TPACK Newsletter, Issue #26: February 2016

Welcome to the twenty-sixth 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

"Information is not knowledge."
- Albert Einstein

In This Issue

1. TPACK Newsletter Update

The TPACK Newsletter has been published via the tpack.news email list since January 2009. It has 1184 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: 33 articles, 40 chapters, 2 books, and 8 dissertations 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

Agyei, D. D., & Voogt, J. M. (2015). Pre-service teachers' TPACK competencies for spreadsheet integration: Insights from a mathematics-specific instructional technology course. *Technology, Pedagogy, and Education, 24*(5), 605-625. doi:10.1080/1475939X.2015.1096822

Abstract: "This article explored the impact of strategies applied in a mathematics instructional technology course for developing technology integration competencies, in particular in the use of spreadsheets, in pre-service teachers. In this respect, 104 pre-service mathematics teachers from a teacher training programme in Ghana enrolled in the mathematics instructional technology course for one semester. Strategies applied in designing the course were: aligning theory and practice, collaborative design, learning technology by design, modelling how to use technology and scaffolding authentic technology experiences. The pre-service teachers' technology integration competencies were assessed through analysis of lesson plans and lesson observations, their self-reported technological pedagogical content knowledge and attitudes towards technology. Findings show that pre-service teachers' technology integration competencies improved after participation in the course. All strategies were considered important, but in particular, scaffolding authentic technology experiences including feedback from teaching try-outs made significant contributions to the pre-service teachers' developed technology integration competencies. The study provides guidelines that can serve as a benchmark for implementing strategies in the design of a subject-specific teacher education programme in preparing pre-service teachers to integrate technology in teaching."

Bakir, N. (2016). Technology and teacher education: A brief glimpse of the research and practice that have shaped the field. *TechTrends, (60)*1, 21-29. doi:10.1007/s11528-015-0013-4

Abstract: "Technology integration, an integral component of teaching and learning, has been widely investigated during the past several decades as teacher education programs have struggled to implement and model best teaching technology integration practices in the preparation of pre-service teachers. Initiatives led by educational organizations at the federal, state, and local levels have recognized these challenges and have, in response, allocated time, money, and effort to develop and incorporate methods to better prepare pre-service teachers to teach with technology. This report provides a brief glimpse at a number of these initiatives and reforms developed by the government, national professional organizations, accreditation agencies, and business collaborations that affect and strengthen the adoption of technology in teacher education programs."

Beriswell, J. E., Bracey, P. S., Sherman-Morris, K., Huang, K., & Lee, S. J. (2016). Professional development for promoting 21st century skills and Common Core state standards in foreign language and social studies classrooms. *TechTrends, (60)*1, 77-84.doi:10.1007/s11528-015-0004-5

Abstract: "To help satisfy the pressing need for technology-related professional development for in-service teachers, the Global Academic Essentials Teacher Institute (GAETI) was implemented to provide in-service foreign language and social studies teachers with content, pedagogy, and technology explorations centered on the teaching of the Common Core State Standards and 21st Century Skills. Sixteen teachers attended the institute, which consisted of 20 days during the summer plus one follow-up day in September and one in March. The strongest aspects of GAETI were the demonstration activities that integrated subject-area content, successful pedagogies, and ways to effectively integrate the latest and most effective classroom technologies. Participants not only reflected positively on their experiences with GAETI but also showed a significant level of improvement in all dimensions of technological pedagogical and content knowledge (TPACK). Improvement from pre to post-test was most pronounced in the four dimensions of TPACK most closely associated with technology."

Cabus, S. J., Haelermans, C., & Franken, S. (2015). SMART in mathematics? Exploring the effects of in-class-level differentiation using SMARTBoard on math proficiency. *British Journal of Educational Technology*. Advance online publication. doi:10.1111/bjet.12350

Abstract: "This paper explored the effects of in-class-level differentiation by making innovative use of an interactive whiteboard (SMARTboard) on math proficiency. Therefore, this paper evaluates the use of SMARTboard in class, in combination with teacher training, using a randomized field experiment among 199 pre-vocational students in seventh grade in the Netherlands. During 6 weeks, students in the intervention group participated in math classes in which the SMARTboard was used to apply level differentiation. The teachers of these classes received a specific training (Technological Pedagogical and Content Knowledge [TPACK]) in using the SMARTboard in class. Control classes were taught by teachers without the training, who did not use the SMARTboard in class. The results showed that level differentiation in class, which was possible because of the efficient use of the SMARTboard, significantly increased math proficiency with 0.25 points."

Catma, Z., & Corlu, M. S. (2016). How special are teachers of specialized schools? Assessing self-confidence levels in the technology domain. *Eurasia Journal of Mathematics, Science & Technology Education, 12*(3), 583-592. Retrieved from www.ejmste.com/Makale.aspx?kimlik=2462

Abstract: "This study investigates whether specialized high school mathematics teachers, chosen to educate selected students, are mentally ready to integrate Fatih project technologies into their teaching. Forty mathematics teachers from randomly selected specialized and general high schools in Ankara responded to a survey comprising 31 items grouped under four measures of self-confidence in the technology domain. An independent t-test revealed no statistically significant difference between specialized and general high school teachers' self-confidence levels. We conclude that technological pedagogical content knowledge should be an essential criterion for selecting specialized school teachers, who educate the country's future innovators."

