Interrelationship between Stages of Concern and Technological, Pedagogical, and Content Knowledge: A study on Taiwanese senior high school in-service teachers

Yang-Hsueh Chen [a,*], Syh-Jong Jang [b,*]

[a] Department of Education, National University of Tainan, 33, Sec. 2, Su-Lin St., Tainan, Taiwan
[b] Graduate School of Education, Chung Yuan Christian University, Chung-Li 32023, Taiwan

ABSTRACT

Whereas teachers' Stages of Concern (SoC) and their Technological, Pedagogical, and Content Knowledge (TPACK) appear to be related constructs, studies are scant regarding the connection between these two research areas. This study intensively examined the association between Taiwanese senior high school teachers' SoC and TPACK through a national survey ($N = 605$) and canonical correlational analysis. To ensure rigor of study, we revised a TPACK instrument for Taiwanese senior high school teachers, statistically tested SoC's developmental phases, and reworked the Stages of Concern Questionnaire. Three canonical correlations became evident, portraying a significant connection between SoC and TPACK and further supporting our hypothesis that a higher level of technology integration would correlate higher with more synthesized types of teacher knowledge. Recommendations were put forward regarding support strategies of change facilitators, as well as directions for future research.

© 2013 Elsevier Ltd. All rights reserved.

1. Introduction

Promoting teachers' Technology Integration has become one of the major education policies throughout the world, as the past two decades have seen vast advancement of computer, Internet, and mobile technologies that opened up new possibilities for learning. In Taiwan, the Ministry of Education (2008) has issued the White Paper on Information Technology Education for Primary and Secondary Schools. Teachers are required to spend more than 20% of their class time for technology-infused teaching, and a main goal was to make 90% of primary and secondary schoolteachers use technologies regularly in their classrooms. To achieve this goal, nation-wide action plans were set up to ensure digital opportunities among teachers and students, develop diversified e-learning resources, map out technology training courses, and encourage schoolteachers to regularly evaluate their own abilities of technology integration.

In the United States, the International Society for Technology in Education (ISTE, 2000, 2008) has outlined critical dimensions for schoolteachers, including: (1) technology operations and concepts; (2) planning and designing learning environments and experiences; (3) teaching, learning, and the curriculum; (4) assessment and evaluation; (5) productivity and professional practice; and,

(6) social, ethical, legal, and human issues (ISTE, 2000). The ISTE dimensions and associated standards have been adopted by the Taiwan Ministry of Education to develop a national self-evaluation sheet for schoolteachers (Hsu, 2010). It follows that a teacher should possess a variety of knowledge domains, such as technology literacy, teaching and learning theory, social and contextual sensitivity, subject matter knowledge, etc., to be well-fitted in the digital age.

A useful framework that delineates teachers' knowledge for technology integration is TPACK, standing for Technological, Pedagogical, and Content Knowledge (Koehler & Mishra, 2005; Thompson & Mishra, 2007). Koehler and Mishra argued that effective teachers possess a sophisticated knowledge base, wherein *content*, *pedagogy*, and *technology* interplay in high degrees. Through continual professional development, teachers gain a deep understanding of the educational context and students' learning needs. They also learned how to tacitly select technologies to enhance what they teach, how they teach, and what students learn. The TPACK framework provides an analytic lens or instrument to study categories of teachers' knowledge (Archambault & Barnett, 2010; Chai, Koh, Tsai, & Tan, 2011; Jang & Tsai, 2012; Lin, Tsai, Chai, & Lee, 2012; Sahin, 2011). It can also be used as a reflection guideline (see www.ualberta.ca/~kpeacock/Presentations/TPACKReflection.docx for an example) or assessment rubric (Harris, Grandgenett, & Hofer, 2010) to examine teachers' status of technology integration.

In contrast to knowledge and skills, another strand of technology integration research focuses on teachers' attitude and

* Corresponding authors. Tel.: +886 988 621 571, +886 3 2656812; fax: +886 6 214 4409.
  E-mail addresses: siderali@gmail.com, kcchen@mail.nutn.edu.tw (Y.-H. Chen), jang@cycu.edu.tw (S.-J. Jang).

affection. *Stages of Concern* (SoC, Hall, 2013) delineates the motivation, thoughts, and considerations that a teacher may go through when implementing technology. In addition to illustrating a teachers' change process, SoC identifies key issues to be resolved within each stage. It can also be used as a diagnostic and supportive framework to address teachers' needs and aspirations, ultimately promoting teachers' professional development.

Although Stages of Concern (SoC) and Technological, Pedagogical, and Content Knowledge (TPACK) are both important constructs of Technology Integration, studies connecting the two acknowledged research areas are barely retrievable. We deem that examining the association between SoC and TPACK will help us gain a broader perspective and deeper understanding of teachers' technology integration. Hence, change facilitators can more aptly design strategies for teacher concerns, foster teachers' actions, and leverage their knowledge acquisition.

