TPACK Newsletter, Issue #24: August 2015

Welcome to the twenty-fourth edition of the (approximately bimonthly) TPACK Newsletter! TPACK work is continuing worldwide. This document contains recent updates to that work that we hope will be interesting and useful to you, our subscribers.

If you are not sure what TPACK is, please surf over to http://www.tpack.org/ to find out more.

Gratuitous Quote About Knowledge

"The best advice I ever got was that knowledge is power and to keep reading."
- David Bailey

In This Issue

1. TPACK Newsletter Update

The TPACK Newsletter has been published via the tpack.news email list since January 2009. It has 1203 subscribers currently. Subscription numbers have held steady (+ or – 1% to 3%) since October 2011.

2. Recent TPACK Publications

Below are recent TPACK publications that we know about: 29 articles, 15 chapters, 2 books, and 13 dissertations and theses that have not appeared in past issues of this newsletter. If you know of others that were published within the past several months, please let us know at: tpacknews.editors@wm.edu.

Articles

Almenara, J. C., Díaz, V. M., & Garrido, C. C. (2015). Validation of the application of TPACK framework to train teacher in the use of ICT. *@tic: Revista D'Innovacio Educativa, 14* [online journal]. doi: 10.7203/attic.14.4001

Abstract: "Training teachers in the use of Information and Communication Technologies (ICT) is now an undeniable necessity if we wish to incorporate ICT into teaching-learning processes in an educational and significant manner, and not merely use them as an additional element operating separately from the other curricular variables (contents, strategies, methodologies, etc.). The incorporation of ICT in teachers' professional development is affected by such peculiar elements as the teachers' different types of knowledge. The design of the TPACK (Technological Pedagogical Content Knowledge) framework, which was fundamentally put forward by Koehler and Mishra (2007), has highlighted the link between the different types of knowledge and is forming the basis of a line of research, diagnosis and reflection on teacher training in ICT."

Arslan, Y. (2015). Determination of technopedagogical content knowledge competencies of preservice physical education teachers: A Turkish sample. *Journal of Teaching in Physical Education, 34*(2), 225-241. doi:10.1123/jtpe.2013-0054

Abstract: "This study examined preservice physical education teachers' (PPETs') technopedagogical content knowledge (TPCK) competencies. The participants were 1028 PPETs from 26 major universities representing all seven geographical regions of Turkey. The Technological Pedagogical Content Knowledge Deep- Scale developed by Kabakci Yurdakul et al. (2012) was used to measure TPCK competencies of PPETs. Descriptive statistics, an independent samples t test, and multivariate analysis of variance were used to analyze the data. The results showed that PPETs rated themselves at a high level in self-reported TPCK competencies in terms of the entire scale and its factors (design, exertion, ethics and proficiency). There was no significant main effect for gender ($p > .05$). Computer/ internet-based background ($p < .05$) and PPETs' interest in keeping up with the latest PE-related technological developments ($p < .05$) were significant variables in PPETs' TPCK competencies. Overall, this study offers some evidence that the use of information and communication technology (ICT) is an important factor affecting PPETs' TPCK competencies."

Bakir, N. (2015). An exploration of contemporary realities of technology and teacher education: Lessons learned. *Journal of Digital Learning in Teacher Education*, *31*(3), 117–130. doi:10.1080/21532974.2015.1040930

Abstract: "In order to better prepare preservice teachers to teach with technology, this study examines the current practices and barriers in technology implementation in three teacher education programs. This multiple-case study relied upon site visits, observations, in-depth interviews with faculty, staff, and preservice teachers, and examinations of artifacts. Data analysis was performed both within case and across case. Findings showed that the lack of a

systematic implementation in each program resulted in inconsistent technology integration across the programs. A variety of interrelated factors influenced or hindered technology implementation, including levels of integration, administrative support, faculty development, technology support, funding, and technology access. However, the most significant hindrance was the faculty attitudes and pedagogical beliefs at each program. This research outlines recommendations for teacher training programs to support and strengthen their strategies and their integration of technology."

Baran, E., & Canbazoglu Bilici, S. (2015). Teknolojik Pedagojik Alan Bilgisi (TPAB) uzerine alanyazin incelemesi: Türkiye ornegi. [in Turkish]. *Hacettepe Universitesi Egitim Fakültesi ergisi [Hacettepe University Journal of Education], 30*(1), 15-32.

Abstract: "Technological Pedagogical Content Knowledge (TPACK) framework has played an important role in rethinking current teacher education and technology practices both in Turkey and around the world. Due to the recent increase in the number of research studies conducted on TPACK in Turkey, there has been an emerging need to investigate the research on TPACK to evaluate the current literature as well as to guide future research studies. To help better inform teacher educators and researchers, the authors embarked upon a systematic review of 30 research articles published between January 2005 and December 2013 and that investigated the TPACK framework in Turkey's teacher education contexts. To understand the research trends in the literature the research articles' contexts, subjects, TPACK approaches, research methods, participants, TPACK based activities, data collection tools, data analysis methods, validity and reliability studies, and main results were analyzed. The results of the study revealed that; surveys were the main data sources used in TPACK research in Turkey, preservice teachers were the most common participant groups, and science and math disciplines were the most common subject domains investigated. The study provides recommendations and research directions to teacher educators and researchers for improving teachers' effective technology integration knowledge and practices in teacher education programs."

Baser, D., Kopcha, T. J., & Ozden, M. Y. (2015). Developing a technological pedagogical content knowledge (TPACK) assessment for preservice teachers learning to teach English as a foreign language. *Computer Assisted Language Learning*. Advance online publication. doi:10.1080/09588221.2015.1047456

Abstract: "This paper reports the development and validation process of a self-assessment survey that examines technological pedagogical content knowledge (TPACK) among preservice teachers learning to teach English as a foreign language (EFL). The survey, called TPACK-EFL, aims to provide an assessment tool for preservice foreign language teachers that addresses subject-specific pedagogies and technologies. Using mixed methods approach, survey items were generated first using qualitative methods (e.g. expert interviews and document analysis). The content validity of the items was established through expert and preservice teacher reviews. The survey was then validated through two rounds of exploratory factor analysis (EFA), the first with 174 preservice EFL teachers and the second with 204 preservice EFL teachers. The results of the first round indicated a five-factor structure: technological knowledge (TK),

content knowledge (CK), pedagogical knowledge (PK), pedagogical content knowledge (PCK) and a fifth factor that combined TCK, TPK, and TPACK items. After revising the survey, the second round of EFA results showed a seven-factor structure that was consistent with the TPACK framework. The final TPACK-EFL survey included a total of 39 items: 9 TK, 5 CK, 6 PK, 5 PCK, 3 TCK, 7 TPK, and 4 TPACK. The results offer survey developers and teacher educators insight into establishing clear boundaries between the TPACK constructs. In particular, subject-specific strategies were used to generate clear and distinct items within the TCK and TPK constructs. Implications for developing other subject-specific TPACK surveys and using the TPACK-EFL survey in other countries are discussed."

Brueck, J. S., & Lenhart, L. A. (2015). E-books and TPACK. *The Reading Teacher, 68*(5), 373-376.

Abstract: "Today's tech savvy young learners are equipped with a variety of technological tools used as easily as pencils and paper. Many reach for the laptop first when it's time to write or look for an ebook when it's time to read. Ebooks are increasingly viewed as an appropriate source for literacy exposure to books and reading by parents and educators, as net sales revenue from ebooks surpassed hardcover books in the first quarter of 2012 (Boog, 2012).

As educators consider adopting ebooks as instructional resources, we must consider how to effectively merge content, pedagogy and technology in the early literacy classroom. In this article we discuss the emerging role of ebook technology in early reading instruction, along with describing how the Technological Pedagogical Content Knowledge (TPACK) framework (Mishra & Koehler, 2006) can assist teachers in understanding the dynamic relationship between content, pedagogy and technology in the literacy classroom."

Cetin-Berber, D., & Erdem, A. R. (2015). An investigation of Turkish pre-service teachers' technological, pedagogical and content knowledge. *Computers, 4*(3), 234-250. doi:10.3390/computers4030234

Abstract: "The purpose of this study is to investigate pre-service teachers' technological, pedagogical and content knowledge (TPACK) in Turkey. By using the "Survey of Pre-service Teachers' Knowledge of Teaching and Technology" developed by Schmidt et al. (2009), the study sought to determine if significant differences could be found in pre-service teachers' perceptions of TPACK when examined by gender, age, educational program, year of study, kind of instruction (day or night education) and field experience. Regression analysis was also used to examine if technology knowledge (TK), pedagogical knowledge (PK) and content knowledge (CK) significantly contributed to pre-service teachers' TPACK development. Participants of this study were 491 elementary pre-service teachers who attended the summer semester at Pamukkale University. The analysis of the collected data found a significant difference in pre-service teachers' perceptions of the TPACK when examined across gender, program, year of study and field experience, but no significant differences were found regarding age and kind of instruction. Finally, our regression model showed that CK and PK contributed significantly to pre-service teachers' TPACK development, but TK was not a significant predictor."

Colvin, J.C., & Tomayko, M.C. (2015). Putting TPACK on the radar: A visual quantitative model for tracking growth of essential teacher knowledge. *Contemporary Issues in Technology and Teacher Education, 15*(1), 68-84. Retrieved from http://www.citejournal.org/vol15/iss1/currentpractice/article1.cfm

Abstract: "Since Mishra and Koehler's (2006) description of technological pedagogical content knowledge (also known as TPACK), scholars have analyzed the various paths preservice and in-service teachers can take to develop their knowledge in each of the subdomains. However, the model of the overall framework can be confusing to teachers, as Venn diagrams are generally used for categorization. Furthermore, no representation of TPACK to date has presented a means to accurately reflect a teacher's growth in knowledge over time. This paper proposes a visual and quantitative representation of TPACK that will help teachers better understand the TPACK framework and track their growth in the knowledge domains over time. A pilot study was conducted with 24 preservice science and mathematics teachers. Quantitative evidence indicated that an explanation of TPACK using a radar diagram was at least as effective as an explanation using a Venn diagram in terms of these students' understanding of TPACK. Furthermore, the qualitative evidence supported the assertion that teachers would benefit from a way to track their growth in the essential knowledge areas encompassed by the framework."

Crook, S. J., Sharma, M. D., & Wilson, R. (2015). Comparison of technology use between biology and physics teachers in a 1:1 laptop environment. *Contemporary Issues in Technology and Teacher Education, 15*(2). Retrieved from http://www.citejournal.org/vol15/iss2/science/article1.cfm

Abstract: "Using a mixed-methods approach the authors compared the associated practices of senior physics teachers (n = 7) and students (n = 53) in a 1:1 laptop environment with those of senior biology teachers (n = 10) and students (n = 125) also in a 1:1 laptop environment, in seven high schools in Sydney, NSW, Australia. They found that the physics teachers and students reported more use of their laptops than did their biology counterparts, particularly in regard to higher order, engaging activities such as simulations. This disparity is consistent with the differences between the prescribed NSW physics and biology curriculum documents. The physics curriculum specifies that students should engage with various technologies (especially simulations) frequently within the course content, while the biology curriculum makes only generic statements within the course outline. Due to the curriculum mandate, physics teachers seemed to be capitalizing on the opportunities afforded by the 1:1 laptop environment, whereas the biology teachers had less of a mandate and, consequently, incorporated less technology in their teaching."