Chai, C. S., Sang, G.-Y., Koh, J. H. L., & Tsai, C.-C. (2014). Exploring the profiles and interplays of pre-service and in-service teachers' technological pedagogical content knowledge (TPACK) in China. *Journal of Educational Technology & Society, 18*(1), 158-169. Retrieved from http://www.ifets.info/journals/18_1/14.pdf

Abstract: "This research surveyed three hundred and ninety pre-service and three hundred and ninety four in-service teachers with regards to the seven factors of technological pedagogical content knowledge, their beliefs about constructivist oriented teaching (CB) and design disposition (DD). Both exploratory and confirmatory factor analyses showed that the survey based on the nine-factor model had high reliability and validity. Significant differences between pre-service and in-service teachers in the TPACK factors and CB and DD were found and the differences reveal that the pre-service teachers are less knowledgeable and confident with regards to all the factors. In order to identify predictors of TPACK, the research further explores the relationships among TPACK factors, CB and DD through structural equation models. The findings reveal that DD consistently predicts both pre-service and in-service teachers' TPACK and this provides support about the importance of design disposition for TPACK advancement. However, CB does not predict the pre-service teachers' TPACK. In addition, CB is a significantly negative predictor for the in-service teachers' TPACK. The findings may imply that while the inservice teachers believe strongly in constructivist oriented teaching, they need further professional development in designing instruction to actualize their desired form of education."

Chang, Y., Jang, S., & Chen, Y. (2015). Assessing university students' perceptions of their physics instructors' TPACK development in two contexts. *British Journal of Educational Technology, 46*(6), 1236-1249. doi:10.1111/bjet.12192

Abstract: "Technological Pedagogical and Content Knowledge (TPACK) has been gaining traction among educational researchers; however, studies documenting university students' perceptions of their teachers' TPACK remain limited. This study intends to investigate the professional development of two physics instructors through the lens of the TPACK framework. Moreover, this study spans an 18-week semester within both the contexts of Taiwan and China. Multiple data were collected and analyzed, including the pretest and posttest TPACK surveys, instructor interviews, in-class observations and students' feedback and opinions. The results revealed that John's instructional representations and strategies and technology integration and application scores increased significantly, as well as Mike's knowledge of students' understanding score showing a significant increase from the middle to the end of semester. John (Taiwan) emphasized life examples and the use of multimedia while Mike (China) chose to emphasize students' knowledge and evaluation. Such results showed different teaching characteristics in the two contexts. Implications and suggestions are put forward based on the results of this study."

Chien, C.-W. (2015). Analysis of Taiwanese undergraduates' learning and development of TPCK in English instruction. *International Journal of Teaching and Case Studies, 6*(3), 212-230. doi:10.1504/IJTCS.2015.072629

Abstract: “This study analyses 30 Taiwanese undergraduates' construction and development of technological pedagogical content knowledge (TPCK) in English instruction in a language teacher education program in a northwestern university in Taiwan. Data included class projects, surveys, and interviews. This study has these findings. First, the participants became aware of different types of multimedia tools through the instructor's demonstration and modelling and their own hands-on experiences and manipulation. Their TPCK was developed and constructed through the evaluation of multimedia tools, lesson plans and activity designs, group and class discussions, and personal reflections. Suggestions regarding course design on developing undergraduates' TPCK are provided.”

Gomez, M. (2015). When circles collide: Unpacking TPACK instruction in an eighth-grade social studies classroom. *Computers in the Schools: Interdisciplinary Journal of Practice, Theory and Applied Research, 32*(3), 278-299. doi:10.1080/07380569.2015.1092473

Abstract: “The technological pedagogical content knowledge (TPACK) conceptual framework, since its introduction in 2006, has provided researchers and teacher educators a theoretical means by which to understand the knowledge required to teach effectively with technology. However, a clear picture of what TPACK looks like in practice is still in its infancy. Using a case-study approach, this research examines the teaching practices of an eighth-grade social studies teacher, specifically how the teacher operationalizes TPACK within his classroom. Four examples of TPACK practices are given along with the teacher's rationale for his technology use. Two themes emerged: the transformation of technology into something that just happens in the classroom and the teacher's use of technology to shape instruction. Implications from this case study are then discussed, including the process and timing of combining the different knowledge components of TPACK and the need to better capture the role of students in the TPACK model.”

Gungoren, O. C., & Horzum, M. B. (2015). Modeling pre-service teachers’ perception of future internet usage for professional educational purposes. *Croation Journal of Education, 17*(3), 815-834. doi:10.15516/cje.v17i3.1132

Abstract: “This study sought to consider whether there are correlations between pre-service teachers’ attitudes towards the Internet, web pedagogical content knowledge, and the perception of future Internet usage for professional educational purposes. Using the stratified sampling method, 503 university students were selected to participate in the study. For the statistical analyses, structural equation modeling was utilized. Research results indicated that pre-service teachers’ attitudes towards the Internet were a positive predictor of their web pedagogical content knowledge. Also, the perception of future Internet use for professional educational purposes was explained by web pedagogical content knowledge and the attitudes towards the Internet. In conclusion, pre-service teachers’ attitudes towards the Internet use were found to positively affect the transfer of their web pedagogical content knowledge into the classes. In addition, results indicated that pre-service teachers’ web pedagogical content knowledge positively affects their Internet use for professional purposes.”

