Συνέδρια της Ελληνικής Επιστημονικής Ένωσης Τεχνολογιών Πληροφορίας & Επικοινωνιών στην Εκπαίδευση

Vol 1 (2008)

6ο Συνέδριο ΕΤΠΕ «Οι ΤΠΕ στην Εκπαίδευση»

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ABSTRACT

This paper discusses the design and evaluation of an online learning environment whose design was based on the theoretical foundation of technological pedagogical and content knowledge (TPACK). The investigation into this multi-scaffolded environment revealed teachers' requests for learning environments to support the teacher as much they support the student if inquiry-based learning environment are to be successfully integrated within the K-12 classroom.

KEYWORDS: *Online learning, TPACK, Instructor support, Scaffolding, problem-based learning*

INTRODUCTION

Traditionally, when designing learning environments and curricular materials for the K-16 classroom, the focus has been on the learner. Designing learning materials with the instructor in mind has frequently been disregarded (Bransford, Brown, & Cocking, 1999). Moreover, when instructor support has been contemplated in the design process, it has focused on the content of the lesson, with little consideration about pedagogy or technology. Yet, pedagogical and technological knowledge are important components in the successful teaching of a lesson. For instance, Shulman (1987) noted that effective teachers need to command the interrelated knowledge of pedagogy and content, what he referred to as pedagogical content knowledge. *Content or subject matter knowledge* is the depth and breadth of knowledge in a specific content area, while *pedagogical knowledge* is the knowledge of teaching and learning that spans content areas. Shulman's work has recently been expanded by adding a third domain to teacher knowledge – technological knowledge. Specifically, Mishra and Koehler (2006) coined the framework, "technological pedagogical content knowledge" or "TPCK." Albeit popularized by Mishra and Koehler, others have previously included technological knowledge as a component of teacher knowledge (e.g., Hughes, 2000, 2005; Niess, 2005). In short, the TPCK framework strives to "capture some of the essential qualities of knowledge required by teachers for technology integration in their teaching, while addressing the complex, multifaceted and situated nature of teacher knowledge" (Mishra & Koehler, 2006). Recently the acronym was updated to TPACK (Thompson & Mishra, 2007-2008); thus we will refer to TPCK as TPACK throughout the rest of this article.

GEOTHENTIC: LEARNING TECHNOLOGY THROUGH GEOPATIAL TECHNOLOGIES

TPACK is a framework for teacher educators to reflect on the development of their curricula. It is also a reflective tool for teachers to think about where they might situate themselves within the framework. Even though there has been a great deal of discussion about TPACK (e.g. http://www.tpck.org), this discussion has been absent from the area of instructional design for teachers. In this paper, we attempt to draw light on the TPACK framework via our work with *Geothentic* and present initial findings with regards to designing an online environment with the intention of supporting the teacher as he/she is teaching a lesson. Geothentic, formerly known as a multi-scaffolding environment (MSE) (see Authors, 2007a), is an online learning environment that assists teachers teaching and students learning geography using geospatial technologies (e.g. Google Earth). Geothentic is a scaffold and module-based environment with student *and* teacher interfaces. The teacher interface is designed to assist teachers to effectively teach with limited background knowledge. The scaffolds specifically address the technological, pedagogical and content knowledge domains of each module within the design of the environment. For example, when a teacher is preparing to teach the module on global climate change s/he is provided with content knowledge – a curriculum with resources and background information; pedagogical knowledge – three ideas for integrating the module within their classroom; and technological knowledge – screen-capture videos that describe how to use the geospatial technologies. To summarize, the designers of Geothentic have taken traditional instructional design and have focused it around both the learner *and* the teacher, rather than simply on the learner, incorporating scaffolds based on the TPACK knowledge domains.

RESEARCH QUESTIONS

Geothentic is focused on enhancing teachers' TPACK. To this end, we were interested in understanding how designing a learning environment with TPACK was perceived by teachers in relation to the support they would like to have had while teaching with Geothentic. We were interested in scaffolding the teachers to teach Geothentic modules and in knowing (a) in what ways teachers would like to be supported, (b) in what TPACK domains they would like support, (c) how we could design Geothentic to make teaching problem-based geography a seamless experience *for the teacher*.

METHOD

Eight teachers chose to participate in this project. Five teachers were female and three were male, with four teaching high school and four teaching middle school. All teachers were tenured and had been teaching for more than ten years, and all but one taught in public schools. During the study, half of the teachers taught in the city and half taught in first-ring suburbs. Table 1 lists specific information about each teacher, her/his school, and the classes s/he taught.

All teachers used Geothentic – teaching three lessons to all of their students – a total of 1050 students. After using the environment for three months, each teacher

was interviewed in a semi-structured and open-ended manner for thirty minutes. The interviews focused on the implementation of the MSE program in each teacher's classroom. Yet, the data reported herein focus on teacher support within the learning environment.

To analyze the data and develop salient categories and patterns, we used the constant comparative method (Glaser and Strauss, 1967). First, each author analyzed data independently, with each author noting emerging patterns. The authors then met five times to discuss their individual findings. At each meeting, the data were reanalyzed and triangulated across data sources in order to confirm and disconfirm evidence for the patterns. This process continued until consensus was reached between the authors.

RESULTS

Based on the teacher interviews of designing with TPACK, three major themes were revealed. These are discussed in turn: (1) **TPACK Designed a New Experience -** Teachers were not accustomed to an environment that encompassed all knowledge domains of TPACK. They were used to content "mixed with some teaching ideas," but never the three knowledge domains interwoven *for the teacher*. Teachers stated that usually they have to "go on their own virtual hunt" for lesson plans, integration ideas, and authentic data, whereas in this case, everything was seamlessly integrated for them at one location. In this way, teachers noted that having access to content, pedagogical ideas, and technology support is valuable for their work in classrooms. (2) **Few Steps to Solutions -** The idea of bringing all knowledge domains together to assist teachers in teaching by providing scaffolds was never experienced by any of the participants. Marissa commented, "Within Geothentic, if we had a question on how our students would analyze data or how to use a resource, the answer was available to us. I had never experienced this before." Designing the learning environment with a specific focus on the teacher afforded teachers the ability to use the learning environment as an integrated system where their diverse classroom needs were all supported in one locale. (3) **Authentic Modules Supported by TPACK -** The teachers noted that because all three knowledge domains were supported, they felt more successful when teaching the inquiry-based modules. Jack said, "In geography it was always difficult for me to let my students jump into an inquiry-based assignment with technology because I didn't know it. As I experienced in this environment, I didn't need to know it all as there was a scaffold to support me." It is important to echo teachers' feelings regarding their experiences. Albeit we usually expect teachers to need technology assistance, they might also require assistance in selecting appropriate pedagogies and content.

IMPLICATIONS AND RECOMMENDATIONS

This study revealed that designing scaffolded *teacher* learning environments based on TPACK is extremely beneficial for the teacher. Teachers' comments indicated that TPACK-based design enabled them to feel supported and to successfully integrate the learning environment in their classroom. Per this result, we suggest

that (a) designers should design for *both* the learner and the instructor devoting attention to both sides of the learning environment, (b) online learning environments for teachers should be designed using frameworks such as TPACK that explicitly focus on teachers, and (c) scaffolding teachers through TPACK is a design with much promise as teachers feel the on-demand support leads them to be more successful in the classroom. The ineffectiveness of short-term workshops (Fullan & Stiegelbauer, 1991) along with the positive comments from this study, make the idea of ongoing teacher scaffolding within online learning environments a very attractive and viable option.

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