Design of a Virtual Internship to Develop Technological Pedagogical Content Knowledge

Diler Oner, Bogazici University, diler.oner@boun.edu.tr

Abstract: The purpose of this study is to design a new *virtual internship* (an epistemic game) for preservice teachers to develop their *technological pedagogical content knowledge* (TPACK). Virtual internships are learning environments in which participants can develop complex knowledge that make up the epistemic frame of a profession. The virtual internship designed for preservice teachers considers the components of TPACK as epistemic frame elements. As a subsequent step, this study also aims to evaluate preservice teachers' TPACK development using *Epistemic Network Analysis* (ENA). Adapted from social network analysis, ENA is an innovative data analysis method that affords investigation of dynamic interaction among frame elements. In this study, the "dynamic interplay" among TPACK components will be analyzed using ENA. Thus, this study proposes two novel approaches to the challenge of supporting and evaluating preservice teachers' TPACK development, which is considered essential to teach effectively with technology.

The purpose of this study is to design a new *virtual internship* (an epistemic game) for preservice teachers to develop their *technological pedagogical content knowledge* (TPACK). Extending Shulman's (1986, 1987) well-known pedagogical content knowledge (PCK) concept, TPACK aims to capture the essential qualities of teacher knowledge needed for technology integration in teaching (Mishra & Koehler, 2006). A *virtual internship* is a computer-based professional practicum simulation where participants assume the role of a professional, work on authentic tasks collaboratively, interact with mentors, and cultivate complex professional thinking. The theoretical background of virtual internships is the *Epistemic Frame Theory* (EFT) (Shaffer, 2004, 2006, 2007, 2012), which argues that it is not merely the amount of knowledge that makes up expertise in any given profession. It is the connections and configurations among different knowledge bases. Virtual internships are learning environments in which participants can develop complex knowledge that make up the epistemic frame of a profession. The virtual internship designed for preservice teachers considers the components of TPACK as epistemic frame elements. As a subsequent step, this study also aims to evaluate preservice teachers' TPACK development using *Epistemic Network Analysis* (ENA). Adapted from social network analysis, ENA is an innovative data analysis method that affords investigation of dynamic interaction among frame elements (Shaffer et al. 2009). In this study, the "dynamic interplay" among TPACK components will be analyzed using ENA.

Thus, this study proposes two novel approaches to the challenge of supporting and evaluating preservice teachers' TPACK development, which is considered essential to teach effectively with technology. First, it builds a new virtual internship, a computer-based professional practicum simulation that aims to cultivate TPACK. Secondly, it suggests employing ENA to assess preservice teachers' development of TPACK, for which portray of dynamic relationships among its constituent elements has been a challenge for researchers.

One novel approach to support TPACK development of preservice teachers is the use of a virtual internship (or epistemic game). Informed by Epistemic Frame Theory (EFT), *virtual internships* are computer-based games and professional practicum simulations where participants can develop the epistemic frame of a professional practice (Shaffer, 2004, 2006, 2007, 2012). Virtual internships are simulations of professional workplaces, and as such they provide authentic contexts in which learners work on complex design projects collaboratively.

In this study, the author designed a new virtual internship (epistemic game), namely *the School of the Future* (STF), to support the development of preservice teachers' TPACK. The design of this new virtual internship simulation is consistent with the general structure of the virtual internships that the Epistemic Games Group has been developing (Chesler, Arastoopour, D'angelo, Bagley, & Shaffer, 2013). However, it extends the use of this approach to a new area (developing complex teacher knowledge compared to STEM thinking) and targets a new population (preservice teachers compared to K-12 and undergraduate engineering students).

In the game, preservice teachers take the role of teacher interns at a fictitious school, *the School of the Future (STF)*. The school's program coordinator personally welcomes them, explains the purpose of the internship, and informs about their team assignment. The game is composed of eight sessions, called rooms. At the beginning of each session, participants receive an email from their program coordinator that details the tasks they are expected to complete. Each task is built on the previous one and designed to support the teams' completion of the final task: developing instruction that integrates technology (based on participants' majors) to

be used at the STF in the upcoming semester. Students engage in individual research, team discussion, and reflection to complete their tasks while interacting with their mentors (portrayed as mentor teachers) who will be online within the game.

The core data to be analyzed will come from preservice teachers' work at the virtual internship application and their interaction with peers and mentors that will be saved at the online platform. These data will be analyzed using Epistemic Network Analysis (ENA). Adapted from social network analysis, ENA is a data analysis method for quantifying and analyzing an epistemic frame (Shaffer et al., 2009). Built on the idea that simple collection of knowledge structures is not sufficient to characterize expertise, ENA enables to visualize the co-occurrences of frame elements in discourse (Shaffer & Ruis, in press). Thus, with ENA, one can analyze the co-occurrence of frame elements (i.e., the seven components of the TPACK framework) in discourse. It provides a picture of epistemic frames over time showing how they change character between individuals and in different interactional contexts (Nash & Shaffer, 2010). ENA, therefore, allows a new approach to assess TPACK development addressing the interconnected nature of technology, pedagogy, content knowledge. Applying ENA to TPACK development, one could treat each component of the TPACK framework as different frame elements, which become *nodes*, and the patterns of connections among them constitute the *links* between these nodes (Orrill & Shaffer, 2012). Using this method then, one could assess TPACK development in a unique way by capturing the complex interplay between TPACK components.

References

Chesler, N., Arastoopour, G., D'Angelo, C., Bagley, E., & Shaffer, D.W. (2013). Design of a professional practice simulator for educating and motivating first-year engineering students. *Advances in Engineering Education 3*(3), 1-29.

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

Nash, P. & Shaffer, D.W. (2010). Mentor modeling: The internalization of modeled professional thinking in an epistemic game. Paper presented at the International Conference of the Learning Sciences. Chicago, IL.

Orrill, C.H. & Shaffer, D.W. (2012). Exploring connectedness: Applying ENA to teacher knowledge. Paper presented at the International Conference of the Learning Sciences. Sydney, Australia.

Shaffer, D. W. (2004). Epistemic frames and islands of expertise: Learning from infusion experiences. International Conference of the Learning Sciences. Santa Monica, CA.

Shaffer, D. W. (2006). Epistemic frames for epistemic games. *Computers and Education, 46*(3), 223–234.

Shaffer, D. W. (2007). *How computer games help children learn.* New York, NY: Palgrave Macmillan.

Shaffer, D. W. (2012). Models of situated action: Computer games and the problem of transfer. In C. Steinkuehler, K. D. Squire, & S. A. Barab (Eds.), *Games, learning, and society: Learning and meaning in the digital age* (pp. 403–431). Cambridge, UK: Cambridge University Press.

Shaffer, D.W. & Ruis, A.R. (in press). Epistemic network analysis: A worked example of theory-based learning analytics. *Handbook of Learning Analytics and Educational Data Mining*.

Shulman, L. S. (1896). Those who understand: Knowledge growth in teaching. *Educational Researcher, 15*(2), 4-14. (AERA Presidential Address).

Shulman, L. S. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review, 57*(1), 61-77.

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