Hansen, A., Mavrikis, M., & Geraniou, E. (2016). Supporting teachers' technological pedagogical content knowledge of fractions through co-designing a virtual manipulative. *Journal of Mathematics Teacher Education.* Advance online publication. doi:10.1007/s10857-016-9344-0.

Abstract: "This study explores the impact that co-designing a virtual manipulative, Fractions Lab, had on teachers' professional development. Tapping into an existing community of practice of mathematics specialist teachers, the study identifies how a cooperative enquiry approach utilising workshops and school-based visits challenged 23 competent primary school teachers' technological, pedagogical and content knowledge of fraction equivalence, addition and subtraction. Verbal and written data from the workshops alongside observations and interviews from the school visits were analysed using the technological, pedagogical and content knowledge (TPACK) framework. The findings show that the assumptions of even experienced teachers were challenged when Fractions Lab was shared as an artefact on which they were asked to co-design and subsequently interact with, using it in subsequent phases of the cooperative inquiry process. Two original aspects of successful co-design of virtual manipulatives through communities of practice are identified and offered to others: (1) careful bootstrapping of the first design iteration that gathers intelligence about the content area and the technological affordances and constraints available; and (2) involvement of highly motivated teachers who perceive themselves as agents of change in the domain area."

Hilton, J. T. (2016). A case study of the application of SAMR and TPACK for reflection on - technology integration into two social studies classrooms. *The Social Studies, (107)*2, 68-73. doi: 10.1080/00377996.2015.1124376

Abstract: "As emerging technology continues to enter the social studies classroom, teachers need to approach integration of such technology in a systematic manner to ensure that such technology enhances the learning of their students. Currently, scholars of technology integration advocate for the use of one of two different models, either SAMR or TPACK. This article makes use of a case study process to document a yearlong integration of iPad carts into two neighboring social studies classrooms, as examined through both the SAMR and TPACK lenses. The results provide insights for future social studies teachers and departments wishing to effectively integrate technology into their classrooms."

Holland, D. D., & Piper, R. T. (2015). Testing a technology integration education model for millennial preservice teachers: Exploring the moderating relationships of goals, feedback, task value, and self-regulation among motivation and technological, pedagogical, and content knowledge competencies. *Journal of Educational Computing Research.* Advance online publication. doi:10.1177/0735633115615129

Abstract: "The technology integration education model is a 12-construct model that includes 8 primary constructs and 4 moderator constructs. By testing the relationships among two primary constructs (motivation and technological, pedagogical, and content knowledge competencies), and four moderator constructs (goals, feedback, task value, and self-regulation), this study

advances technological, pedagogical, and content knowledge research. This study investigated three research questions and found that goals, feedback, task value, and self-regulation moderated the predictive form relationships among intrinsic motivation and technological knowledge, pedagogical knowledge, and content knowledge. However, only goals moderated the explanation form relationship between intrinsic motivation and technological knowledge. This study provided data-driven insights for educators of preservice teachers as they continue to become evidence-based managers and data-driven decision makers. Educators may be misallocating resources if they only focus on self-determination motivation theory and applications and never consider whether goals, feedback, task value, and self-regulation interact with motivation. The researchers created a new instrument consisting of a 16-item measure of the goals construct and a 6-item measure of the feedback construct. For this exploratory study, the sample consisted of 90 elementary education majors and 51 secondary education majors."

Hutchison, A., & Colwell, J. (2015). Preservice teachers' use of the technology integration planning cycle to integrate iPads into literacy instruction. *Journal of Research on Technology in Education.* Advance online publication. doi:10.1080/15391523.2015.1103146

Abstract: "The purpose of this case study was to examine preservice teachers' use of the Technology Integration Planning Cycle (TIPC; Hutchison & Woodward, 2014) to integrate iPads into literacy instruction. Analysis revealed two findings related to using the TIPC to plan instruction: (a) Though the TIPC provides a structured approach to planning that guides teachers in using their Technological, Pedagogical, and Content Knowledge (TPACK), the preservice teachers still used a technocentric approach to planning instruction and did not fully engage in all elements of the planning cycle; (2) even with the structured planning approach, preservice teachers had difficulty aligning their lesson content with the instructional goals of the lesson; and (3) preservice teachers rely on recommendations from their university classes when selecting apps to use in instruction, rather than independently seeking out resources. The implications of this research suggest the need to support preservice teachers in developing a professional learning network; the importance of a structured approach to planning technology integration to support preservice teachers; and considerations for helping preservice teachers develop their TPACK."

Jaikaran-Doe, S., & Doe, P. E. (2016). Assessing technological pedagogical content knowledge of engineering academics in an Australian regional university. *Australasian Journal of Engineering Education*. Advance online publication. doi: 10.1080/22054952.2015.1133515

Abstract: "The technological pedagogical content knowledge (TPACK) framework is a useful tool to underpin twenty-first-century teaching and learning with digital technology. In an attempt to understand how engineering academics integrate technology in their pedagogical practices, 15 lecturers from the engineering department of an Australian university participated in a Teaching Teachers for the Future TPACK survey in 2013. Comparison of the findings with

results of a previous study including pre-service teachers from another regional Higher Education Institute revealed that the engineering academics' TPACK level was significantly lower."

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, 24*(6), 910-920. 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."

