants felt: "…colleagues can be a wonderful resource. I know it's cliché, but my discussion experiences have proved that two (or three) minds are better than one" (CG).

Discussion

What role do case discussions play in the development of PTICK?

As noted, there were mixed responses to the case analysis process, and participants had different perceptions of the cases. The preservice teachers reported that case analyses were a lot of work; nevertheless, they appreciated input from the group. Sherer, Shea, and Kristensen (2003) define a community of practice (COP) as being made up of individuals who are informally bound to one another through exposure to a similar set of problems and a common pursuit of solutions. They engage in a process of collective learning that creates bonds between them. Our findings corroborated the work of Levin (1995) and Powell (2000). Most preservice teachers made reflective comments that indicated some type of new thinking as a result of the case discussions. In both groups, peers either modeled problem-solving for each other or offered new insights on the topic being discussed. While the groups tended to agree on answers more often as the cases progressed, they felt, and the researchers observed, that the discussions offered a place where they could refine their technology integration ideas as well as challenge and confirm their teacher beliefs.

Group discussions conducted after individual case analysis promoted reflection among group members. According to Dewey (as cited in Rogers, 2002), reflection needs to happen through interactions with others in communities of practice. The group discussions provided the preservice teachers with a context to practice reflection-on-action, what happened to the case characters (Schon, 1987), as well as reflection-for-practice, what they would do differently (Killion & Todnem, 1991).

In this study, participants with prior teaching experience in the Science TEEMS cohort were important in the group discussions. They were able to provide practical insights about teaching, such as classroom management techniques, to the other group members along with problem solving strategies. As Powell (2000) suggests,

> … persons with more knowledge about one dimension of teaching can draw upon that knowledge to enlighten persons who lack it, thus creating a shared culture of learning that moves toward collective and shared understandings of specific dimensions of classroom teaching. (p.406)

This view of learning (COP) is connected to a social theory of learning where learning is seen as a social, situated phenomenon (Putz & Arnold, 2001). Regardless of experience, the preservice teachers learned from one another through their personal narratives, interpretations of and reflections on the cases. Such a process has the potential to transform experience into pedagogical content knowledge (Lave & Wenger, 1991).

What role do case analyses and case reflections reveal about the development of PTICK?

The participants were alternative teacher education preparation students, and already possessed a four-year degree in their content field. As the semester progressed, the preservice teachers displayed an understanding of integrated concepts of PTICK in their case responses and reflections. Analyzing cases seemed to promote the greatest growth with regard to developing PCK, reflective knowledge and technology integration conceptual knowledge. Demonstration of PTICK concepts in their responses was determined to imply that preservices teachers were thinking about integrating technology into their instruction. This was identified from the case responses where participants drew on aspects of student needs, technology integration, and pedagogical knowledge. Regardless of whether preservice teachers had teaching experience or not, PTICK as a whole or other individual aspects of PTICK were frequently identified in the study, and this could be attributed to certain factors.

First, the nature of the course was not just to learn isolated technology skills and knowledge. Rather, the goal was to integrate technology concepts with pedagogical knowledge and content knowledge seamlessly. Nevertheless, technology competencies were something that students acquired as they learned how to use various software packages for the purpose of planning technology-integrated lessons. Not surprising, analyzing cases did not necessarily impact the preservice teachers' technical procedural knowledge.

Second, the nature of the cases selected may have played a role in the nature of the responses. The implication of these findings was found to relate back to the manner in which technology integration concepts were introduced or presented to preservice teachers. For example, some responses seem to be more direct responses to questions at the end of case, such as those assignments that addressed issues of assessment and multiculturalism. Additionally, there was more evidence of technology integration conceptual knowledge in responses than technology as support or technical procedural knowledge. This may be attributable to both the nature of the cases and the questions they responded to, and may possibly influence both how preservice teachers perceived the course structure in general, and how this course may later influence skills and concepts learned into their own technology integration concepts and practices.

Third, all the students, except two in the science cohort, had a background in their content areas. They also had limited teaching experience and teaching methods courses. The summer was their first semester in both IT 7360 as well as methods and graduate level content courses. As the semester progressed, and as they acquired a larger knowledge base in pedagogy and technology integration from these courses, they drew references and connections between technology integration content, science content, and instructional methods courses.

While the responses can be attributed to the nature of the cases and the questions posed at the end of each case, it is noteworthy to mention that students were enrolled concurrently in these courses, and that many of the students were introduced to pedagogy terms in these courses. In particular, terms commonly used in these courses such as constructivism and direct inquiry began to emerge in their case analyses and reflections. The cases provided opportunities for the preservice teachers to apply what they were learning across their program and thus demonstrate their developing pedagogical content knowledge through their written case analyses and group discussions. Researchers in this study attributed these findings to be significant to course sequencing. As suggested in other studies (Powell, 2000; Kleinfeld, 1992), it was determined to be important for preservice teachers to have prior content and pedagogical knowledge or well aligned scheduling of course content taken in the same semester.

Their final course reflection paper comments indicated growth in self-efficacy for integrating technology and problem-solving; however, concerns about implementing what they had learned also were expressed. Preservice teachers' perceptions of barriers to technology integration such as access to technology, students' technical skills and administrative support was an unexpected finding in the course reflection papers and case reflection commentaries. These concerns did not surface until later in the semester after the students had engaged in the second of four case exercises. The cases used in this study took a problem-centered approach (Carter, 1999). Therefore, the preservice teachers encountered teaching practices, contexts, and situations that might be found in a typical classroom: Challenges to integrating technology were included. Anecdotal evidence from students' reflection papers in previous courses did not indicate this trend. Thus, the researchers attributed this finding to the implementation of cases. Although no substitute for actual classroom experiences, case studies may be able to provide preservice teachers with the opportunity to reflect on and discuss aspects of school community that should be considered when planning instruction.

