TWG 9 Working document

Advancing conceptual models of technology integration in education: Implications for researchers, practitioners and policymakers

1. Introduction

One of the ongoing barriers to the effective uptake and uses of technology in education has been the varied and sometimes inappropriate practices to achieve integration. In the past decades, researchers and practitioners have proposed numerous conceptual models on how technology integration in schools can be supported more successfully. Conceptual models are especially promising in this regard as they provide a simplified representation of the complex interplay of factors for technology integration in schools. They typically use graphical representations, which makes them easy to understand and to communicate. Models can also be empirically tested and validated. Some models have triggered international research efforts (e.g., TPACK, Will Skill Tool Model, Technology Acceptance Models) while others have remained largely untested (e.g. SAMR, FRAME or TIM).

The working group 9 seeks to 1) provide an overview of the most prominent and promising conceptual integration models to date, 2) identify quality criteria for technology integration models in education, 3) propose an overarching conceptual model, that combines and expands previous models, 4) provide recommendations to advance the development of models in the context of research, policy and practice.

2. Three models under magnifying glass

The three models presented here illustrate different aspects of ICT-integration in education. The need to learn from different conceptual models may lead to development of an overarching conceptual model. During the EdusummIT sessions more models will be presented, analyzed and integrated by the team members of TWG9.

2.1 The TPACK model

The TPACK (Technological Pedagogical Content Knowledge) model is probably one of the most commonly used technology integration model amongst educational researchers and practitioners (Fig. 1). TPACK outlines teachers' competencies to use technology in education. In 2016, Mishra and Koehler proposed this conceptual framework, clarifying which competences are needed for ICT-integration in teaching and learning processes. Specifically, TPACK distinguishes between three main components of teacher knowledge: Content Knowledge (CK), Pedagogical Knowledge (PK), and Technological Knowledge (TK). The other components, Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK), and Technological Pedagogical Content Knowledge (TPACK), are knowledge developed through the interactions between and among these bodies of knowledge (Koehler & Mishra, 2009).

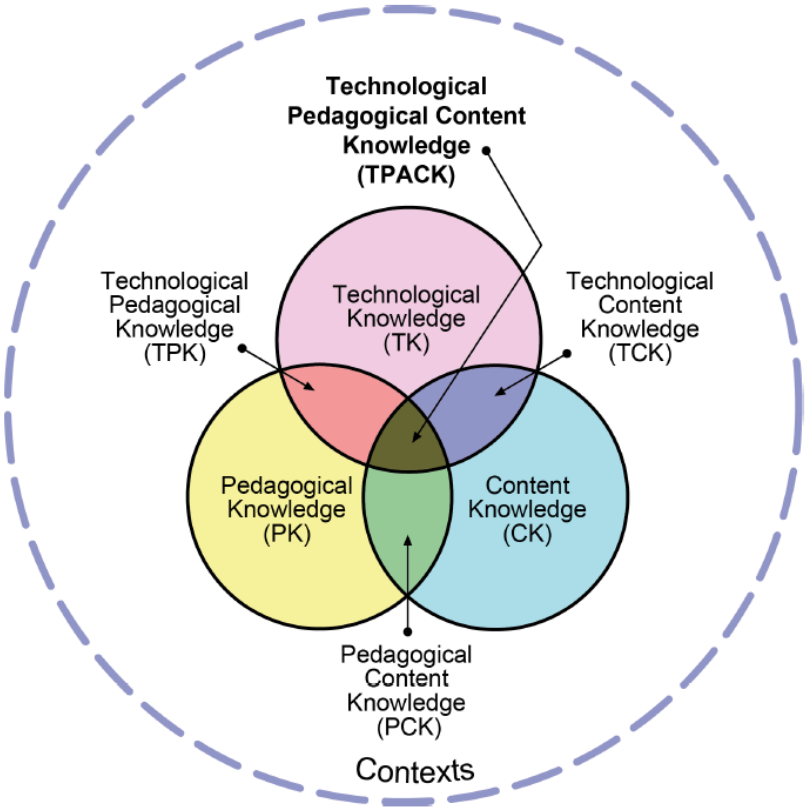

Fig. 1 TPACK (Koehler & Mishra, 2009)

Figure 1 shows the diagrammatic depiction of the relations among the seven constructs. The three main components (constructs) of teacher knowledge in the TPACK framework are content knowledge (CK), pedagogical knowledge (PK) and technological knowledge (TK). The other components, PCK, technological content knowledge (TCK), technological pedagogical knowledge (TPK) and TPACK, are knowledge developed through the interactions between and among these bodies of knowledge (Koehler & Mishra, 2005, 2009). This framework has been widely adopted for teacher preparation of educational technology integration (Voogt et al., 2013). This brings us to the next model.