Jen, T.-H., Yeh, Y.-F., Hsu, Y.-S., Wu, H.-K., & Chen, K.-M. (2016). Science teachers' TPACK-Practical: Standard-setting using an evidence-based approach. *Computers & Education*, *95*, 45–62. doi:10.1016/j.compedu.2015.12.009

Abstract: "Technological pedagogical content knowledge-practical (TPACK-P) refers to the knowledge construct that teachers in the digital era develop for and from their teaching practices with technology. This study explored a standard-setting method using item response theory to cross-validate ranks of proficiency levels and examine in-service and pre-service science teachers' knowledge about and application of TPACK-P in Taiwan. A sample of 99 participants (52 pre-service and 47 in-service science teachers) completed a 17-item TPACK-P questionnaire that described their typical responses, opinions, or actions in different instructional scenarios. Initial analysis of these responses revealed a correlation (r = 0.87) between the ranks of proficiency levels and those previously identified that validated the hierarchical structure of the four proficiency levels (1-lack of use, 2-simple adoption, 3-infusive application, and 4-reflective application). The second analysis located the thresholds of the four proficiency levels in the two dimensions of knowledge about and application of TPACK-P. It was found that there were no significant differences between in-service and pre-service teachers' TPACK-P and that most of the participants displayed knowledge about TPACK-P at Levels 2 and 3, but their application was at Level 1. The validated four proficiency levels coupled with typical performances can be viewed as a roadmap of science teachers' TPACK-P development. The gap between the knowledge about and application of TPACK-P suggests that further practical

experiences in supportive environments are needed in science teacher education programs. Only when teachers gain and learn from practical usage of technology to support science education can their TPACK-P be further developed and strengthened."

Joo, Y. J., Lim, K. Y., & Kim, N. H. (2015). The effects of secondary teachers' technostress on the intention to use technology in South Korea. *Computers & Education*. Advance online publication. doi:10.1016/j.compedu.2015.12.004

Abstract: "This study aims to investigate the structural relationships between secondary school teachers' TPACK, perception of school support for technology use, technostress, and intention to use technology in Korea, where a SMART education initiative has been announced recently for K-12 education. The study employed structural equation modeling in order to examine the causal relationships among the variables, and data from 312 secondary school teachers were analyzed. The results indicated that TPACK and school support had significant effects on technostress. In addition, technostress significantly influenced teachers' intentions to use technology. Lastly, technostress significantly mediated TPACK, school support and the intention to use technology. Discussion and implications for further studies are presented in the paper."

Keser, H., Yilmaz, F. G. K., & Yilmaz, R. (2015). TPACK competencies and technology integration self-efficacy perceptions of pre-service teachers. *Elementary Education Online, 14*(4), 1193-1207. doi:10.17051/io.2015.65067

Abstract: "This study compared the technological pedagogical content knowledge (TPACK) competency of pre-service teachers with their self-efficacy perception towards technology integration, based on various variables; and the correlation between their TPACK competencies and self-efficacy perceptions towards technology integration were examined. The study sample comprised 713 freshmen and senior class students studying at different departments at Ankara University Faculty of Educational Sciences on 2012-2013 academic year spring semester. The data collection tools used in the study were Personal Information Form, Technopedagogical Education Competency Scale and Technology Integration Self Efficacy Scale. At the end of the study, TPACK competencies of pre-service teachers' studying at first and fourth years and their self-efficacy perceptions towards technology integration were revealed; and these competencies were examined by gender, grade and department variables. In addition, the correlation between pre-service teachers' TPACK competency levels and self-efficacy perceptions towards technology integration were predicted."

Kontkanen, S., Dillon, P., Kukkonen, J, & Valtonen, T. (2015). A Second Life experiment in sex education with pre-service teachers and its contribution to the development of their proto-TPACK. *Journal of Educational Inquiry, 14*(3), 17-36. Retrieved from http://www.ojs.unisa.edu.au/index.php/EDEQ/article/viewFile/1036/799

Abstract: "This paper reports research in Finland into how pre-service teachers' experiences of using Second Life in a course about sex education, and how projections about the use of virtual environments like Second Life in their future teaching at primary level, contributed to the

development of their proto-TPACK (Technological Pedagogical and Content Knowledge). Data collected consist of empathy-based stories and reflective discussions. Results suggest that despite challenges with the technology, the pre-service teachers offered insightful reflections on their use of Second Life in learning from the perspective of the different components of the TPACK frame, especially technological knowledge and technological pedagogical knowledge. However, the experience of using Second Life did little to extend their content knowledge (of sex education)."

Maderick, J. A., Zhang, S., Hartley, K., & Marchand, G. (2015). Preservice teachers and self-assessing digital competence. *Journal of Educational Computing Research*. Advance online publication. doi:10.1177/0735633115620432

Abstract: "This study compares matched surveys of subjective self-assessment and objective assessment on seven domains of digital competence for preservice teachers at a large South-west public university. The results, consistent with earlier studies, confirm that the participating preservice teachers inaccurately self-assessed their digital competence.

The study concluded that subjective self-assessment lacks appropriate validity and is not an accurate stand-alone predictor of digital competence among preservice teachers. However, if considered in conjunction with other means, self-assessment may prove to be useful for preservice teachers to aid in their reflection of their competence, skills, and knowledge and to aid them in adjusting their perceptions and attitudes regarding technology throughout their professional practice. In addition, self-assessment in conjunction with other means may assist teacher educators in providing opportunities to improve the competence in teacher training programs."