Suggestions for Case Implementation

Integrating case analysis and discussions into an already full curriculum during a condensed six-week summer session was particularly challenging. It posed management problems for both the students and the instructors. We learned the following key lessons:

- Cases should be robust and specific to the content area and vary the technology tools. Although the cases we used from the text were lengthy, they were fragmented across many chapters and lost continuity from one week's assignment to the next. Nevertheless, the cases had a great deal of impact on the students. In the end, we felt that the students would have benefited from more, detailed, and varied cases.
- While individual and group work with reflection is necessary, caution must be taken to keep workload from decreasing motivation and eclipsing outcomes.
- Students must be trained in case analysis. A practice case analysis offers students a chance for formative feedback prior to an evaluated assignment.
- Give students questions to guide their reflections on case analyses. In addition, it might be helpful for students to have some training in reflection.
- The course was offered during a compressed six-week summer session. The researchers recommend a longer period so that students have greater time to accomplish goals and reflect.

In the same course with a math cohort the following fall semester with the same instructor who taught the science TEEMS cohort, students were given more time to respond to the cases, meet with group members and synthesize the report. With the math cohort, the preservice teachers did not express dissatisfaction with the case analysis method and overall viewed the case analyses process to be valuable. It should also be noted that the math cohort were also simultaneously enrolled in their teaching practicum course in the fall, thus were better able to make connections with the IT7360 course requirements. This was evidenced in both the case studies and course reflections.

Despite the challenge of implementing and managing case analyses exercises, the findings suggest that case-based instruction with preservice teachers can promote aspects of PTICK development. The cases, along with peer-to-peer synchronous discussions, provided opportunities for these preservice teachers to make explicit their beliefs as well as test out assumptions about teaching, lesson design and technology integration. Given the varied nature of our findings and the divergent student reactions generated from the case analyses, PTICK development is a necessary component of teacher preparation and a research focus worthy of increased attention.

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that they exist and where to access such tools. If you know of other dynamic online tools for the teacher education community make sure to share them through outlets such as JCTE and the SIGTE discussion board. Tools such as PBL Online and those available on Web 2.0 have the potential to positively impact the preparation of teachers and their use of technology in classrooms.

All four articles in this issue of JCTE provide us with interesting findings from research studies where the goal is to improve teachers' technology use in classrooms. In her article, "Reexamining the Practicum Placement: How to Leverage Technology to Prepare Preservice Teachers for the Demands of the 21st Century," Karchmer-Klein describes how she created a virtual practicum placement for students enrolled in her literacy methods course. The purpose of this online community was for preservice teachers to interact with and observe experienced classroom teachers while they integrated technology into their literacy instruction. This article provides a unique solution to a common challenge when preparing teachers to infuse technology—to learn from experienced teachers who are integrating technology into a content area. Karchmer-Klein's results provide interesting insights on the importance of making meaningful and 'real' connections between the content of a methods course and students' practicum experiences, especially when using and integrating technology.

In "Benefits and Challenges of Using Live Modeling to Help Preservice Teachers Transfer Technology Integration Principles," West and Graham investigate the impact of using live modeling sessions while preparing preservice teachers to use technology. Their study examines using a modeling approach during an instructional technology course that supports the philosophy that the learning of technology and the learning of pedagogy are simultaneously inclusive. Preservice teachers were learning how to use the technology while they were participating in a modeling session where they were acting as K–12 students. Although it seems students were quite positive about the effectiveness of the live modeling sessions, the authors note that it is still challenging for students to transfer what was learned during the live modeling sessions to a K–12 classroom context. The authors then describe several contextual breakdowns that made the transfer of technology integration knowledge difficult for the students participating in their study.

Technological Pedagogical Content Knowledge (TPCK) has gained much attention in the teacher education community (Mishra & Koehler, 2006). Brantley-Dias, Kinuthia, Shoffner, deCastro and Rigole offer their conceptualization of another proposed framework in, "Developing Pedagogical Technology Integration Content Knowledge in Preservice Teachers: A Case Study Approach." This multi-case study explored using case-based instructional strategies for developing preservice teachers' Pedagogical Technology Integration Content Knowledge (PTICK) in an alternative teacher preparation program. Students were required to analyze, discuss, and reflect upon several case-based scenarios that were aligned with their specific content areas while enrolled in a technology course. Findings indicated that preservice teachers did actively think more about integrating technology into their instruction as they made connections between subject area content, technology integration content and instructional methods. The authors offer suggestions of how others might integrate case analysis and discussions into their teacher preparation courses.

Finally, Hammond suggests using a task-driven framework in instructional technology courses that prepare teachers to integrate technology in classrooms. In "A Task-Oriented Framework for Stand-Alone Technology Integration Classes" the author proposes to focus class discussions and situate assignments around the authentic tasks of teaching and learning. Further, Hammond develops this task-oriented framework using action verbs like communicate, collaborate, research, assess, compose, present and publish and then provides us with examples of how students use technologies to accomplish each teaching and/or learning task. Many of the examples presented include open-source options and related Web 2.0 tools.

The articles presented in this issue of JCTE will provide readers with some thought-provoking ideas on how to better prepare teachers for the realization of using technology in their classrooms. In addition, we must be aware that dynamic tools such as PBL-Online and those listed on the Web 2.0 directory can begin to alter the landscape of teacher education as we continue to improve how we prepare teachers for our future classrooms.

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