Glowatz, M., & O'Brien, O. (2015). An exploration of the technological, pedagogical and content knowledge (TPACK) framework: Utilising a social networking site in Irish higher education. *Irish Journal of Academic Practice*, 4(1). Retrieved from http://arrow.dit.ie/ijap/vol4/iss1/1

Abstract: “Research into the use of social media for academic purposes is growing. Much of it suggests that social networking sites (SNSs) could be used as innovative tools for teaching (Duncan & Baryzck, 2013; Harris, 2012; O’Brien & Glowatz, 2013). This paper argues that research in this field has often neglected to take account of the pedagogy involved in successfully utilising a SNS for educational purposes. Koehler & Mishra (2009) have proposed the technological, pedagogical and content knowledge framework (TPACK) to explore the relationship of technology to teaching in order to build the basis for further research. We explore the suitability of the TPACK framework in the context of SNSs for academic engagement, and we review its relevance to the adoption of a SNS as a teaching tool. Our investigation so far suggests that the current TPACK framework overlooks some important elements that are relevant to the adoption of SNSs. This paper outlines some of these overlooked elements and evaluates the use of the TPACK framework in the exploration of SNS usage in higher education to engage students with curriculum. Specifically, we address the key question, ‘Does the TPACK framework provide an insight into the knowledge base required to effectively deliver a module utilizing SNSs?’”

Gündoğmuş, N., & Gündoğmuş, S. (2015). Study on the technological pedagogical and content knowledge of teacher candidates and their learning strategies. *Participatory Educational Research, 2*(2), 47-58. doi:10.17275/per.15.06.2.2

Abstract: “The aim of this paper is to evaluate the Technological Pedagogical and Content Knowledge (TPACK) of teacher candidates, defining the learning strategies of same candidates and researching whether there is relationship between these changes, or not. The research was carried out upon 493 senior class teachers candidate who studied in Necmettin Erbakan University Ahmet Keleşoğlu Faculty of Education in 2011-2012 spring term. The data is acquired by using Technological Pedagogical Content Knowledge Scale and Motivated Strategies for Learning Questionnaire. The data which is acquired from the scales and the information belongs to participants are analyzed with the SPSS (Statistical Package for the Social Sciences) 19.0 packaged software. During the analysis of data, it was used independent-samples t-test, correlation and regression analysis. According to the findings which were obtained from the research, TPACK levels of teacher candidates are occasionally, male candidates’ technology, pedagogy and technological content knowledge skills are higher than girls. In the research, it can’t be seen that there isn’t any significant difference between groups according to score type used for the placement at university in TPACK components, a significant relationship was found between TPACK and learning strategies such as recursion, learning from friend, help search strategies’ elaboration, organizing, critical thinking, metacognitive self-regulation, time operation environment monitoring, additionally it was understood that organization and critical thinking strategies predicted the TPACK.”

Hosseini, Z. (2015). Development of technological pedagogical content knowledge through constructionist activities. *Procedia - Social and Behavioral Sciences*, *182*, 98–103. doi:10.1016/j.sbspro.2015.04.743

Abstract: “The aim of this case study was to better understand how TPACK can be developed through constructionist activities. Accordingly, a course was designed and a purposively sampled group was selected for collecting in-depth data. The findings of the study demonstrated that teachers’ knowledge and conception of using technology for teaching developed in three levels. With each level, there was an improvement of teachers’ TPACK and its components as a result of performing constructionist activities. First level was limited to usage of technology for exhibiting curriculum information. In the second level, the participants focused on using technology to present content and materials. The results indicated that in this level although two components of the participants’ TPACK, viz. TCK and PCK developed, considering technology as a learning tool (TPK) appeared to be missing. However, in the third level they developed the ability to use technology for enhancing teaching and learning. The result of the study highlighted inter and intra group interactions and learning-through-making as two aspects of constructionist activities that were more influential in the development of TPACK.”

Jaipal-Jamani, K., & Figg, C. (2015). A case study of a TPACK-based approach to teacher professional development: Teaching science with blogs. *Contemporary Issues in Technology and Teacher Education*, *15*(2). Retrieved from http://www.citejournal.org/vol15/iss2/science/article2.cfm

Abstract: “This paper presents a case study of a technology professional development initiative and illustrates how a workshop approach based on technology, pedagogy, and content knowledge (TPACK) was adapted for professional learning at a school site. The case further documents how three middle school science teacher participants developed knowledge about how to teach with technology as they planned and implemented a blog activity in science over a 4-week period. The design of the professional development was informed by the underlying assumptions of the TPACK framework and characteristics for effective professional development for science and technology-enhanced teaching. To obtain insights into the particular experiences of teachers as they participated in the onsite professional development, a naturalistic case study design was used. Data collection procedures included researcher field notes during workshop sessions and lessons, videotaped classroom observations, audiotaped interviews, and teacher and student lesson artifacts. Data on teachers’ planning and lesson implementation of the blog activity to Grade 8 students were analyzed using content analysis. Overall, the results indicate that TPACK is developed through a combination of workshop experiences and immediate application of knowledge gained in the workshop into practice in the real-life teaching context.”

Janssen, N., & Lazonder, A. W. (2015). Implementing innovative technologies through lesson plans: What kind of support do teachers prefer? *Journal of Science Education and Technology*. Advance online publication. doi:10.1007/s10956-015-9573-5.

Abstract: "Lesson plans are a potentially powerful means to facilitate teachers’ use of technology in the classroom. This study investigated which supplementary information is preferred by teachers when integrating a new technology into the classroom. Forty-six high

school biology teachers (23 pre-service and 23 in-service) received a technology-infused lesson plan and were asked to choose between two sets of support materials that differed with regard to the extensiveness and integration of pedagogical and content information. Based on the technological, pedagogical, and content knowledge (TPACK) framework, pre-service teachers (n = 23) were expected to prefer the appendix containing extensive and separate information, whereas in-service teachers (n = 23) were predicted to prefer the succinct and integrated version. Teachers' responses to a forced-choice question confirmed the latter expectation, but lent insufficient support to the former. Semi-structured interviews further showed that the justifications of in-service teachers were generally consistent with the TPACK framework. Most pre-service teachers, by contrast, were future-oriented and preferred support that would help increase their proficiency rather than consolidate their existing knowledge base."

Kildan, A. O., & Incikabi, L. (2015). Effects on the technological pedagogical content knowledge of early childhood teacher candidates using digital storytelling to teach mathematics. *International Journal of Primary, Elementary, and Early Years Education, 43*(1), 238-248. doi:10.1080/03004279.2013.804852

Abstract: "This study aimed to present early childhood teacher candidates' experiences preparing digital stories and to reveal the resulting changes, if any, in self-reported technological pedagogical content knowledge (TPACK). This study was quasi-experimental and indicated that teacher candidates' evaluations of digital storytelling were affected by their preparation experiences. Moreover, results showed a shift from dual intersections of technology, pedagogy, and content knowledge to the triple intersection of TPACK."

Koh, J., Chai, C., Benjamin, W., & 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*. Advance online publication. doi:10.1007/s40299-015-0237-2

Abstract: "This conceptual paper argues that to develop students' twenty-first century competencies, teachers need to consider how technological pedagogical content knowledge (TPACK) can be applied through design thinking processes. It proposes a conceptual framework articulating various TPACK considerations and how these various forms of TPACK can be used as epistemic resources to support design thinking for developing ICT-integrated lessons targeted at twenty first century learning. This framework provides an initial vocabulary for describing how teachers create TPACK through design, which is a critical gap in extant TPACK research. Implications for teachers' design of ICT-integrated lessons as well as future directions of research are discussed."

Koh, J., Chai, C., & Lee, M.-H. (2015). Technological pedagogical content knowledge (TPACK) for pedagogical improvement: Editorial for special issue on TPACK. *The Asia-Pacific Education Researcher*. Advance online publication. doi:10.1007/s40299-015-0241-6

Abstract: "The papers in this special issue have showcased different ways of using TPACK for instructional planning, curriculum leadership, e-learning, and teacher assessment; notably including teachers in the fields of early childhood and special needs, which have not often been studied. Several areas in the field of TPACK can still be further developed. Firstly, TPACK has contextualized knowledge for ICT used with specific content and pedagogies. Unique kinds of TPACK specifications still need to be developed as languages of pedagogical improvement for different contexts; which are examples of what Harris et al. (2009) defined as TPACK Activity Types. Harris and Hofer (2011) have begun some work on such kinds of activity types in different subject areas. More of such studies are still needed. Secondly, Chai et al. (2013) suggested that the TPACK framework can also be extended to the assessment of the design of online activities. Thirdly, how teachers use their existing knowledge as epistemic resource to create TPACK under the influence of their epistemic and pedagogic beliefs needs further unpacking. Chai et al. (2011) have alluded that the nature of TPACK as a form of knowledge is not that of "verified true beliefs" but "usable design knowledge." The process of generating TPACK could be partly through the dynamic activation of epistemic resources, which inevitably include the seven kinds of TPACK knowledge that the teachers may possess. Teachers' acquired ways of framing design problems and the situational and discursive synthesis of the epistemic resources to solve the instructional problems at hand could also contribute to the creation of TPACK. Teachers' decisions could also be influenced by the multiple demands that they face as part of the context of their work, and their personal intentions with using technology. Further analysis of how contextual factors influence teacher's TPACK development is thus necessary (Porras-Hernasndez and Salinas-Amescua 2013). Furthermore, how TPACK is generated from the perspective of teachers' mental models (see for e.g., Krauskopf et al. 2012) needs further theorization and empirical illustration. This constitutes an area of study that can be further explored. As teachers change their pedagogical practices with technology integration, such are examples of TPACK that are being enacted in the classroom. Such kinds of change influence students' conceptions of learning with technology (Hammond and Manfra 2009; Khan 2011). The fourth area for future study therefore relates to the effects of teachers' TPACK application on students either in terms of learning outcomes or their conceptions of learning with technology. A final gap observed is the lack of critical perspectives about the TPACK framework (Hewitt 2008) as most papers have accepted the TPACK framework as it is even though a theoretical analysis of the TPACK constructs find the need for much more precision in its theoretical definitions (Cox and Graham 2009). Therefore, studies that consider alternative interpretations of the TPACK frameworks can further enhance the critical discourse and theoretical development of the framework. These are several potential areas that can contribute to the enhancement of the TPACK framework's usefulness for supporting teachers' pedagogical improvement."