2. Theoretical framework

2.1. Stages of Concern: a transformative view

When it comes to technology implementation, we cannot proceed without mentioning Hall and his colleague's groundbreaking work: the Concerns-Based Adoption Model (CBAM, Hall, 2013; Hall & George, 1979; Hall, George, & Rutherford, 1977; Hall & Hord, 1987, 2011; Hall, Wallace, & Dossett, 1973; Hord, Rutherford, Huling, & Hall, 2004). *Concern*, as defined by Hall et al. (1977), is a "composite representation of feelings, preoccupation, thought, and consideration" (p. 5). Elaborated from Fuller's (1969) three-stage model of early career development, the CBAM framework has become a widely applied theory and methodology for the process of implementing educational changes by teachers and by persons acting in change-facilitating roles (Anderson, 1997). It assumes that *change* is an internal process that reflects a growth in skills and mindset. Accordingly, teachers move through different Stages of Concern (SoC) for technology integration as they better their computer literacy, enrich their pedagogical knowledge and skills, and strengthen their self-efficacy, belief and motivation of technology implementation.

The Stages of Concern framework posits seven stages of feelings and motivation that a teacher might face when implementing an innovation. In each stage, a teacher's level of concern is greater than the previous stage. At the onset, a teacher shows little interest about the innovation (*Stage 0, Awareness*). When some occurrences spark the teacher's interest, they start to seek out more information about the technological innovation (*Stage 1, Informational*). After becoming familiar with the innovation, the teacher begins to feel concerned with their ability to carry out any changes, as well as the costs and benefits that the innovation may incur (*Stage 2, Personal*). The moment a teacher overcomes personal uncertainty and confusion, they start to experiment with the innovation and put the changes into practice. The teacher becomes aware of issues such as time management and balance of duties as they grow more concerned. (*Stage 3, Management*). At *Stage 4, Consequence*, the teacher is confident about the utility of the innovation and may think of ways the innovation can be fine-tuned to bring about greater impact on students. Even more, some teachers may try to understand what others are doing about the innovation, and seek collaboration with others to maximize the potential of technology (*Stage 5, Collaboration*). At the highest level of concern (*Stage 6, Refocusing*), the teacher is interested in ways to "innovate" the innovation, or find better alternatives to replace the innovation.

The above seven stages can be sorted into three meta-stages: *personal concerns* (Awareness, Informational, and Personal), *task concerns* (Management), and *impact concerns* (Consequence, Collaboration, and Refocusing). It is important to note that the above states are not mutually exclusive. A teacher can experience several concern stages simultaneously, with each level of concern reaching a different intensity. However, as a teacher becomes more experienced and skilled with an innovation, lower stages will decrease and while higher stages (i.e., Consequence, Collaboration, and Refocusing) will increase.

The Concern-Based Adoption Model had inspired research in many directions (Hall, 2013). In a longitudinal study, Crawford, Chamblee, and Rowlett (1998) tracked the changes of concern among a sample of mathematics teachers who received a new algebra curriculum. The study found that the teachers' lower Stages of Concern (Awareness and Informational) had decreased while high concern Stages (Refocusing) had increased over one year of implementation. Conway and Clark (2003) examined six interns' concerns and aspirations about teaching in the context of a two-semester Internship program. The authors found that the interns' concerns had moved from self to task concerns, and then to impact concerns, portraying a journey *outward*. On the other hand, the interns' aspirations about teaching also shifted from self-survival to identity seeking, and then to self-improvement, portraying a reflexive journey *inward*. The studies listed above show the dynamic nature of teachers' concerns and how they manifest themselves in different aspects of teaching.

Another branch of study focuses on teacher demographics and backgrounds, like age, gender, teaching experience, and technology usage. Dooley, Metcalf, and Martinez (1999) examined the role of the teacher training programs and their professional development through the lens of Diffusion of Innovation (Rogers, 1995) and Stages of Concern models. Dooley et al. found that teachers' levels of concern correlated with their use of technology: those who use technology more frequently (or high users) exhibited *impact* and *task* concerns while those who use technology less frequently (or low users) exhibited *personal* concern meta-stages. The characteristics of these groups of users also matched Rogers' theorizing of Diffusion of Innovation. High users demonstrated positive attitudes about change, sought information about new hardware and software, and explored possible applications in their classroom. Middle users were more cautious and skeptical towards innovations and less willing to risk leaving their comfort zones. Lastly, low users, described by Rogers as *laggards*, showed the least interest and most resistance to innovation and change.

Despite immense influence of CBAM on technology integration, Anderson (1997) pointed out a curious lack of theoretical critique and revisions of the model. He called for a systematic review and test of CBAM to ensure its applicability in the 21st century. In line with Anderson's call, Cheung, Hattie, and Ng (2001) used confirmatory factor analysis (CFA) to thoroughly test the psychometric quality of SoCQ (Hall et al., 1977), a 35-item questionnaire that assesses the seven stages of concern. Unfortunately, the SoCQ-based model failed to fit empirical data. Worse, correlations between the seven stages deviated from a simplex pattern, opposing the "transformative" assumption of the CBAM framework. After adjustments and comparisons among alternative models, a revised five-stages SoC was proposed: (1) Awareness, (2) Informational/Personal, (3) Management, (4) Consequence/Collaboration, and (5) Refocusing. Furthermore, the number of items had been reduced to 22. In view of its much improved psychometric quality, this study adopted Cheung et al.'s (2001) revised SoC questionnaire to assess in-service teachers' stages of concern.

2.2. TPACK: the essential knowledge of teachers

Building upon Schulman's (1986, 1987) Pedagogical Content Knowledge (PCK) model, Koehler and Mishra (2005) conceptual-