Minshew, L., & Anderson, J. (2015). Teacher efficacy in 1:1 iPad integration in middle school science and math classrooms. *Contemporary Issues in Technology and Teacher Education, 15*(3), 334-367. Retrieved from https://www.editlib.org/p/147432/

Abstract: "Many schools are beginning to adopt one-to-one computing with the goal of developing students' 21st-century skills, which allow students not only to learn content but to acquire critical skills (e.g., creativity, collaboration, and digital literacy) that will lead to future careers. Technology offers teachers the ability to transform the quality of instruction—to achieve a more student-centered learning environment, have more differentiated instruction, and develop problem- or project-based learning, and demand higher order thinking skills. A number of barriers and influences have emerged from the findings of this study on teachers' practice and integration of technology into their classrooms. This study examines how these barriers, both internal and external, influence classroom pedagogy. Using a technology, pedagogy, and content knowledge (TPACK) framework, this paper examines the classroom practice of two middle grades mathematics and science teachers integrating a 1:1 initiative and the ways they dealt with the barriers in their classroom practices."

Olofson, M. W., Swallow, M. J. C., & Neumann, M. D. (2016). TPACKing: A constructivist framing of TPACK to analyze teachers' construction of knowledge. *Computers & Education, 95*, 188-201. doi:10.1016/j.compedu.2015.12.010

Abstract: "The Technological Pedagogical Content Knowledge (TPACK) framework is a commonly used conceptual tool in studies that consider technology integration into classrooms. Although the framework identifies categories of knowledge, it is limited due to its static classification of knowledge. The proposed TPACKing framework instead uses TPACK as a starting point for analyzing a teacher's knowledge construction practice. This qualitative multiple-case study uses the active understanding of TPACKing to illuminate differences in the processes of teachers previously identified as having TPACK. Teachers' TPACKing processes were mediated by individual pursuit of technological knowledge, the inclusion (or exclusion) of information from contextual interactions, and the pedagogical assumptions in the technological tool. These findings point to the relevance of the TPACKing lens and its use in analyzing teacher practice. The focus on knowledge construction may be useful when working with in-service teachers to provide learning opportunities related to technology integration."

Phillips, M. (2016). Re-contextualising TPACK: Exploring teachers' (non-)use of digital technologies. *Technology, Pedagogy, and Education*. Advance online publication. doi: 10.1080/1475939X.2015.1124803

Abstract: "Technological, pedagogical and content knowledge (TPACK) has been used by hundreds of studies as a theoretical framework to explore teachers' technology use in classroom settings. While these studies have contributed to understandings of the interplay between these different knowledge domains and the differences between pre- and in-service teachers' knowledge, little work has been done to examine the influence of teachers' socially mediated workplace settings on TPACK enactment. This article begins to address this issue reporting findings from an eight-month case study involving 10 teachers in an Australian secondary school. Results reported in this article indicate that TPACK enactment is influenced by processes of identity development and practice. These findings challenge the established position of knowledge as an epistemological possession inherent in the TPACK framework rather than also considering knowing as an epistemology of practice. Implications for in-service teachers and school authorities are discussed and suggestions for future research considered."

Pilgrim, J., & Martinez, E. (2015). Web literacy and technology integration: Moving beyond TPACK with student-centered instruction. *Journal of Literacy and Technology, 16*(2), 121-153. Retrieved from http://www.literacyandtechnology.org/uploads/1/3/6/8/136889/jlt_v16_2_pilgrim_martinez.pdf

Abstract: "Due to the abundance and availability of information throughout the world, students must be exposed to ways to navigate and discern online information. This exposure occurs through student-centered research opportunities, in which students apply Web literacy skills to acquire new knowledge. The purpose of this study was to examine teacher perceptions of

teacher integration and Web literacy skills and to examine technology integration within this context using Mishra and Koehler's (2006) Technological Pedagogical Content Knowledge (TPACK) model. Focus group participants in this study implemented Web literacy activities in their classrooms and shared their experiences. Findings regarding the TPACK and ways it applies to technology integration and Web literacy activities led to the consideration of a revised, student-centered framework for technology integration."

Ritzhaupt, A. D., Huggins-Manley, A. C., Ruggles, K., & Wilson, M. (2015). Validation of the survey of pre-service teachers' knowledge of teaching and technology: A multi-institutional sample. *Journal of Digital Learning in Teacher Education, 32*(1), 26-37. doi:10.1080/21532974.2015.1099481

Abstract: "The TPACK (technological pedagogical content knowledge) framework (Mishra & Koehler, 2006) has gained tremendous momentum from within the educational technology community. Specifically, much discourse has focused on how to measure this multidimensional construct to further define the contours of the framework and potentially make some meaningful predictions. Some have proposed observation scales while other have proposed self-report measures to gauge the phenomenon. The Survey of Pre-service Teachers' Knowledge of Teaching and Technology instrument is one popular tool designed to measure TPACK (Schmidt et al., 2009) specifically from preservice teachers in teacher education programs. This study extends the measurement framework by providing a confirmatory factor analysis of the theoretical model proposed by Schmidt et al. (2009) on a sample of 227 preservice teachers from four public institutions of higher education in the southeastern United States. The data did not fit the theoretical 10-factor model implied by Schmidt et al. (2009), thus, an exploratory factor analysis was conducted to determine the optimal structure of the measurement tool for these data. This resulted in a nine-factor model, and there were measurement issues for several of the constructs. Additionally, the article provides evidence of external validity by correlating the instrument scores with other known technology constructs."