Kuo, N.-C. (2015). Action research for improving the effectiveness of technology integration in preservice teacher education. *i.e.: inquiry in education, 6*(1), article 3. Retrieved from http://digitalcommons.nl.edu/ie/vol6/iss1/3

Abstract: "This study aims at exploring how the technological pedagogical content knowledge (TPACK) framework can be used to improve the effectiveness of integrating IDEA '04 and

Research for Inclusive Settings (IRIS) modules in preservice teacher education. The purposes of this study are to maximize the potential of TPACK at the college and university level and to improve the quality of technology integration in teacher education. The results indicate that the use of TPACK in teacher education can offer teacher educators a way to enhance technology integration and to help preservice teachers build a more solid foundation of knowledge and practices. With the development of technology integration in higher education (Bates & Poole, 2003; Garrison & Kanuka, 2004; Jonassen, Mayes, & McAleese, 1993), identifying a valid and effective way to examine the impact of technology integration in preservice teacher education is important and urgent. The TPACK framework extended from Shulman's (1987) idea of pedagogical content knowledge has been proven as one of the most important approaches for effective technology integration in the classroom. However, there is limited existing research in preservice teacher education addressing how TPACK can be used to enhance the quality of technology integration, such as the IRIS modules. Grounded in action research, the present study aims at exploring how TPACK can be used to examine the impact of integrating IRIS modules in preservice teacher education."

Lee, L., Mohamed, A., & Altamimi, A. A. (2014). Design, development, and evaluation of an automated e-learning tutorial system to instruct pre-service special educators in the Malay braille code. *The Asia-Pacific Education Researcher*. Advance online publication. doi:10.1007/s40299-014-0219-9

Abstract: "This paper reports on the design, development, and evaluation of an online e-learning tutorial system to instruct pre-service special educators in Malay braille code. The technological pedagogical content knowledge framework (TPACK) was employed to integrate expertise in content, pedagogy, and technology to design and develop this system. A directive, automated e-learning architecture was created from applying the principles of TPACK. Evaluation of the system was carried out using a multi-step evaluation framework. Seventy seven pre-service special educators at a university in northern Malaysia learnt braille through this system and evaluated the system using a survey instrument. The findings showed that the learners were satisfied and confident of using the system, and the system was also well accepted in terms of perceived usefulness and ease of use. In terms of design, features that apply mastery learning, extrinsic motivation, practice-feedback in direct instruction, and clarity of graphical interface were the most highly rated. Content-based features, ease of use and perceived usefulness together, explain 65 % of the variance in learner satisfaction. Content- and pedagogy-based design features together significantly predicted learner confidence. The findings indicated that the system (http://ekodbraille.ses.usm.my) is viable to support independent braille code instruction online. This work also suggested that TPACK can be a powerful framework for e-learning systems development. The design steps described in this paper also serve as a prescriptive template for future designers attempting to use TPACK for design purposes."

Lin, C. Y., Kuo, Y. C. & Ko, Y. Y. (2015). A Study of pre-service teachers' perception of technological pedagogical content knowledge on algebra. *Journal of Computers in Mathematics and Science Teaching, 34*(3), 327-344.

Abstract: “The purpose of this study was to investigate elementary pre-service teachers’ content knowledge in algebra (Linear Equation, Quadratic Equation, Functions, System Equations and Polynomials) as well as their technological pedagogical content knowledge (TPACK) in teaching algebra. Participants were 79 undergraduate pre-service teachers who were enrolled into the university core program and the teacher education program where the former offered a content course and the latter the methods course. A paper-based survey was distributed to the students to collect data. Quantitative analysis was utilized to analyze the collect data. Results indicated that there were no significant differences in content knowledge for algebra between the pre-service teachers from two programs. Pre-service teachers in the teacher education program had better pedagogical knowledge than those in the university core program. The five sub-scales of the algebra content were significantly correlated with each other. Content knowledge and pedagogical knowledge significantly predicted TPACK. Levels of technology skills among the pre-service teachers had a significant impact on their technology knowledge, technological content knowledge and TPACK.”

Liu, Q., Zhang, S., & Wang, Q. (2015). Surveying Chinese in-service K-12 teachers’ technology, pedagogy, and content knowledge. *Journal of Educational Computing Research,* Advance online publication. doi:10.1177/0735633115585929

Abstract: “Technology, pedagogy, and content knowledge (TPACK) has been considered as a promising theoretical framework to guide teacher educators in designing and developing in-service K12 teacher education programs. However, it seems unclear whether in-service teachers have different TPACK perceptions when entering the education programs. This study surveyed the TPACK perceptions of 2,728 Chinese in-service K12 teachers. A questionnaire adapted from Koh, Chai, and Tsai’s survey was validated by reliability and validity tests. Exploratory factor analysis revealed that Chinese in-service K12 teacher’s TPACK perceptions could be grouped into five scales. Analyses of means and standard deviation of all the variables of the TPACK construct to examine Chinese in-service K12 teachers’ TPACK perceptions showed that teachers had rated themselves as slightly above five points for all the variables. Independent sample *t*tests to examine the relationships between in-service K12 teachers’ gender and the TPACK variables indicated that male teachers rated themselves higher than female teachers for the variable content knowledge (CK) and lower for the variable pedagogical content knowledge. *F* tests to examine the relationships between in-service K12 teachers’ years of service and the TPACK variables revealed that young in-service K12 teachers tended to perceive better in the capacities of applying technology and worse in the capacities of teaching method and subject matter. Hierarchical regression analysis to explore which variables (technological knowledge, pedagogical knowledge, CK, pedagogical content knowledge, technological content knowledge, and technological pedagogical knowledge) could predict the variable of TPACK showed that in-service K12 teachers’ perceptions of pedagogical knowledge, technological knowledge, and CK had the largest positive effect on the TPACK variable.”

Messina, L., & Tabone, S. (2015). Technology proficiency, TPACK and beliefs about technology: A survey with primary school student teachers. *Research on Education and Media, 5*(1), 11-30. Retrieved from http://ojs.pensamultimedia.it/index.php/rem_en/article/view/1413

Abstract: “The present research aimed at investigating some features characterising the profile of 79 student teachers at the end of their pre-service training. Technology proficiency, TPACK and beliefs on the value of technology in teaching and learning were explored through a self-administered questionnaire. Data show the following: student teachers’ low proficiency with new or dedicated technology; some difficulties in integrating technology, pedagogy and disciplinary content, joined with the lack of modelling by Faculty; the prevalence of a functionalist/instrumental view of technology, associated with perceived benefits for teachers, and in contrast with a social/potentialistic view of technology. The results highlight the necessity to boost initial teacher training in the direction of specific/dedicated technology integration and to support Faculty in developing the integration of technology in teaching practices.”

Owusu, K.A., Conner, L. & Astall, C. (2015). Assessing New Zealand high school science teachers’ technological pedagogical content knowledge. *Journal of Computers in Mathematics and Science Teaching, 34*(3), 345-373.

Abstract: “Technological pedagogical content knowledge (TPACK) is the knowledge required for effective technology integration in teaching. In this study, New Zealand high school science teachers’ TPACK was assessed through an online survey. The data and its analysis revealed that New Zealand’s high school science teachers in general had a high perception of their understanding of TPACK and its related constructs. Science teachers had high mean scores on all the constructs of technological knowledge. This indicated that science teachers in New Zealand perceived themselves as being able to teach with technology effectively. Correlation analysis revealed that all six constructs correlated significantly with TPCK. Multiple and stepwise regression analyses revealed that TPK and TCK made statistically significant unique contributions to TPCK.”

Quintana, M. G. B., & Zelaya, D. S. (2015). The TPACK model to prepare and evaluate lesson plans: An experience with pre-service teachers using social networks and digital resources. *Journal of Mobile Multimedia, 11*(1&2), 134-146.

Abstract: “It is essential to understand and manage technology for pre-service teachers in order to propose methodological, educational and assessment strategies that allow them to innovate and respond adequately to the demands of the educational system. The objective is to identify the elements that pre-service teachers use in learning situations for the production of digital educational resources created to teach using social networks through the TPACK rubric. This research was developed focused on a quantitative methodology and a descriptive design. The sample was formed by 32 pre-service teachers who attend an Information and Communication Technology Course in 2014, at the Faculty of Education, Universidad Católica de la Santísima Concepción. Main results obtained from the analysis of three educational resources (blog, Prezi and cartoons) indicate that they possess a low level of integration of curricular objectives and technologies; however, results show that students have a high level to select the technological resources in the design of didactic activities. It can be concluded that incorporation of the TPACK model, positively helps pre-service students to know how to integrate the teaching

resources in an innovative way. It enables the achievement of an adequate articulation of technology in teaching and learning."

Rosenberg, J. M., & Koehler, M. J. (2015). Context and technological pedagogical content knowledge: A systematic review. *Journal of Research on Technology in Education.* Advance online publication. doi:10.1080/15391523.2015.1052663

Abstract: "Context is an important aspect of educational research and the technological pedagogical content knowledge (TPACK) framework, but is often missing from TPACK research, or its specific meaning is not clear. To provide a systematic and comprehensive view of the extent to which context is included in such research, and to understand the meaning of context when it is included, we conducted a systematic review of publications about TPACK. Context was included in descriptions, explanations, or operationalizations of TPACK among 36% of the 193 empirical journal articles we examined. When context was included, classroom and school factors and those related to teachers were more likely to be included than those related to students and society. The grounds for context being included among around one-third of the articles and why some contextual factors are examined more than others are discussed. Implications for practice and recommendations for future research focus on investigating the complexity of practice, the development of measures that include context, and aligning TPACK and educational technology research with other disciplines through greater attention to context."

Sancar-Tokmak, H., & Yanpar-Yelken, T. (2015). Effects of creating digital stories on foreign language education pre-service teachers' TPACK self-confidence. *Educational Studies*. Advance online publication. doi:10.1080/03055698.2015.1043978

Abstract: "This study aimed to examine the effects of creating digital stories (DSs) on the self-confidence of foreign language education (FLE) pre-service teachers with regard to technological, pedagogical and content knowledge (TPACK). A one-group pretest/posttest experimental research design was applied, supported by a qualitative approach. A total of 71 FLE pre-service teachers created DSs on a topic from the national foreign language programme. Data were collected through a self-confidence TPACK scale, demographic questionnaire, open-ended question and observations. Results showed positive significant differences between TPACK self-confidence scores before and after DS creation. Specifically, scores on technological pedagogical knowledge and technological knowledge improved significantly. The mean scores of technological content knowledge also improved, but the change was not significant. Moreover, qualitative data showed that FLE pre-service teachers used TPACK-relevant adjectives to describe their DSs as instructive, consistent with aims, appropriate for target students, thought provoking and creative."

