

Developing Teachers' Technological Pedagogical Content Knowledge for 21st Century Learning (TPACK-21CL) through Design Thinking

Joyce Hwee Ling Koh, Ching Sing Chai and Wei Ying Lim Rebekah

KEY IMPLICATIONS

The TPACK-21CL design process:

- Enhances teachers' confidence for 21st century ICT lesson design
- Supports teachers to engender pedagogical change for 21st century learning
- Can be used more successfully in schools with strong instructional leadership

BACKGROUND & FOCUS

Teachers need to design ICT-integrated learning experiences that help students to acquire 21st century competencies such as problem-solving, collaboration and knowledge construction. Yet, empirical studies show that teachers continue to use ICT to support information transmission (e.g., Player-Koro, 2013). Teachers lack technological pedagogical content knowledge for 21st century learning (TPACK-21CL), a kind of professional know-how for creating ICT-integrated learning experiences that support 21st century learning (Koh, Chai, Wong, & Hong, 2015).

TPACK emerges as teachers engage in ICT lesson design but the current TPACK framework has been criticized for its limitation as an ICT lesson design framework. This study proposes that teachers' development

of TPACK-21CL could be enhanced through a five-phase design thinking process: (1) assess current lesson design with TPACK-21CL rubric; (2) set TPACK-21CL goals; (3) co-design with TPACK-21CL lesson planning heuristics; (4) implement lessons and evaluate student outcomes; and (5) review and reflect.

The TPACK-21CL rubric and TPACK-21CL lesson planning heuristics are design thinking scaffolds developed from our previous research work (see Chai, Ng, Li, Hong, & Koh, 2013; Koh, 2013). This study examines the effectiveness of this design thinking process in terms of its influence on teachers' perceived design efficacy and perceived efficacy for TPACK-21CL, its influence on teachers' design and implementation of pedagogical change, and areas for improving the process.

KEY FINDINGS

There were significant positive differences in the perceived technological pedagogical knowledge (TPK), technological content knowledge (TCK), TPACK and lesson design practices (LDP) of teachers from the school-based design teams, with large effect sizes. The graduate course participants registered significant positive increases in confidence for technological knowledge (TK), TPK, and TPACK; also with large effect sizes. Analysis of the differences

between the initial and final/implemented lesson designs of study participants found that they were able to transform lessons where students engage in the reproduction of subject content with ICT to lessons that involve students using ICT to support divergent knowledge expressions through the construction of verbal, written, visual, conceptual or product-oriented artefacts collaboratively.

Teachers also created more authentic lessons by moving from the mere presentation of real-world problems with ICT tools to having students use ICT tools to investigate real-world problems. Teachers were also able to enhance students' Intentionality by engaging ICT tools to support students' self-diagnosis of learning gaps and engagement in providing peer feedback.

The study participants reflected that the process supported student-centered pedagogical change with design thinking scaffolds that helped teachers benchmark 21st century learning. More customization of the scaffolds for different subject areas and pedagogies was requested. Participants also felt that the process can be implemented more successfully when school management provides strong instructional leadership and clear pedagogical directions.

SIGNIFICANCE OF FINDINGS

MOE's fourth ICT Masterplan envisions creating quality learning through technology. One of the enablers of this process is for teachers to be designers of learning experiences and environments (<http://ictconnection.moe.edu.sg/masterplan-4/overview>). The TPACK-21CL survey, design rubrics, and design heuristics are design scaffolds developed within this study that can be used to support and evaluate teachers' design efficacy and the quality of teachers' lesson plans with respect to 21st century learning dimensions respectively. The TPACK-21CL

process therefore provides schools with a theoretically-driven design process for managing pedagogical change that has been tested in both school-based and graduate learning contexts.

RESEARCH DESIGN & PARTICIPANTS

The process was evaluated with 10 school-based ICT lesson design teams from two primary schools (comprising 47 teachers), and another 47 in-service teachers, higher/adult education instructors who were attending a graduate course in ICT integration at NIE. The school-based design teams redesigned and implemented ICT lessons throughout a school year whereas the graduate course participants worked on lesson redesign across a 13-week semester. Pre- and post-study surveys, content analyses of teachers' lesson plans, video-recordings of implemented lessons, and teachers' post study reflections were data sources for the study.

REFERENCES

- Chai, C.S., Ng, E.M.W., Li, W., Hong, H.Y., & Koh, J.H.L. (2013). Validating and modeling technological pedagogical content knowledge framework among Asian Preservice teachers. *Australasian Journal of Educational Technology*, 29(1), 41–53.
- Koh, J.H.L. (2013). A rubric to analyze teachers' conceptions of meaningful learning in ICT lesson planning. *Australasian Journal of Educational Technology*, 29(6), 887–900.
- Koh, J.H.L., Chai, C.S., Wong, B., & Hong, H.Y. (2015). Technological Pedagogical Content Knowledge (TPACK) and design thinking: A framework to support ICT lesson design for 21st century learning. *The Asia Pacific Education Researcher*, 24(3), 535–543.
- Player-Koro, C. (2013). Hype, hope and ICT in teacher education: a Bernsteinian perspective. *Learning, Media and Technology*, 38(1), 26–40.

About the authors

Joyce Hwee Ling KOH is with the National Institute of Education, Singapore. CHAI Ching Sing is with the Chinese University of Hong Kong. LIM Wei Ying Rebekah is with the Singapore University of Social Sciences.

Contact Joyce at joyce.koh@nie.edu.sg for more information about the project.

This brief was based on the project OER 05/13 KHL: Developing teachers' Technological Pedagogical Content Knowledge for 21st Century Learning (TPACK-21CL) Through Design Thinking.

How to cite this publication

Koh, J.H.L., Chai, C.S., & Lim, R.W.Y. (2017). *Developing Teachers' Technological Pedagogical Content Knowledge for 21st Century Learning (TPACK-21CL) through Design Thinking*. (NIE Research Brief Series: 17-008). Singapore: National Institute of Education.

Request for more details

Please approach the Office of Education Research, National Institute of Education, Singapore to obtain a copy of the final report.

>> More information about our research centres and publications can be found at: <http://www.nie.edu.sg>