Sancar-Tokmak, H., Yelken, T. Y., & Konokman, G. Y. (2013). Pre-service teachers' perceptions on development of their IMD competencies through TPACK-based activities. *Journal of Educational Technology & Society, 16*(2), 243-256. Retrieved from http://www.ifets.info/journals/16_2/20.pdf

Abstract: "The current study investigated perceived development of pre-service teachers in their Instructional Material Design (IMD) competencies through the course Instructional Technology and Material Design, which is based on a technological, pedagogical, and content knowledge (TPACK) framework. A total of 22 Elementary Education pre-service teachers participated in the study. Five activities based on TPACK were designed by the instructors to provide students with specific teaching experience. Action research methodology was followed during the study, and each activity was part of the cycle of design. Data were collected through a questionnaire on pre-service teachers' IMD competencies, their journals, assignments, open-ended questionnaires, teaching practice forms, observations, and software evaluation forms. The study revealed that pre-service teachers gained essential competencies in instructional

material design. Moreover, the results showed that they experienced incorporating TPACK into their future teaching practices."

Sen, S. & Temel, S. (2016). Analysis of prospective chemistry teachers' attitudes towards information and communication technologies, and of their confidence in technological and pedagogical content knowledge. *Participatory Educational Research*. Advance online publication. doi:10.17275/per.16.spi.2.1.

Abstract: "This study aims to analyse prospective chemistry teachers' attitudes towards Information and Communication Technologies (ICT) as well as their confidence in Technological and Pedagogical Content Knowledge (TPACK). Information and Communication Technology Attitude Scale (ICTAS) developed by Günbatar (2014), and the Technological Pedagogical Content Knowledge Confidence Survey (TPCKCS) developed by Graham et al (2009) and adapted into Turkish by Timur and Taşar (2011) were used in this research as the tools of data collection. The study was performed in the survey model, one of the quantitative research methods. 53 prospective chemistry teachers participated in this research. The TPCKCS consists of four dimensions: technological pedagogical content knowledge, technological pedagogical knowledge, technological content knowledge, and technological knowledge. The ICTAS, on the other hand, consists of such dimensions as general tendency of ICT, access to information in virtual environments, computer hardware, use of software and communication in virtual environments. The correlations of the sub-dimensions of both scales were analysed through correlation analysis. In addition to that, a correlation analysis was performed in order to determine the relations between the total scores of both scales. At the end of the study, the correlation coefficients for the scores that prospective chemistry teachers have received from the sub-dimensions of both scales are presented."

Serrado, A., Meletiou-Mavrotheris, M., & Paparistodemou, E. (2015). EarlyStatistics: A case study on in-service teachers' technological pedagogical content knowledge of statistics. *Quaderni di Ricerca in Didattica, 23*(1), 444-451. Retrieved from www.journal-sfds.fr/index.php/StatEns/article/download/298/279

Abstract: "EarlyStatistics is a professional development course for in-service elementary and middle school European teachers, which aims at enhancing the teaching and learning of statistics. In this paper, we present some of the insights gained from a case study of a group of nine teachers participating in the course. We examine the impact of teachers' engagement in comparing their national statistics curriculum with international, standards-based curricula on the development of their technological pedagogical content knowledge of statistics."

Valtonen, T., Sointu, E., Makitalo-Siegl, K., & Kukkonen, J. (2015). Developing a TPACK measurement instrument for 21st century pre-service teachers. *International Journal of Media, Technology, and Lifelong Learning, 11*(2), 87-100. Retrieved from https://www.researchgate.net/publication/283664667_Developing_a_TPACK_measurement_instrument_for_21st_century_pre-service_teachers

Abstract: “Future skills, so-called 21st century skills, emphasise collaboration, creativity, critical thinking, problem-solving and especially ICT skills (Voogt & Roblin, 2012). Teachers have to be able to use various pedagogical approaches and ICT in order to support the development of their students’ 21st century skills (Voogt & Roblin, 2012). These skills, particularly ICT skills, pose challenges for teachers and teacher education. This paper focuses on developing an instrument for measuring pre-service teachers’ knowledge related to ICT in the context of 21st century skills. Technological Pedagogical Content Knowledge (TPACK; Mishra & Kohler, 2006) was used as a theoretical framework for designing the instrument. While the TPACK framework is actively used, the instruments used to measure it have proven challenging. This paper outlines the results of the development process of the TPACK-21 instrument. A new assessment instrument was compiled and tested on preservice teachers in Study1 (N=94). Based on these results, the instrument was further developed and tested in Study2 (N=267). The data of both studies were analysed using multiple quantitative methods in order to evaluate the psychometric properties of the instruments. The results provide insight into the challenges of the development process itself and also suggest new solutions to overcome these difficulties.”