Wu, Y.-T., & Wang, A. (2015). Technological, pedagogical, and content knowledge in teaching English as a foreign language: Representation of primary teachers of English in Taiwan. *The Asia-Pacific Education Researcher*. Advance online publication. doi:10.1007/s40299-015-0240-7

Abstract: “The importance of teachers’ technological, pedagogical, and content knowledge (TPACK) in conducting effective technology-enhanced instruction has been recognized; however, the understanding of teachers’ TPACK when teaching English as a Foreign Language (EFL), as well as the need for their further TPACK development, has not been properly addressed. To fill the gap in TPACK research in the EFL domain, this study aims to explore the TPACK among 22 in-service EFL teachers at elementary schools in Taiwan. Also, the possible needs of these EFL teachers for their future professional development were investigated. In order to better portray the TPACK of the EFL teachers, both their synthesized TPACK and performance on the seven TPACK construct components were evaluated in this study. A quantitative questionnaire was used to assess the EFL teachers’ performance on the seven TPACK construct components. Their synthesized TPACK was revealed by means of interviews and classroom observations. The Revised Bloom’s Taxonomy and the pedagogic framework for computer-assisted language learning were used to analyze the qualitative data collected from the interviews and class observations. The results indicated that the EFL teachers needed more technology knowledge to further develop their TPACK, and that the EFL teachers’ TPACK focused much on motivating students, rather than on using technology for creating opportunities for students to use English language meaningfully and authentically.”

Xiong, X., & Lim, C. (2015). Curriculum leadership and the development of ICT in education competencies of pre-service teachers in South China. *The Asia-Pacific Education Researcher*. Advance online publication. doi:10.1007/s40299-015-0238-1

Abstract: “Based on the collective case study of two teacher education programs at a normal university in South China, this paper examines the role of curriculum leadership in the development of information and communication technology (ICT) in education competencies of pre-service teachers. The two cases allow comparisons to uncover the complex interrelationship of components in curriculum leadership system and its role in the ICT in education curriculum structure and content, and ICT in education competencies of pre-service teachers. As the self-assessed pre-service teachers’ technological, pedagogical, and content knowledge (TPACK) perception is more likely to be a good predictor of their ICT in education competencies, a total of 99 pre-service teachers in the two programs were surveyed to examine their self-assessment of the TPACK. The study employed the sequential mixed-method approach. Data from this survey supported by documents and interviews suggest that curriculum leadership has an impact on pre-service teachers’ ICT in education competencies. The curriculum leaders at the university level [e.g., the Vice -President (Academic)] provide support in terms of policy formulation and resource allocation. Subordinate school level curriculum leaders [e.g., the Vice-Dean (Academic)] have a significant impact on the ICT in education curriculum structure, course objectives and academic credit management; whereas curriculum leaders at the classroom level (e.g., course coordinators or lecturers) have a significant impact on course content and pedagogy. The findings also suggest that (1) curriculum leadership shapes and is shaped by the teacher education program; (2) sustained efforts are required to improve coordination and communication between different curriculum leadership levels; and (3) feedback and reflections of pre-service teachers’ ICT learning experiences are important to inform the practices of the curriculum leaders.”

Chapters

Chien, Y.-T., & Chang, C.-Y. (2015). Developing preservice teachers' sensitivity to the interplay between subject matter, pedagogy, and ICTs. In Y.-S. Hsu (Ed.), *Development of science teachers' TPACK* (pp. 91–104). Singapore: Springer.

Abstract: "Mishra and his colleagues' notion of technological pedagogical content knowledge (TPCK, renamed as TPACK in Thompson AD, Mishra P, Breaking news: TPCK becomes TPACK! [Editorial]. J Comput Teach Educ 24(2):38 & 64, 2007–2008) theorizes that the required knowledge for teachers to teach with information and communication technology (ICT) involves comprehensive understanding of the transactional interplay between the subject matter being taught, the pedagogy being used, and the ICT tools being adopted in teaching practice. Aligning with the conceptualization of TPACK, developing preservice teachers' sensitivity to the interplay between subject matter, pedagogy, and ICT is a key objective for teacher preparation programs. Based on the theoretical framework of cognitive apprenticeship, we propose a 4-phase cyclic MAGDAIRE model (abbreviated from modeled analysis, guided development, articulated implementation, and reflected evaluation) to develop preservice teachers' sensitivity to the interplay between subject matter, pedagogy, and ICT. MAGDAIRE is subsequently employed to enhance the science teacher education courses of National Taiwan Normal University. The TPACK conceptual framework is adapted as an analytic tool to examine the growth in preservice science teachers' knowledge about technology integration in teaching. The results of the studies and courses indicate that, within MAGDAIRE, these preservice science teachers' reasoning on the use of ICT transited toward a more connected model in which ICT is jointly considered with subject matter and/or pedagogy. Moreover, these preservice teachers' development of TPACK stimulated them to modify their practice. In this chapter, the details of MAGDAIRE and a synthesis of the studies into MAGDAIRE are reported."

Chui, H. L., Au-Yeung, H. K. C., & Cheng, G. (2015). Reflective practice with digital portfolio for teacher readiness and maturation of prospective teacher within the TPACK framework. In K. C. Li, T.-L. Wong, S. K. S. Cheung, J. Lam, K. K. Ng (Eds.). *Technology in education: Transforming educational practices with technology* (pp. 156-162). Berlin: Springer Berlin Heidelberg.

Abstract: "This study explores the influence of digital portfolio on reflective practice of prospective teachers (PTs) with the Technological Pedagogical Content Knowledge framework (TPACK). A total of 36 PTs studying in a teacher education course (one-year full-time) at a tertiary education institute in Hong Kong took part in the study. Blended learning approach was adopted to facilitate the completion of digital portfolio with various applications of Web services as a pedagogical tool. At the end of the course, the PTs completed the same questionnaire again as a post-test. Results showed that engaging PTs in digital portfolio integrated with different levels of Web services can increase their degree of readiness and maturation in different dimensions under the TPACK framework. The findings shed light on the development of teacher readiness for their entering of teaching profession in terms of

technical, pedagogical and content knowledge individually and holistically, and further cultivated a higher degree of sustainability in reflective practice for the prospective teachers."

Fisser, P., Voogt, J., van Braak, J., & Tondeur, J. (2015). Measuring and assessing TPACK (technological pedagogical content knowledge). In J. Spector (Ed.), *The SAGE encyclopedia of educational technology.* (pp. 490-493). Thousand Oaks, CA: SAGE.

Abstract: "In 2005, the term Technological Pedagogical Content Knowledge (TPCK) was introduced as a conceptual framework to describe the knowledge base for the effective integration of technology in teaching. Matt Koehler and Punya Mishra built their ideas based on Lee Shulman's notion of Pedagogical Content Knowledge (PCK) and indicated that TPCK consists of Technological Knowledge (TK), Pedagogical Knowledge (PK), Content Knowledge (CK) and the overlapping domains Pedagogical Content Knowledge (PCK), Technological Pedagogical Knowledge (TPK), Technological Content Knowledge (TCK), and Technological Pedagogical Content Knowledge (TPCK). In 2007, TPCK was changed to TPACK to better reflect the interdependence of the three contributing knowledge domains, and in 2008 "context" was added to the framework because it was argued that teaching with technology does not take place in isolation but is each time situated in a specific educational context."

Herring, M., & Smaldino, S. (2015). TPACK (technological pedagogical content knowledge): Implications for 21st-century teacher education. In J. Spector (Ed.), *The SAGE encyclopedia of educational technology.* (pp. 786-788). Thousand Oaks, CA: SAGE.

Abstract: "Teacher education programs have to adapt to ensure that teacher candidates are ready to teach in schools that are continually adding new technology. It is not enough for teacher candidates to know how to use technology for their personal use; it is essential that these future educators reexamine classroom practice to integrate technology into teaching. With the introduction of emerging technologies, the context of learning has changed dramatically, changing how best to prepare educators. This adds to the responsibilities of teacher educators to ensure that teacher candidates are prepared to integrate technology effectively into their teaching. Margaret Niess argues that unless teacher preparation courses change dramatically, K–12 students will be robbed of a meaningful and productive education. Teacher education preparation programs have an obligation to meet the expectations associated with integrating new technologies, content, and pedagogy."

Hsu, Y.-S. (2015). The development of teachers' professional learning and knowledge. In Y.-S. Hsu (Ed.), *Development of science teachers' TPACK* (pp. 3–15). Singapore: Springer.

Abstract: "Teacher educators have endeavored to understand what comprises teachers' instructional knowledge because only when we know how that knowledge is developed can we adequately plan and implement teacher education programs that are appropriate for the twenty-first century. Many teacher educators have referred to this complex knowledge construct as pedagogical content knowledge (PCK), following up with different strands of teacher knowledge constructs and teacher education programs. Technological pedagogical

content knowledge (TPACK) is a strand of PCK that focuses more on teachers' knowledge of teaching with technology. This chapter reviews what TPACK inherits from PCK and how its integrative and transformative frameworks are conceptualized. Though TPACK can be viewed as an interdisciplinary knowledge construct that today's teachers are advised to develop, TPACK is also discipline-based in nature and trans-disciplinary in terms of the knowledge and competence students require. The more mature the TPACK the teacher develops, the more appropriate the in-class uses of technology will be."

Hsu, Y.-S., Yeh, Y.-F., & Wu, H.-K. (2015). The TPACK-P framework for science teachers in a practical teaching context. In Y.-S. Hsu (Ed.), *Development of science teachers' TPACK* (pp. 17–32). Singapore: Springer.

Abstract: "TPACK refers to the knowledge construct that teachers rely on to facilitate their instruction with technology. In order to decompose what constitutes this knowledge construct, researchers have proposed and validated frameworks from different perspectives or for different purposes. However, no one has tried to develop a working model of TPACK within an actual teaching context such as science. Therefore, we recruited experts and experienced science teachers to participate in panels and used the Delphi survey technique to collect their ideas and develop consensus for the framework of TPACK-Practical (TPACK-P) that reflects how teachers applied TPACK while teaching science in their classrooms. A total of eight knowledge dimensions were identified as critical contributions to science teachers' TPACK-P; 17 indicators were generated to further define the specifics of these knowledge dimensions. This framework of TPACK-P will give novice science teachers ideas about expert science teachers' technology-infused instructional practices and inform science teacher educators about critical technological aspects that should be facilitated in science teacher education programs."

Koehler, M., & Mishra, P. (2015). TPACK (technological pedagogical content knowledge). In J. Spector (Ed.), *The SAGE encyclopedia of educational technology.* (pp. 783-786). Thousand Oaks, CA: SAGE.

Abstract: "Technological, pedagogical, and content knowledge— TPACK—refers to the framework developed by Punya Mishra and Matthew Koehler to describe the knowledge that teachers need in order to effectively teach with technology. The TPACK framework was developed to respond to two challenges confronting teacher educators. First, there was a systemic push for teachers to integrate technology in ways more consistent with the growth of technology outside of education. Second, there was limited treatment of technology for teachers, beyond generic uses. As Judith B. Harris and her colleagues reported, technology use in classrooms has historically been conceptualized and supported using a predominance of approaches that overemphasize technology and technology skills. These approaches typically include additional technology-focused teacher education courses; professional development workshops; and demonstration resources, lessons, and projects."