2.2 A model of TPD for technology-enabled learning

As stated above, numerous research studies have investigated the factors that affect ICT integration in education. Several conditions, such as ICT infrastructure, seem to be absolute requirements for ICT to be used in classrooms. Some, including access to ICT, available time, and curriculum flexibility, are unlikely to be influenced by TPD (teachers' professional development). These might be considered to be foundational enabling conditions and are represented as such in the base of the model proposed in Figure 1 to represent teacher professional development for technology- enabled learning (for more info see Albion, Tondeur, Forkosh Baruch, & Peeraer, 2015).

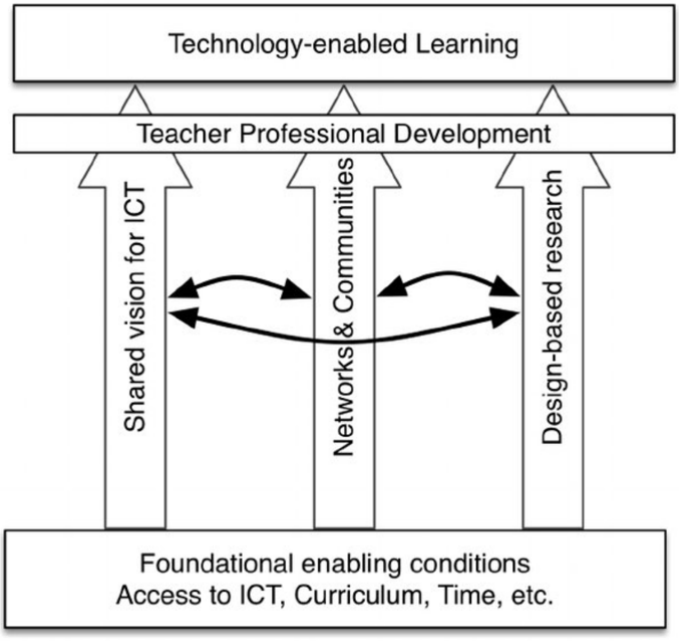

Figure 1: TPD for technology enabled learning model

This conceptual model for in-service teachers is based on discussions in TWG3 at EDUsummIT 2013 around three foci derived from analysis of the literature. The large vertical arrows in Figure 1 represent those elements, with some adjustments informed by the discussions in TWG3 and the literature. Those factors, and others, are likely to be in complex reciprocal relationships with TPD as indicated by the smaller horizontal arrows. For example, shared vision for the use of ICT in a school may be developed through TPD but will also influence the content and style of TPD. Similarly, both networks and communities for informing teachers and design research may either provide subjects for TPD or be used as modes of delivery for TPD.

2.3 A model to prepare *pre-service* teachers for ICT integration

The focus of the third conceptual model (Fig 3) is on in-service training, but there are also a range of strategies needed to prepare pre-service teachers for technology integration in future teaching. For this conceptual model (Fig. 3) Tondeur, Van Braak, Sang, Voogt, Fisser, & Ottenbreit-Leftwich (2012) reviewed the qualitative literature. Specifically, a systematic review method was used to locate, critically appraise, and synthesise qualitative studies that examined technology training for pre-service teachers. The study used a "meta-ethnography" approach, an interpretive strategy originally developed by Noblit and Hare (1988)to Synthesize Qualitative Data (SQD) in the field of education. Nineteen articlesfrom eight journals were included in the review andincorporated data from pre-service teachers, teacher educators, and other faculty members (e.g., project leader, head of the department). The studies included in the meta-ethnography were conducted in six different countries: six were from the United States, six from the United Kingdom, three from Turkey, two from Taiwan, one from Finland and one from Cyprus.