Varol, Y. K. (2015). Predictive power of prospective physical education teachers’ attitudes towards educational technologies for their technological pedagogical content knowledge. *International Journal of Progressive Education, 11*(3), 7-19. Retrieved from http://www.inased.org/v11n3/IJPE%20V11N3.pdf

Abstract: “The aim of the research is to determine the predictive power of prospective physical education teachers' attitudes towards educational technologies for their technological pedagogical content knowledge. In this study, a relational research model was used on a study group that consisted of 529 (M age=21.49, SD=1.44) prospective physical education teachers. As a data collection tool, a "technology attitude scale" and a "technological pedagogical content knowledge scale" were used. Regarding analyses, inferential statistics as correlation and regression analyses were used, in addition to descriptive analyses. At the end of the research period, it was observed that attitudes towards educational technologies had a high-level effect on technological pedagogical content knowledge, and the variables that constituted a sub-dimension of the attitude scale for educational technologies explained 31% of the total variance in technological pedagogical content knowledge. In addition, it was established that attitudes towards educational technologies and the technological pedagogical content knowledge of prospective physical education teachers were at a high level.”

Wu, B., Hu, Y., Gu, X., & Lim, C.-P. (2015). Professional development of new higher education teachers with information and communication technology in Shanghai: A Kirkpatrick’s evaluation approach. *Journal of Educational Computing Research*. Advance online publication. doi: 10.1177/0735633115621922

Abstract: “As information and communication technology (ICT) continues to develop, it is essential for teachers to acquire ability for teaching with ICT. In China, new higher education (HE) teachers often lack teaching experience because there are limited teaching opportunities during their postgraduate studies. This status quo may compromise the quality of teaching and

learning in higher education institutions. In 2013, Shanghai Municipal Education Commission initiated a professional development program for new teachers from all local higher education institutions. This article examines their ICT professional development through the lens of Kirkpatrick's evaluation model. Data were collected from online surveys both immediately after an ICT module and 6 months later. The results showed that participants intended to integrate ICT in teaching and had an above-average level of Technological Pedagogical and Content Knowledge (TPACK). Participants and their department heads also confirmed distinctive teaching performance of these new teachers and better learning behavior of their students. The study revealed that demographic variables of new HE teachers may also affect their perception of ICT and TPACK. This study suggests that ICT professional development can have positive impacts on new HE teachers' perception of ICT, their TPACK competence, and ICT-related teaching practice and student learning."

Yelken, T. Y., Cocuk, H. E., Konokman, G. Y., & Pan, V. L. (2015). The effect of digital story preparation on technological pedagogical content knowledge (TPCK) self-confidence. *Anthropologist, 22*(2), 188-195. Retrieved from http://krepublishers.com/02-Journals/T-Anth/Anth-22-0-000-15-Web/Anth-22-2-000-15-Abst-PDF/T-ANTH-SV-22-2-185-15-1549-Tugba-Yanpar-Y/T-ANTH-SV-22-2-185-15-1549-Tugba-Yanpar-Y-Tx[5].pdf

Abstract: "The effect of the prospective pre-school teachers' digital story preparation on their technological pedagogical content knowledge self-confidence is proposed to be determined in mix method designed study. During the research, prospective pre-school teachers determined their objectives for a digital story, wrote scenarios, selected audio and visual materials, created and presented their digital stories. The qualitative and quantitative data were obtained through technological pedagogical content knowledge self-confidence scale and open-ended metaphorical question as pre- and post-tests. In quantitative and qualitative data analysis, t-test for the dependent samples and inductive content analysis were conducted. The findings demonstrated the prospective pre-school teachers' digital story preparation increased their self-confidence on TPCK. It was inferred from the metaphors that the prospective pre-school teachers perceived self-confidence on TPCK as a guide and a vital necessity. Data analysis results indicated digital story preparation had positive effect on the prospective pre-school teachers' self-confidence on TPCK."

Books

Herring, M. C., Koehler, M. J., & Mishra, P. (2016). *Handbook of technological pedagogical content knowledge (TPACK) for educators* (2nd ed.). New York, NY: Routledge. Abstract retrieved from https://www.routledge.com/products/9781138779396

Abstract: "The 2nd edition of the *Handbook of Technological Pedagogical Content Knowledge (TPACK) for Educators* addresses the concept and implementation of technological pedagogical content knowledge—the knowledge and skills that teachers need in order to integrate technology meaningfully into instruction in specific content areas. Driven by the growing

influence of TPACK on research and practice in both K-12 and higher education, the 2nd edition updates current thinking about theory, research, and practice.

Offering a series of chapters by scholars in different content areas who apply the technological pedagogical content knowledge framework to their individual content areas, the volume is structured around three themes:

- Current thoughts on TPACK Theory
- Research on Technological Pedagogical Content Knowledge in Specific Subject Areas
- Integrating Technological Pedagogical Content Knowledge into Teacher Education and Professional Development"

Khine, M. S. (2015). *New directions in technological pedagogical content knowledge: Multiple perspectives.* Charlotte, NC: Information Age. Abstract retrieved from http://www.infoagepub.com/products/New-Directions-in-Technological-Pedagogical-Content-Knowledge-Research

Abstract: "In the past decades wide-ranging research on effective integration of technology in instruction [has] been conducted by various educators and researchers with the hope that the affordances of technology might be leveraged to improve the teaching and learning process. However, in order to put the technology in optimum use, knowledge about how and in what way technology can enhance the instruction is also essential. A number of theories and models have been proposed in harnessing the technology in everyday lessons. Among these attempts Technological and Pedagogical Content Knowledge (TPACK) framework introduced by Mishra and Koehler has emerged as a representation of the complex relationships between technology, pedagogy and content knowledge. The TPACK framework extends the concept of Shulman's pedagogical content knowledge (PCK) which defines the need for knowledge about the content and pedagogical skills in teaching activities. Since then the framework has been embraced by the educational technology practitioners, instructional designers, and educators. TPACK research received increasing attention from education and training community covering diverse range of subjects and academic disciplines and significant progress has been made in recent years. This book attempts to bring the practitioners and researchers to present current directions, trends and approaches, convey experience and findings, and share reflection and vision to improve science teaching and learning with the use of TPACK framework.