Koh, J., Chai, C., Wong, B., & Hong, H.-Y. (2015). Design thinking and 21st century skills. In J. Koh, C. Chai, B. Wong & H.-Y. Hong (Eds.). *Design thinking for education: Conceptions and applications in teaching and learning* (pp. 33–46). Singapore: Springer.

Abstract: "This chapter reviews major 21st century learning frameworks and derives five common dimensions that characterize 21st century learning. These are the social-cultural, cognitive, metacognitive, productivity, and technological dimensions. It then discusses how design experiences can be used to foster these 21st century learning dimensions in students. A design-thinking model is then presented to articulate how students can be guided in their experiences of 21st century learning dimensions. The chapter also considers the kinds of technological pedagogical content knowledge (TPACK) that teachers need to support their design of 21st century learning experiences as well as how TPACK may feature in teachers' design decisions in such contexts."

Lin, T.-C., & Hsu, Y.-S. (2015). The current status of science teachers' TPACK in Taiwan from interview data. In Y.-S. Hsu (Ed.), *Development of science teachers' TPACK* (pp. 33–50). Springer: Singapore.

Abstract: "Teachers' knowledge about technology-infused instruction has recently attracted much research attention. This chapter focuses on science teachers' technological pedagogical and content knowledge (TPACK) in the practical context of teaching, namely, TPACK-Practical (TPACK-P). The proposed framework of TPACK-P includes three major domains—assessments, planning and designing, and teaching practice—that are theoretically transformed from the perspectives of pedagogical content knowledge (PCK). To explore science teachers' TPACK-P, 40 in-service teachers were interviewed, and a coding scheme was developed to analyze the interview responses. The findings indicated that the science teachers generally know how to adopt technologies in teaching within each domain of TPACK-P. A cluster analysis based on the participants' level of TPACK-P categorized their patterns of knowledge. Three groups of science teachers emerged from these analysis categories: infusive application, transition, and plan and design emphasis. The infusive application group represents science teachers with sophisticated levels of TPACK-P across the three domains; the transition group includes science teachers whose knowledge achieved average levels across the three dimensions. However, the plan and design emphasis group refers to the science teachers who were more knowledgeable about planning and designing technology-infused teaching than about the assessment and teaching practice domains. The overall results indicate that the knowledge of planning and designing may be a more independent part in TPACK-P that supports science teachers' implementation of technology-infused teaching. The revealed patterns of this science teachers' TPACK-P may provide the groundwork for developing instruments to evaluate science teachers' competence in teaching with technologies."

Mishra, P., & Henriksen, D. (2015). The end of the beginning: An epilogue. In Y.-S. Hsu (Ed.), *Development of science teachers' TPACK* (pp. 133–142). Singapore: Springer.

Abstract: “This final chapter serves as the epilogue, as both a summary and a synthesis of the chapters in the book. We begin by providing an informal historical overview of the current impact of TPACK as a theoretical framework in terms of the quantifiable reach of the theory as well as the rapidity and breadth of its acceptance. We then provide an overview of each chapter that includes, first, how they are grouped thematically and, then, its core ideas. For Chaps. 2, 3, 4, 5, 6, and 7, we identify and summarize a few key takeaways and points of interest. Following this overview, we identify three crosscutting themes: the importance of the idea of learning by design for the development of TPACK; an emphasis on the evaluation and measurement of TPACK; and, finally, the important role that communities of practice play in TPACK development. We note how learning by design is relevant because several of the studies here involved educators working through the design process (creating software applications, lessons, and other teaching artifacts) to extend it into the arena of TPACK research. Evaluation/measurement is important as well because the work in this book seek to develop rubrics that would allow teacher educators to evaluate different facets of TPACK. Communities of practice were also relevant because, rather than looking at teachers in isolation, the work in this book represents settings that support partnership/teamwork between preservice and in-service teachers (as well as educational researchers, teacher educators, and others). Finally, after considering these points, we offer a note of both positive points and constructive critique regarding this book’s potential contributions to the internationalization of TPACK research.”

Northcote, M. (2015). Missing in action: Looking at the humanisation of online higher education through a TPACK lens. In M. S. Khine (Ed.), *New directions in technological and pedagogical content knowledge research: Multiple perspectives* (pp. 57–82). Charlotte, NC: Information Age.

Abstract: “The TPACK Framework (Mishra & Koehler, 2006) has become a valuable tool for analysing teaching, learning and course design. Teachers use TPACK as a guide to meaningfully integrate ICTs (Information and Communication Technologies) into their work while developing varied types of teacher knowledge. The usefulness of TPACK has extended into online university teaching contexts which have sometimes been regarded as lacking a sense of belonging or as being dehumanised and disinviting. To reverse this trend, Reeves and Herrington (2010) have called for a greater emphasis on student engagement in university courses while Salmon (2013) has appealed for more focus on the actions of online teachers and students.

In response to these calls, this chapter uses the TPACK Framework as a lens through which online course design literature is viewed to extract practical principles for the development of personalised, interactive and humanised online courses. By drawing on research about online presence and emotionality, aspects of online education that have yet to be explored in conjunction with TPACK, the chapter offers educators a set of humanising online course design guidelines to promote engagement and satisfaction while also contributing to our understanding of TPACK.”

Polin, L., & Moe, R. (2015). Locating TPACK in mediated practice. In K. Graziano & S. Bryans-Bongey (Eds.), *Online teaching: Issues, methods, and best practices for K-12 educators.*

Advance online publication. Retrieved from http://profmoe.com/PolinMoe_OnlineTeaching_v1a.pdf

Abstract: "Technological, Pedagogical Content Knowledge (TPACK) is a framework for formal educators, developed to help those understand the interplay of three unique domains of knowledge necessary for teaching: an understanding of contents, pedagogy and technology. TPACK is grounded in the work of Lee Shulman's earlier work combining pedagogy and content knowledge, and both Shulman and the authors of TPACK allude to the importance of contemporary learning theories such as constructivism, constructionism and social learning theory as integral to the TPACK construct as a transformative opportunity to do things as prerequisite for learning to do. Unfortunately, TPACK in practice more often resembles a contents checklist, a 'plug and play' rubric for inserting technology rather than immersing practices in a theory-grounded framework. This chapter presents TPACK from the historical and theoretical perspectives in order to provide a full understanding of the construct as a model for learning by doing. By doing this, we see that the Technology signifier in TPACK is problematic, and propose an alternate signifier as a way of more firmly grounding TPACK in its theory, history and purpose."

So, W.-M., Fok, A.-P., Liu, M.-F., & Ching, F.-Y. (2015). Examining teachers' TPACK in using e-learning resources in primary science lessons. In Y.-S. Hsu (Ed.), *Development of science teachers' TPACK* (pp. 105–130). Singapore: Springer.

Abstract: "The advocates of technology in education have dramatically stirred up the life of teachers, requiring substantial changes to their practices and processes of teaching and learning. Yet, there are tendencies to merely introduce technology to teaching and learning without much understanding of the knowledge required for teachers to use the technology effectively and efficiently. This study refers to the technological pedagogical content knowledge (TPACK) framework to better understand the phenomenon of teachers' integration of content knowledge, pedagogy, and technology in their teaching. In this study, e-learning resources of four science topics in Key Stage 2 of the Hong Kong primary curriculum have been designed and developed based on the resource-based e-learning environments (RBeLEs). A total of 19 teachers from six primary schools were invited to use these e-learning resources in their classrooms. Analysis of the teachers' use of the e-learning resources can help to provide tangible understanding of how technology supports teaching and learning. The data collected included students' pre/post lesson tests, lesson observations of teachers' use of the e-learning resources, and teachers' interview responses that provided useful information to enhance our understanding of how e-learning resources are used in primary classrooms."

Yeh, Y.-F., Chien, S.-P., Wu, H.-K., & Hsu, Y.-S. (2015). Rubrics of TPACK-P for teaching science with ICTs. In Y.-S. Hsu (Ed.), *Development of science teachers' TPACK* (pp. 53–70). Singapore: Springer.

Abstract: "Advances in information communication technologies (ICTs) have diversified teacher instruction. The appropriateness of representation selections and learning activity designs

involving ICTs is determined by teachers' technological pedagogical content knowledge-practical (TPACK-P), a knowledge construct transformed and reinforced through different tasks in teaching. This study developed rubrics for evaluating preservice teachers' TPACK-P, according to the proficiency levels and features identified by in-service teachers. We collected lesson plans and microteaching video clips of seven preservice teachers in order to verify the rubrics and explore how their TPACK-P was demonstrated in lesson plans and microteaching. Results revealed that the preservice teachers' performances on lesson planning and microteaching were similar, with discrepancies of +/− 1 level on the rubrics. Their performances on teaching with ICTs were comparatively better in curriculum design and enactment than on assessment. It may not be difficult for preservice teachers to implement ICTs, but the real challenges are to use ICTs with considerations of students, content, and pedagogy. Teacher education programs are advised to pay attention to how meaningfully ICTs are used to support instruction, rather than simply counting the number of times ICTs are used."

Yeh, Y.-F., Hwang, F.-K., & Hsu, Y.-S. (2015). Applying TPACK-P to a teacher education program. In Y.-S. Hsu (Ed.), *Development of science teachers' TPACK* (pp. 71–88). Singapore: Springer.

Abstract: "We propose a teacher community called the learning module design team (LMDT) in which preservice teachers, in-service teachers, and science education researchers' work together to enhance each other's TPACK-Practical (TPACK-P). Within the teacher community, in-service teachers designed physics learning applications (APPs) and learning modules with their TPACK-P; preservice teachers then tested the APPs and implemented them into their microteaching. Designing these APPs and learning modules allow in-service teachers in the community to refine their TPACK-P, while implementing these artifacts develops preservice teachers' TPACK-P. A professor who was also a physics teacher educator and science education researcher played the role of a facilitator, ensuring within- and between-group communication. Besides elaborating upon each other's TPACK-P, the LMDT developed a total of 12 android APPs on multitouch tablets to help students better understand physics concepts such as spring resonance, slingshot physics, and friction. This chapter presents the design principles, functions, and features of the 12 APPs; it also describes how these teachers collaborated with each other within the community."

Books

Bauer, W. I. (2014). *Music learning today: Digital pedagogy for creating, performing, and responding to music.* New York: Oxford University Press.

Abstract: "Music Learning Today: Digital Pedagogy for Creating, Performing, and Responding to Music presents an approach to conceptualizing and utilizing technology as a tool for music learning. Designed for use by pre- and in-service music teachers, it provides the essential understandings required to become an adaptive expert with music technology, creating and implementing lessons, units, and curriculum that take advantage of technological affordances to assist students in developing their musicianship.

