

## **Strategies for teacher professional development on TPACK**

### **Abstract**

This symposium reports about research on professional development strategies that prepare pre-service teacher education students from various countries to become TPACK competent. All strategies have in common that they use a design approach to teachers' professional development. Pre-service teachers' performance on a TPACK outcome measure is also reported. The symposium particularly aims to identify characteristics of professional development that contribute to teachers' integration of technology and will also include an update on the development of an assessment instrument designed to measure teachers' development of TPACK.

### **Organization of the symposium**

Symposium Chair: Joke Voogt, University of Twente, the Netherlands

First hour:

- *Introduction to the symposium – Joke Voogt (5 minutes)*
- *Contribution 1: Technology Integration in the Science Teachers Preparation Program in Kuwait: Becoming TPACK competent through Design Teams (20 minutes)*
- *Contribution 2: Developing TPACK by design in a Master's Program (20 minutes)*
- *Discussion with audience – 15 minutes*

Second hour:

- *Contribution 3: Developing Technological Pedagogical Content Knowledge through Teacher Design Teams: The case of pre-service mathematics teachers in Ghana (20 minutes)*
- *Contribution 4: The Development of an Instrument to Assess Teacher Development of TPACK (20 minutes)*
- *Discussion with audience – 15 minutes*
- *Wrapping up – Joke Voogt*

### **Introduction to the symposium**

Research reveals that, although we observe an increase in the use of technology, computers are poorly integrated into teaching and learning processes (Cox et. al., 2004; Tondeur et. al., 2008). According to Cox et al. (2004), a gap exists between what teachers are taught in their courses and what they are expected to do with technology in a real classroom. In this respect, recent calls for effective technology integration stress the need to help teachers to bridge the gap between knowledge of good pedagogical practice, technical skills and content knowledge.

Koehler and Mishra (2008) introduced the concept Technological Pedagogical Content Knowledge (TPCK or TPACK) to emphasize the comprehensive set of competencies teachers need to successfully integrate technology in their educational practice. TPACK constitutes an integrative knowledge base of technological knowledge and skills, as well as knowledge of learners, subject matter content and pedagogy that are necessary for

teachers to become competent to teach with technology in the classroom. From this point of view, a computer does not embody one single pedagogical orientation; it includes a spectrum of approaches to teaching and learning. Clearly, no single solution exists to address technology integration in education because different perspectives of integrating technology can be chosen. TPACK encompasses that teachers are able to make sensible choices in their use of technology when they have to teach specific content for a specific target group.

The need to better align teachers' preparation in the integration of technology with pedagogical issues and curriculum integration is well understood (e.g. McDougall, 2008; Voogt, 2003, Law, Pelgrum & Anderson, 2008). As with any educational innovation, teachers' active involvement is crucial for a successful implementation of integration of technology in schools (e.g. Fullan, 2007). Several large scale studies (Garet, Porter, Desimone, Birman, & Yoon, 2001; Penuel, Fishman, Yamaguchi, & Gallagher, 2007) investigated the relation between teacher professional development strategies and the quality of implementation of curriculum innovations. Findings from these studies reveal specific features of the professional development arrangement that mattered for the implementation of innovations, such as integration of technology. From the perspective of curriculum implementation professional development arrangements are effective when they focus on subject matter content and skills, provide opportunities for active learning (exposing teachers to actual practice) and are coherent with other learning activities (embedding teacher learning in the local context). Related to these core features, specific formats added to the effectiveness of professional development arrangements: accommodation of follow up support, stretched across longer periods of time and provision of opportunities for group support and collaboration. These features of effective professional development provide an empirical basis for so called curriculum-based professional development arrangements that aim to contribute to the implementation of a curriculum innovation, such as integration of technology.

## **Contributions**

### **Technology Integration in the Science Teachers Preparation Program in Kuwait: Becoming TPACK competent through Design Teams**

*Ghaida M Alayyar, PAAET, Kuwait, Petra Fisser & Joke Voogt, University of Twente, The Netherlands*

The research studies the integration of technology in the science teacher preparation program in Kuwait at the Public Authority of Applied Education and Training (PAAET) aiming at preparing prospective teachers to work in the school of the 21st century.

The TPACK framework is used as a starting point for designing a course where prospective student-teachers are prepared to integrate technology in elementary science education. In the course a group of 50 science students had to design and implement a technology application in small groups (3-4 persons) for elementary science education. During the design the small groups were coached by subject matter, pedagogical and technology experts. Data were collected on students' TPACK competencies (Schmidt et al. 2009), their attitudes towards technology, their perception on collaborative group work, their appreciation of the new course and the quality of their products.

### **Developing TPACK by design in a Master's Program**

*Punya Mishra, Matthew J. Koehler, Tae Seob Shin, Leigh Graves Wolf, & Mike DeSchryver, Michigan State University*

As evidenced by Koehler and Mishra's (2005) study, the "learning technology by design" is an effective instructional technique to develop deeper understanding of TPACK. In this study, we introduce an intense educational technology course sequence designed to create an experience that would expose in-teachers to ideas and skills from educational technology that can be incorporated into their own teaching. These experiences happen in cohort based summer study programs with students who are experienced educators. These programs include a unique face to face context in Europe in and a hybrid format for in-state educators. During the course, participants worked on a range of assignments that required them to learn and use technology in multiple pedagogical contexts including developing digital video, writing a technology based grant proposal, exploring web 2.0 technologies, and designing a personal web portfolio. The analysis of pre and post-test data showed that in-service teachers' understanding of TK, TCK, TPK, and TPACK improved as a result of their course experience.

### **Developing Technological Pedagogical Content Knowledge through Teacher Design Teams: The case of pre-service mathematics teachers in Ghana**

*Douglas Agyei, University of Cape Coast, Ghana, & Joke Voogt, University of Twente, The Netherlands*

Although many studies have shown the need to better align teachers' preparation in the integration of technology in classroom practice, most teachers in Ghana have not had any preparation that develops their technology pedagogical content knowledge (TPCK). This paper presents a case study of four pre-service mathematics teachers at the University of Cape Coast, Ghana; who worked in two design teams to develop lessons and subsequently teach in a technology-based environment for the first time. To make them familiar with technology use in mathematics teaching the pre-service teachers first discussed and used exemplary lesson materials, which were prepared by the researcher. Based on this experience the pre-service teachers designed their own technology-based lessons, which they taught to a group of pre-service teachers. Interview, observation, and survey data were collected throughout the study. The study revealed key attributes of a professional development scenario to foster growth of pre-service teachers in TPCK.

### **The Development of an Instrument to Assess Teacher Development of TPACK**

*Denise Schmidt, Evrim Baran, & Ann Thompson, Iowa State University*

A research group including faculty and students from both Michigan State University and Iowa State University have been working on the creation and validation of an instrument designed to assess the development of TPACK in pre-service teachers (Schmidt et al., 2009). Current work on the instrument will be shared. The instrument is used at the beginning and end of an introductory pre-service teacher technology course. Results suggest that with a minor modification of the survey items, the survey is a reliable and

valid instrument that will help educators design longitudinal studies to assess pre-service teachers' development of TPACK. Results also indicated statistically significant gains in all seven TPACK components.

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