Fig. 3 SQD-model

According to the findings of this review, twelve key themes need to be in place in the training of pre-service teachers. The SQD (synthesis of qualitative data) model includes three levels of consideration when preparing pre-service teachers for technology use (Author/s, 2018). The outer level includes systematic and systemic change efforts, along with aligning theory and practice. The second level considers aspects of the institution, such as technology planning and leadership, training staff, access to resources, or cooperation within and between the institutions. The inner circle includes the six micro level strategies such as using teacher educators as role models, or scaffolding authentic technology experiences.

3. Moving forward

Clearly, the three conceptual models all focus on technology integration in education, but at the same time they target different aspects. They all reduce complexity in a valid way (Goldilocks principle), focus on core aspects, omits perhaps less relevant aspects. These models describe the important relations between these core aspects, and they are graphically represented. They can stand as examples for many other models that explain the interplay of factors for technology integration in education. Some questions remain for the discussion during the sessions: What are the main quality criteria for valid models for technology integration in schools? What about their practical relevance? Are they compatible with general models? Etc. This brings us to the main goals of TWG9.

The working group will work on the following issues:

1. The group will collect and compare the most prominent models for technology integration in educational settings. In particular, the working group will compare models describing teacher-level, school-level and system-level factors. To this end, participants are expected to bring and present the models they use.

   > Goal: A grouped list of models, commonly used to inform educational technology integration in schools.

2. The working group will discuss the defining characteristics of models as well as quality criteria from the perspectives of educational policy-makers, researchers and practitioners.

   > Goal: Joint definition and criteria of good conceptual models with regard to educational technology integration.

3. An overarching model will be developed, combining the most promising and compatible models while expanding the model with recent key issues. The model should meet the criteria stated in step 1. I addition, it should be aligned with other domain general theories and models.

   > Goal: A plausible overarching conceptual model for technology integration in education.

4. Directions for future activities will be discussed and recommendations will be formulated.

   > Goal: A list of recommendations for further research and development.

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4. Schedule (draft)

Session 1 (Mo 9:30 - noon)

- Present yourself with your favourite model of technology integration
- Goals of the working group
- Discuss and expand criteria for models

Session 2 (Mo 2:30 - 5pm)

- Group the models (work in two subgroups)
- Compare the grouping of models of the two subgroups

Session 3 (Tu 9:00 - noon)

- Sketch an overarching model
- Integrate existing models

- Identify blank spots (e.g. nanolevel)

Postersession

Session 4 (Tu 2:30 - 5pm

- Outline of the article(s)
- Cooperation/collaboration of authors

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5. Participants

TWG 9 co-leaders: Jo Tondeur (Vrije Universiteit Brussel), Dominik Petko (Universität Zürich)

List of participants

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6. References and interesting studies

Albion, P. R., Tondeur, J., Forkosh-Baruch, A., & Peeraer, J. (2015). Teachers' professional development for ICT integration: Towards a reciprocal relationship between research and practice. Education and Information Technologies, 20(4), 655-673. https://www.researchgate.net/publication/276156508_Teachers'_professional_development_for_ICT_integration_Towards_a_reciprocal_relationship_between_research_and_practice

Bonfiglio-Pavisich, N. (2018). Technology and Pedagogy Integration: A Model for meaningful technology integration. *Australian Educational Computing*, *33*(1).

Koehler, M., & Mishra, P. (2009). What is Technological Pedagogical Content Knowledge (TPACK)? Contemporary Issues in Technology and Teacher Education, 9(1), 60–70.

Knezek, G., & Christensen, R. (2016). Extending the will, skill, tool model of technology integration: Adding pedagogy as a new model construct. *Journal of Computing in Higher Education*, *28*(3), 307-325.

Knezek, G., Christensen, R., & Fluke, R. (2003). Testing a Will, Skill, Tool Model of Technology Integration.

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers college record*, *108*(6), 1017-1054.

Romrell, D., Kidder, L., & Wood, E. (2014). The SAMR model as a framework for evaluating mLearning. *Online Learning Journal*, *18*(2).

Tondeur, J., Van Braak, J., Sang, G., Voogt, J., Fisser, P., & Ottenbreit-Leftwich, A. (2012). Preparing pre-service teachers to integrate technology in education: A synthesis of qualitative evidence. *Computers & Education*, *59*(1), 134-144.

Voogt, J., Fisser, P., Pareja Roblin, N., Tondeur, J., & van Braak, J. (2013). Technological pedagogical content knowledge–a review of the literature. *Journal of computer assisted learning*, *29*(2), 109-121.