Author William I. Bauer makes connections among music knowledge and skill outcomes, the research on human cognition and music learning, best practices in music pedagogy, and technology. His essential premise is that music educators and students benefit through use of technology as a tool to support learning in the three musical processes - creating, performing, and responding to music. The philosophical and theoretical rationales, along with the practical information discussed in the book, are applicable to all experience levels. However, the technological applications described are focused at a beginning to intermediate level, relevant to both pre-service and in-service music educators and their students. (Utilizes a unifying, research-based, conceptual model - Technological Pedagogical and Content Knowledge (TPACK))"

Hsu, Y-S. (Ed.) (2015). *Development of science teachers' TPACK*. Singapore: Springer.

Abstract: "The Science Education Center at National Taiwan Normal University has been exploring topics of science teaching and learning and designing technology-enabled science instruction for years. With these longitudinally academic research endeavors, the Center received grants from the Aim for the Top University Project that is funded by the Ministry of Science Education in Taiwan for making an overall improvement for science education in terms of science learning, teaching practice, policy, and research. This book tries to report on what the Center and its associates have done in promoting science teachers' instructional knowledge in teaching with technology and how they refi ne their science instruction with technological supports. Important TPACK issues, professional development, and teacher development are discussed, including theoretical and practical concerns, knowledge framework construction and evaluation rubrics, and actual observations on science teachers' TPACK development."

3. Recent TPACK-Related Dissertations and Theses

Chang, Y. H. (2015). *Correlates between elementary and middle school teachers' teaching beliefs and technological pedagogical content knowledge of digital game-based learning* (Master's thesis, National Taiwan University of Science and Technology). Retrieved from http://pc01.lib.ntust.edu.tw/ETD-db/ETD-search/view_etd?URN=etd-0204115-162139

Abstract: "The purpose of this study was to investigate the relationships between teachers¡¦ game-based teaching belief and their game-based pedagogical content knowledge. The participants included 384 elementary and middle school teachers in Taiwan (206 elementary school teachers and 178 middle school teachers). This study used Game-based Teaching Belief Scale (GTBS) (Chang & Tsai, 2014) and Technological Pedagogies Content Knowledge-Game (TPACK-G) (Hsu, Liang, Chai & Tsai, 2013) to evaluate teachers¡¦ belief and knowledge about game-based learning. Exploratory factor analyse, confirmatory factor analyse, structural equation modeling, independent t-tests, one way ANOVA and path analyse were used to analyze the data. The results indicated that game knowledge (GK) and game-based pedagogical knowledge (GPK) were key factors which predicted game-based pedagogical content knowledge (GPCK). GPCK significantly predicted teachers¡¦ game-based teaching attitudes and

motivation moderated by their beliefs of game-based teaching. This suggests that enhancing teachers' GPCK may improve teachers' game-based teaching belief, attitude and motivation. Besides, this study also found some individual differences in background variables: the elementary school teachers had stronger belief and motivation in using digital game-based teaching methods than did the middle school teachers; the male teachers had more game knowledge than the female teachers; the younger teachers and junior teachers had more game knowledge, game content knowledge and game pedagogical content knowledge than elder and senior teachers. Several suggestions for future studies were made in this study."

Goh, L. I. (2015). *Examining teachers' TPACK for designing comprehension assessment: efficacy of a corpus-based Chinese language support tool* (Master's thesis, National Institute of Education, Nanyang Technological University). Retrieved from http://hdl.handle.net/10497/16759

Abstract: "This study attempts to describe the complex design processes that Chinese Language teachers undergo while designing comprehension tests with and without the use of a corpus-based language support tool. Using TPACK as a theoretical framework, two Chinese Language teachers' reasons for making the decisions on choice of vocabulary, changes to original passages given, sentence construction of the questions and answers and formation of distractor options for the multiple-choice response were found to render significant bearings on the validity of the test papers. It was found that among the seven TPACK constructs, PCK and TCK featured most prominently in teachers' consideration. The teachers engaged in complex processes which interweave to influence their decisions on selection of texts, language used in the question texts and the use of distractors, bearing in mind how the content may be represented to test students' higher and lower order thinking skills. Implications for the use of TPACK for analyzing teachers' assessment design decisions as well as suggestions for improving the corpus-based language support tool are discussed."

Hall, A. N. (2015). *Technological, pedagogical and content knowledge (TPACK) for web 2.0 tools* (Doctoral dissertation). Available from ProQuest Dissertations and Theses Global database. (UMI No. 3701013)

Abstract: "The purpose of this study was to measure middle school teacher use of Web 2.0 tools. Factors (both positive and negative) affecting the use of Web 2.0 tools were examined. This study explored the use of Web 2.0 tools by middle school classroom teachers through the lens of Technological, Pedagogical and Content Knowledge (TPACK) Framework. An investigation into the influences that contribute to and restrict the use of Web 2.0 tools for use by middle school was conducted with mixed methods.

An online survey was made available to educators and analyzed using an exploratory factor analysis. Factors that emerged were identified as: Low TPACK for Web 2.0 Tools, High TPACK for Web 2.0 Tools, and Factors Preventing Web 2.0 Implementation.

The lowest-rated Web 2.0 tools for TPACK included: social news networks, events, blogs and wikis. Additionally, other Web 2.0 tools were ranked low for Technological, Pedagogical, and/or Content area use. The highest rated Web 2.0 tools for TPACK included only pictures. Other Web 2.0 tools were ranked high for Technological, Pedagogical, and/or Content area use. Two factors preventing Web 2.0 implementation emerged. Professional development and training, professional development for Web 2.0 tools, and personal interest were the highest ranked factors affecting classroom implementation. Implications with regard to qualitative responses, TPACK, 21st century skills, and Universal Design for Learning are discussed."

Hoffmann, M. (2015). *An exploratory study: Mobile device use for academics* (Doctoral dissertation). Available from ProQuest Dissertations and Theses Global database. (UMI No. 3685662)

Abstract: "As mobile devices become more and more ubiquitous among teens, such devices have also been fighting their way into the educational landscape. In this digital world where people are constantly entertained, educators have found it difficult to capture their students' attention and motivate them to stay engaged in formal class. Rather than focus specifically on types of devices as education has historically done, this study focused on ways in which those tool could be used. Using a TPACK framework (technological, pedagogical, content knowledge) allows educators to pull the attention from specific types of devices and focus on how those devices could be used academically. This exploratory study surveyed how undergraduate students and higher education instructors at two small faith-based universities in Southern California used mobile devices in and outside of the class for academic purposes. The researcher cross-referenced the results from the 2 groups to make correlations. The results of this study showed that nearly all instructor participants had multiple devices and almost half of the student participants had 2 or more devices as well. Those devices are being used in and outside of formal class for academics in very basic and emerging way that are just touching the surface of their capabilities. This study found that students use their devices in class to read, reference, or search materials. Faculty reported using their devices as presentation devices most often. Both groups, students and teachers, reported a few unique mobile devices using special purpose applications. Those special purpose uses are beginning to move in the direction progressive mobile learning and beginning to touch the surface of TPACK integration. This study aimed to integrate the current uses of mobile devices by students and faculty with the TPACK educational framework. It connected current mobile device usage to advanced device usage to integrate TPACK teaching strategies for educators to integrate those devices into their future instruction."

Holland, D. J. (2015). *Principal technology leadership and student achievement* (Doctoral dissertation). Available from ProQuest Dissertations and Theses Global database. (UMI No. 3702194)

Abstract: "The purpose of this study was to determine if principal technology leadership skills are significantly correlated with of student achievement. Surveys were distributed to all principals in five of the seven English school boards in Nova Scotia, Canada who oversee Grade

8 students. This resulted in 35 principals completing the Principal Technology Leadership Assessment (PTLA) assessment and 84 teachers completing the Technological Pedagogical Content Knowledge (TPCK) assessment. Results were then correlated with Grade 8 standardized provincial assessment results and various permutations of the data were explored. The results definitively indicate that there was no statistically significant correlation between principal technology leadership and student achievement. In addition, analyses also definitively revealed no statistically significant correlation between teacher technological pedagogical content knowledge and student achievement. Further analyses revealed differences in responses to each survey according to school board, experience, and gender all of which indicate further research is needed. Results of this study have important implications for the area of technology integration in the current educational landscape."

Keane, K. J. (2015). *Reflecting on technology integration in teacher education programs* (Doctoral dissertation). Available from ProQuest Dissertations and Theses Global database. (UMI No. 3703550)

Abstract: "This instrumental case study, using interviews and document analysis, examined the perceptions and reflections of newly hired teachers about the instruction they received regarding technology integration in their teacher education program and how it applied to their instruction in the classroom once hired. The Technological Pedagogical Content Knowledge (TPACK) framework was used as an analytic lens for this examination. The main research questions guiding this study were: What technology-related components of their teacher education program did newly hired teachers find to be most useful for classroom technology integration? and How does teachers' knowledge of content and pedagogy facilitate their inclusion of technology? and What technology-related components or instruction do newly hired teachers identify as lacking in their teacher education programs? Findings indicated that the teacher education program was able to help teachers learn how to integrate technology into their classrooms. Content knowledge was found to be the central consideration among participants when creating lesson plans, supported by pedagogy and technology. Technology integration was limited by several obstacles, yet the benefits of technology integration were widely documented and identified specifically as an increase in student motivation and engagement, Overall, the key implication that has emerged from this study is that we need to strengthen the use of TPACK as being a foundational framework introduced in the teacher education program and extend its application through the professional development offered to current teachers so that it becomes a widely used model of technology integration."

Lambert, M. P. (2015). *Technology practices and 21st century learning: A high school case study* (Doctoral dissertation). Available from ProQuest Dissertations and Theses Global database. (UMI No. 3704238)

Abstract: "This qualitative case study applies the Technology, Pedagogy, and Content Knowledge (TPACK) framework to understand the integration and perceived impact of technology on teaching and learning. The purpose of this study was to identify practices that promote the use of technology which transform teaching and learning in a 21st century K-12

school. This study also sought to discover the roles school climate and leadership played in the orchestration of existing and prospect technology initiatives at the school. The research questions focused on three key areas: access and types of technology, instructional practices and pedagogy, and school climate and leadership. The researcher studied a public high school in California which demonstrated academic success and a commitment to meaningful technology integration. Data were collected through a staff survey, interviews, observations, and document analysis. Findings from this study indicate transformative teaching practices through the lens of the TPACK theoretical framework include utilizing technology for student collaboration and formative assessments to help teachers more accurately aid students in learning. Learning outcomes were perceived to increase when technology was used for peer-to-peer collaboration, and when used for formative feedback enabling instructors to immediately address gaps in student learning. A systematic and comprehensive approach to utilizing technology was found including support from site and district leadership. Implications from this study include socioeconomic and geographic factors which effect students' 21st Century Skills and their college and career readiness."

McGee, R. (2015). *Technology professional development phenomena in today's* schools (Doctoral dissertation). Available from ProQuest Dissertations and Theses Global database. (UMI No. 3704505)

Abstract: "This interpretive phenomenological case study explores the Technology Director's understanding of technology professional development phenomena in today's public K-12 schools. This research was conducted to provide a greater understanding of technology needs in school systems in southeastern Massachusetts and Rhode Island. Through interviews with current technology directors, significant themes emerged from current practices. These themes were The Call to Educational Technology, The Role of a Technology Director, Technology Proficiency, and Professional Development. These themes were further analyzed resulting in significant findings.

The significant findings that emerged as a result of this case study were categorized into three main categories which were Pedagogical Beliefs of Technology Directors, Technology Proficiency and Technology Director's Understandings of Professional Development. This research can help school districts gain a better understanding of the role of the educational technology leader. This research documents current technology professional development findings in southeastern Massachusetts and Rhode Island. The information in this research gives stakeholders a better understanding of technology professional development and how a TPACK theoretical framework and Adult Learning Theory can generate important technology conversation. These finding can provide a means to share current practices and focus on future implementation of technology professional development."

Millen, R. A. (2015). *Closing the gap between technological and best practice innovations: Teachers' perceived technological pedagogical content knowledge and self-efficacy towards differentiated instruction* (Doctoral dissertation). Available from ProQuest Dissertations and Theses Global database. (UMI No. 3704505)

Abstract: “Shifting from an industrial model of education to a model that best provides students with differentiated instruction (Tomlinson, 2014) requires educational philosophical change (Fullan, 2014) as well as innovation diffusion (Rogers, 2003). The problem is not the amount of research that exists on differentiation, the diffusion of innovations, or the change process. The problem is what new technological pedagogical content knowledge (Koehler & Mishra, 2008) do educators need to make this change process happen? How is this knowledge communicated to finally change the “fundamental processes of schooling” (Elmore, 1996, p. 4)?

This sequential, mixed-methods study addressed the following condensed research questions: What are in-service teachers’ perceived knowledge levels in relation to technological pedagogical content knowledge (TPACK)? What are teachers’ perceived levels of comfort to differentiate instruction (DI)? Is there a significant relationship among perceived levels of comfort to DI and TPACK? What are the relationships between educators’ TPACK and DI self-efficacy and the following demographics: grade level, years of teaching, adopter category, device-student ratio, professional development hours in technology or DI, class size, certification(s), and educational background?

A questionnaire with open-ended questions provided quantitative and qualitative data (*N*=72). On a 5-point (SD – SA) Likert scale, pre-kindergarten to grade 12 teachers self-perceived TPACK ranged from 3.46 to 4.00. The educators’ self-efficacy to DI (5-point; *Not Confident-Very Confident*) was 4.01 and DI with technology (DI-T) was 3.16. Grade 8-12 teachers demonstrated significantly higher TPACK and self-efficacy to DI than pre-kindergarten to grade 4 teachers.

Of the respondents, 22% were categorized as innovators and 32% as early adopters-considered teacher leaders. Both groups demonstrated more confidence with DI-T than later adopter categories. Even with significant correlation between TPACK and DI (r=.47, r^2= .22; p < .001), TPACK and DI modeling ranged from 2.20 (teachers) to 1.75 (teacher leaders) and from 2.32 to 2.03 respectively (1= *25%* or less to 4=*76–100%*).

Qualitative themes confirmed the problem. Even though TPACK and self-efficacy to DI were relatively strong, these innovative practices were being rejected. Thus, recommendations identified specific professional development needs, and for educational systems to create communication channels to more rapidly diffuse innovational pedagogies.”

Mortensen, C. (2015). *Contextual factor profiling: Teacher-created classroom website design influences in Texas high schools* (Doctoral dissertation). Available from ProQuest Dissertations and Theses Global database. (UMI No. 3688500)

Abstract: “With increasing student access to technology and the Internet, Texas school districts have invested in content management systems (CMS), improved technology infrastructure, and professional development with little research available about best practices and current use of class websites. Using the technological pedagogical content knowledge (TPACK) framework, this study investigated how contextual factors predicted the number of website components related to the teacher information, communication, classroom management, and teaching content section of a class website designed by a Texas high school teacher. This quantitative,

predictive correlational research design included data collected from a proportional allocation of 191 Texas high school teacher websites representing 20 geographic areas, 5 content areas, 5 grade levels, Title 1 designation, campus enrollment levels, and self-reported teacher technology readiness. Multiple regressions revealed the campus' Title 1 designation was a significant predictor of the number of teacher information and teaching content components included on the class websites of Texas high school teachers. The study revealed that opportunities to access online resources through class websites were reduced for students in Title 1 designated schools. Several possibilities that positively contribute to social change were discovered. Educational decision makers and administrators may use this information to determine where expenditures should be made to ensure development of class websites that meet students' needs. Estimates show a 2-day professional development to create class websites for Texas secondary teachers would cost $93,237,200. Ensuring funds spent results in sites that provide optimal academic support to students could improve learning and bring significant social change."

Mulkey, K. (2015). *Educators' perceptions of the role of the instructional technology specialist* (Doctoral dissertation). Available from ProQuest Dissertations and Theses Global database. (UMI No. 3702206)

Abstract: "The purpose of this study was to investigate perceptions of educators concerning the role of the instructional technology specialist in PK-12 schools in the state of Georgia. The literature review created the basis for the theoretical framework combining the standards for technology coaches from ISTE (2011), TPACK (Koehler & Mishra, 2009), and references from Frazier and Bailey, (2004). The study utilized a mixed methods approach with the use of a survey with a sample of 351 participants and interviews from 18 educators. The findings revealed a high need for an instructional technology specialist with a desire to increase utilization in the curricular realm. The results included a significant difference in administrators, teachers, and the instructional technology specialists' perceptions for the role's responsibilities. There was also a significant difference between the perceptions of public school and independent school educators. Conclusions resulted in a need to employ a certified instructional technology specialist in every school, publicize the newly created certification for this role in the state of Georgia with the requirement that all schools meet this certification, and the need to separate instructional technology from technical support."

O'Brien, T. (2015). *Assessing the impact of teachers' technology, pedagogy, and content knowledge, and beliefs, in a regional vocational education and training context* (Doctoral dissertation, Murdoch University). Retrieved from http://researchrepository.murdoch.edu.au/27597/1/whole.pdf

Abstract: "This thesis examines the knowledge and beliefs that teachers have about teaching with technology in a regional vocational education and training (VET) institute in Australia. Vocational teachers must demonstrate teaching expertise (pedagogical knowledge) as well as industry expertise (content knowledge) to work with diverse learners in different contexts. Recent surveys have revealed that teachers' use of technology within the VET sector is not

effectively incorporated nor has it been embraced in pedagogically defensible ways. Thus there is a need for teachers to embrace 'technology' knowledge commensurate with industry and workplaces and to integrate it more effectively into their pedagogy. Through the lens of the TPACK (technological pedagogical content knowledge) framework, this study examined teachers' beliefs about the nature of knowledge (epistemology) and beliefs about effective ways of teaching and learning (pedagogy). Using a mixed-methods approach, this research sought to understand how VET teachers' knowledge and beliefs influenced their technology integration practices. The study found that teachers' beliefs had a significant impact upon their use of technology. In particular, their epistemological beliefs were reflected in their perceptions of students and thus shaped their decisions about integrating technology into their teaching. These findings concluded that teacher beliefs about the nature of knowledge and its influence on teaching should be further studied since these core beliefs acted as a springboard from which to understand vocational teachers' technology integration practices. Finally, this thesis illuminated the need for teacher education and professional development programs to focus on developing teachers' knowledge by examining their beliefs across the technological, pedagogical and content domains."

Rae, D., (2015). *2014 STEM professional development summer institute: K12 teacher progression identified in TPACK assessment* (Doctoral dissertation, Boise State University). Retrieved from http://scholarworks.boisestate.edu/td/956

Abstract: "This study examined the relationship between K12 teachers' STEM (science, technology, engineering, and mathematics) instructional technology knowledge before and after a four-day professional development summer institute. In 2014, a total of 533 K12 teachers, across six Idaho regional locations, participated in a professional development institute. Through this research, I hoped to determine if STEM-focused professional development led to shifts in teacher instructional technology knowledge and practice, as defined by the TPACK (Technology Pedagogy and Content Knowledge) assessment. My research provides insight into teachers' perceptions of integrating instructional technology to teaching mathematics and science, which may be useful for informing teacher professional development and the status of teacher instructional technology practices."

4. Recent TPACK Presentations

Brill, A. S., Listman, J.B., & Kapila, V. (2015, June). *Using robotics as the technological foundation for the TPACK framework in K-12 classrooms*. Paper presented at the annual meeting of the American Society of Engineering Education Annual Conference and Exposition, Seattle, WA. Abstract retrieved from http://www.asee.org/public/conferences/56/papers/12024/view

Abstract: "In this paper, we consider the use of the LEGO Mindstorms EV3 robotics kit to allow teachers to create unique and varied representations of disciplinary content in science and math. The use of robotics in the classroom can generate excitement and encourage participation in STEM learning for a wide range of students. Thus, this paper considers a novel

instantiation of TPACK with robotics through three illustrative examples of classroom lessons in physics, biology, and math. Whereas previous TPACK research has focused on teachers' readiness to implement technology, suggested qualitative assessment tools, and potential criteria to assess the implementation, this paper puts these concepts into practice, providing descriptions of three lessons, including the rationale for the use of the TPACK framework in their development, and a comprehensive analysis of the classroom implementation of one lesson. This analysis includes teacher and researcher observations, pre- and post-assessment of learning, and an evaluation of the technology in pedagogy."

Campbell, C., Al Harthi, A., & Karimi, A. (2015, June). Evaluation of the learning designs of cloud-based content using the TPACK framework. Paper presented at the World Conference on Educational Media and Technology, Quebec, Canada. Abstract retrieved from http://www.editlib.org/p/151271/

Abstract: "The paradigm shift in the adoption of cloud-based technology in educational settings in the United States and globally is undeniable. For the first time, an entire nation is connected through a single, cloud-based learning platform under the Malaysian 1BestariNet project. The Malaysian Ministry of Education has connected over 10,000 public schools, 5 million students, 500,000 teachers and 4.5 million parents via high speed 4G Internet connectivity and the cloud based Virtual Learning Environment called FrogVLE. This study focuses on teachers' cloud-based resource development and the developed of a rubric created to use the Technological Pedagogical and Content Knowledge (TPACK) framework to investigate teachers learning designs that are made available on the cloud for their students to access. This rubric has been evaluated for its validity and reliability which is reported in this paper."

Demirbag, M., & Kilinc, A. (2015, April). *Beyond TPCK: Exploring a science teacher's technological pedagogical content belief system.* Paper presented at the annual meeting of the National Association for Research in Science Teaching, Chicago, IL. Abstract retrieved from http://www.researchgate.net/publication/278327845_Beyond_TPCK_Exploring_a_Science_Teachers_Technological_Pedagogical_Content_Belief_System

Abstract: "In last two decades, the governments including Turkey have invested in technology integration projects in educational context (OECD, 2009) in order to reach the citizens who are equipped with technology skills and who can cope with the problems of 21th century. In parallel with these investments, the standards and accountability for the technology integration, particularly in the case of teachers, have been developed and updated. One of the standards suggested by ISTE (The International Society for Technology in Education, 2014), for example, is to facilitate and inspire student learning and creativity by encouraging teachers to use their knowledge of subject matter, teaching and learning and technology. Despite huge investments in (preservice and inservice) teacher education, this standard produces a challenge for current teachers – to integrate subject matter, pedagogy and technology (Keengwe, Onchwari & Wachira, 2008). In other words, a science teacher who wants to teach photosynthesis need not only to know the conceptual (e.g., what is

photosynthesis?) and procedural (e.g., how do plants produce glucoses?) knowledge components about the subject matter, but also to know the learning difficulties of students (e.g., confusion between respiration and photosynthesis), suitable teaching methods (e.g., inquiry based laboratory environments) and the technologies (e.g., simulations showing photosynthesis reactions) that can effectively be integrated into subject-matter education. How can teachers succeed such integration? By enhancing their knowledge of new technologies (e.g., Web 2 tools)? By joining pedagogical workshops emphasizing recent learning environments (e.g., discourse/argumentation)? or By learning about recent developments about the subject-matter (e.g., the communication among the plants). The scholars such as Mishra and Koehler (2006) consider that the answer should include all of them and much more. In their Technological Pedagogical Content Knowledge framework, inspired by Shulman's Pedagogical Content Knowledge (PCK) approach, they argue that teachers should possess three areas of knowledge –content, pedagogy and technology- and blend them with unique combinations to effectively teach the subject-matters in technologically enriched classrooms. They also consider that teachers should develop pairs of these knowledge areas –technological pedagogical knowledge, technological content knowledge and pedagogical content knowledge. Today, a number of researchers base their research on Mishra and Koehler's framework to investigate and analyze their data about preservice and inservice teachers' technology integration in different subject-matter fields. The curriculum and policy makers also benefit from this framework in designing courses, textbooks and workshops."

Glowatz, M., & Keane, O. (2015, March). *Academic engagement using social media: Revisiting the technological, pedagogical and content knowledge framework in higher education today*. Paper presented at the Higher Education in Transformation Conference, Dublin, Ireland. Abstract retrieved from http://arrow.dit.ie/cgi/viewcontent.cgi?article=1003&context=st6

Abstract: "Research into the use of social media for academic purposes is increasingly emerging. Such research suggests that a social networking site (SNS) could be used as an innovative tool for teaching purposes. However, much of previous research has focused on outlining the experience of students and the empirical evidence to date reports how a SNS may develop a higher level of academic engagement amongst students. In addition, research in this field has overlooked review of the pedagogy involved in utilising a SNS for education purposes successfully. Previously, Koehler and Mishra (2009) proposed the TPACK framework to explore the relationship of technology in teaching which builds the basis for this research. This paper explores the suitability of the TPACK framework in the context of utilising SNSs and reviews its relevance to the adoption of a SNS as a teaching tool. Initial observations suggest that the current TPACK framework overlooks some important elements which are relevant to the adoption of SNS."

Jordan, K., Dinh, H., & Elsden-Clifton, J. (2015, June). *Measuring TPACK in Vietnam: Issues still remain.* Paper presented at the World Conference on Educational Media and Technology, Quebec, Canada. Abstract retrieved from http://www.editlib.org/p/151493/

Abstract: “In recent times, there has been a lot of research interest in the TPACK framework particularly in the United States and Australia, which seeks to explain the knowledge that teachers need to integrate ICT into practice (Abbitt 2011). Measuring teacher TPACK knowledge has become one of the main areas of interest, however a number of theoretical issues around defining the constructs and how these constructs relate to one another have compounded research. This study seeks to contribute to this research by focusing on English as a Foreign Language (EFL) teachers’ self-assessment of their TPACK at Hanoi University Vietnam. It also suggests that there are issues in measurement and that reconceptualization of the framework maybe needed.”

Ouyang, F. (2015, June). *Exploring an experienced online instructor’s applications of TPACK in a graduate-level online course through the online students’ perspectives: Design of a qualitative case study.* Paper presented at the World Conference on Educational Media and Technology, Quebec, Canada. Abstract retrieved from http://www.editlib.org/p/151296/

Abstract: “This paper reported the design of a case study using qualitative methods - participant observation and online focus group interview to examine an experienced online instructor’s applications of Technological Pedagogical Content Knowledge (TPACK) in a graduate-level online course. Firstly, this paper described the evolvement of TPACK in which this study was grounded, and presented a review of relevant literature focused on addressing practical issues of TPACK measurement and teachers’ professional development. In addition, this paper proposed an initial design of a qualitative case study to examine an experienced online instructor’s applications of TPACK in an online course. The research design included research questions, rationale for the choice of the setting and participants, research procedure design, data collection design, analysis strategies, and validity and reliability. Finally, the article concluded with limitations, future research, and implications of this case study.”

Powell, A. B., & Alqahtani, M. M. (2015, May). *Tasks and activities to enhance technological pedagogical content knowledge of mathematical teachers.* Paper presented at the 14th Inter-American Conference of Mathematics Education, Chiapas, Mexico. Abstract retrieved from http://xiv.ciaem-iacme.org/index.php/xiv_ciaem/xiv_ciaem/paper/viewFile/1471/692

Abstract: “From a sociocultural perspective, we examine activities generated by genres of tasks to understand how the tasks shape teachers’ knowledge of technology and mathematical content for teaching. The tasks and activities come from a professional development project that engages the cyberlearning system, Virtual Math Teams with GeoGebra. Working in teams, teachers enhance their understanding of dynamic geometry and how to engage in productive mathematical discussion. We theorize and discuss principles of our task design. We explore a task and the collaborative work of a team of teachers to illustrate relationships between the task design, productive mathematical discourse, and the development of new mathematics knowledge for the teachers. Implications of this work suggest further investigations into interactions between characteristics of task design and learners mathematical activity.”

Samarji, A. (2015). Technological, pedagogical and content knowledge (TPACK): Unpacking the TPACK features. *QScience Proceedings, 4.* Paper presented at the Conference on Education 2015, Doha, Qatar. doi:10.5339/qproc.2015.coe.4

Abstract: "The Technological, Pedagogical and Content Knowledge (TPACK) model is an emerging one which adds technology as a lens and context to the Pedagogical and Content Knowledge (PCK) model. Technology is no longer an ad hoc visitor, where teachers are at liberty of inviting or excluding. Hence, the TPACK model has emerged in response to the fact that teaching and learning should be viewed, conceptualised, and re-contexualised from a "21st century digital lens." This presentation showcases a mathematics education "TPACKed course" which was delivered to education students at Victoria University, Melbourne. The course embedded ICT enriched and carefully planned activities, exemplars, and e-practices. Towards the end of the course, the students were surveyed about their TPACK experiences. The presentation will share the promising and encouraging results associated with students' attitude towards the implemented TPACK approach. Reported concerns and challenges will also be shared. This presentation will argue that whilst the integration of technology across teaching and learning is essential, technology itself should neither become the focus of education nor a superficial mean to merely promote the "know how" capabilities. Technology should be a strategic and tactical investment into education to actively engage students, promote students' understanding, connect to students' experiences, and promote their "know why" conceptual understanding."

5. Call for TPACK-related Award Nominations

AACTE (American Association for Colleges of Teacher Education)'s
2016 Best Practice Award for the Innovative Use of Technology

"This award, overseen by AACTE's Committee on Innovation and Technology, recognizes an innovative use of educational technologies in a school, college, or department of education (SCDE). In addition to recognizing the award winner at the 2016 Annual Meeting, AACTE will showcase award finalists in the Ed Prep Matters blog.

SCDE initiatives that infuse technology throughout the curriculum may or may not be technologically sophisticated. To be considered innovative, the SCDE must use technologies to stretch beyond what might normally be done in its teacher education programs; the programs must have changed in some way as a result of the technology use and integration.

A narrative, not to exceed 2,000 words, that addresses the program's context (e.g., urban/rural, elementary/secondary, etc.), objectives, components, duration, sustainability, outcomes, and how technologies, content goals, and pedagogies are integrated as per the TPACK framework."

Entry Deadline: October 9, 2015

More information and application materials are available at:
https://secure.aacte.org/apps/rl/res_get.php?fid=2004&ref=res

6. TPACK Newsletter Suggested Citation

Our thanks to Lisa Winebrenner, who wrote to suggest that *we* suggest a citation format for you 'academic types' who might want to cite something that appears in this humble virtual publication. Our reading of the most recent (6th edition) of the *Publication Manual of the American Psychological Association* suggests that the citation should look like this:

Harris, J., & Rodriguez, K. (Eds.). (2015, August 13). TPACK newsletter issue #24: August 2015 [Electronic mailing list message]. Retrieved from http://www.matt-koehler.com/tpack/tpack-newsletters/

7. Learning and Doing More with TPACK

Interested in learning more about TPACK or getting more involved in the TPACK community? Here are a few ideas:

- Visit the TPACK wiki at: http://tpack.org/
- Join the TPACK SIG at: http://site.aace.org/sigs/tpack-sig.htm
- Subscribe to the tpack.research, tpack.teaching, tpack.grants and/or tpack.future discussion lists at: http://site.aace.org/sigs/tpack-sig.htm
- Access the TPACK Learning Activity Types taxonomies at: http://activitytypes.wm.edu/
- Access three tested TPACK assessment instruments at http://activitytypes.wm.edu/Assessments

Please feel free to forward this newsletter to anyone who might be interested in its contents. Even better, have them subscribe to the TPACK newsletter by sending a blank email to sympa@lists.wm.edu, with the following text in the subject line: subscribe tpack.newsFirstNameLastName (of course, substituting their own first and last names for 'FirstName' and 'LastName' — unless their name happens to be FirstNameLastName, in which case they can just leave it as is).

If you have a news item that you would like to contribute to the newsletter, send it along to: tpack.news.editors@wm.edu.

Standard End-Matter

If you have questions, suggestions, or comments about the newsletter, please send those to tpack.news.editors@wm.edu. If you are subscribed to the tpack.news email list, and — even after reviewing this impressive publication — you prefer not to continue to receive the fruits of our labors, please send a blank email message to sympa@lists.wm.edu, with the following text in the subject line: unsubscribe tpack.news

- Judi & Kim

…for the SITE TPACK SIG leadership:

Petra Fisser,	Chair, SLO Expertise Center, National Curriculum Development
Josh Rosenberg,	Associate Chair, Michigan State University
Candace Figg,	Rocking Chair, Brock University
Mark Hofer,	Sedan Chair, College of William & Mary
Judi Harris,	Wing Chair, College of William & Mary
Mario Kelly,	Futon, City University of New York
Matt Koehler,	Chaise Lounge, Michigan State University
Punya Mishra,	Recliner, Michigan State University