A wide array of topics will be covered in this book including applications in teacher training, designing courses, professional development and impact on learning, intervention strategies and other complex educational issues. Information contained in this book will provide knowledge growth and insights into effective educational strategies in integration of technology with the use of TPACK as a theoretical and developmental tool. The book will be of special interest to international readers including educators, teacher trainers, school administrators, curriculum designers, policy makers, and researchers and complement the existing literature and published works."

Chapters

Angeli, C., Valanides, N., & Christodoulou, A. (2016). Theoretical considerations and alternative conceptualizations - TPACK. In M. C. Herring, M. J. Koehler, & P. Mishra (Eds.), *Handbook of technological pedagogical content knowledge (TPACK) for educat*ors (2nd ed., pp. 11-32). New York, NY: Routledge.

Abstract: "In the present chapter, the authors discuss theoretical aspects of Technological Pedagogical Content Knowledge (TPCK or TPACK), as a framework and a body of knowledge, and provide a chronological account of its development. Based on a comprehensive review of the literature, the results are presented with a focus on the following aspects: (a) TPCK frameworks, (b) The integrative versus the transformative nature of TPCK as a body of knowledge, and (c) Domain-general vs. domain-specific TPCK. The authors discuss the findings and conclude with recommendations for future research." (Prepublication version)

Anuar, R., Zakaria, W., Noor, H., & Othman, N. (2016). TPACK in VAE: A study on students' readiness to use e-learning in the teaching and learning of visual art education. In C. Y. Fook, G. K. Sidhu, S. Narasuman, L. L. Fong, & S. B. Abdul Rahman (Eds.), *University learning and teaching* (pp. 811–822). Singapore: Springer. doi:10.1007/978-981-287-664-5_64

Abstract: "A study was conducted among the Art and Design Education undergraduates at Faculty of Education, Universiti Teknologi MARA (UiTM) to find out their readiness to use e-Learning in Visual Art Education (VAE). This paper discusses the use of Technological Pedagogical Content Knowledge (TPACK) to describe students' readiness towards e-Learning through their understanding of technology and pedagogical content knowledge. The data were gathered from 27 final year students in the Art and Design Education programme. A set of questionnaire was distributed to determine the readiness and ability of the undergraduates to adopt the new technological approach in the teaching and learning of VAE. The questionnaire measured their technology knowledge (TK), content knowledge (CK) and technological pedagogical knowledge (TPK). The overall findings on TK showed that the students can learn with technology easily and have technical skills needed to use technology in the teaching and learning of VAE. Majority of the students agreed that they have sufficient CK and could think of various ways of using technology to develop understanding of VAE. Based on students' TPK, the results showed a significant finding towards their ability to adapt technology in the teaching and learning activities. The findings in this study clearly revealed that TPACK is a good platform to measure students' readiness towards using technology in the teaching and learning of VAE. As a conclusion, the findings showed that the undergraduates were ready to use technology in their teaching and learning purposes."

Archambault, L. (2016). Exploring the use of qualitative methods to examine TPACK. In M. C. Herring, M. J. Koehler, & P. Mishra (Eds.), *Handbook of technological pedagogical content knowledge (TPACK) for educat*ors (2nd ed., pp. 65-86). New York, NY: Routledge.

Abstract: "Since the articulation of TPACK, researchers have sought to apply appropriate methodologies for measuring various aspects of the framework and to suggest implications for teaching practice. These qualitative approaches have consisted predominantly of performance assessments, interviews, and observation protocols. The purpose of this chapter is to review literature related to qualitative methods used to assess TPACK. It also examines insights that can be gleaned from current research in this area. From this work, it is clear that qualitative approaches to measuring TPACK are an essential component to cultivating teachers who understand and utilize the affordances of technology to transform content." (Prepublication version)

Baran, E., Bilici, S. C., & Uygun, E. (2016). TPACK-based professional development programs in in-service science teacher education. In M. C. Herring, M. J. Koehler, & P. Mishra (Eds.), *Handbook of technological pedagogical content knowledge (TPACK) for educato*rs (2nd ed., pp. 271-284). New York, NY: Routledge.

Abstract: "With the recent emphasis on using technologies in science education, the need has emerged to prepare science teachers with effective technology integration skills. To address this need, a TPACK-based PD program was designed and implemented as part of an in-service teacher-training project in Turkey. This chapter presents the research on the investigation of the impact of the TPACK-based PD program on science teachers' TPACK development. The analysis revealed that as a result of attending the PD, teachers' TPACK increased and sustained over a period of one year. Research and practical implications for designing in-service science teacher training programs are shared." (Prepublication version)

Benton-Borghi, B. H. (2016). Universal design for learning (UDL) infused technological pedagogical content knowledge (TPACK) model prepares efficacious 21st century teachers. In M. C. Herring, M. J. Koehler, & P. Mishra (Eds.), *Handbook of technological pedagogical content knowledge (TPACK) for educato*rs (2nd ed., pp. 143-166). New York, NY: Routledge.

Abstract: "This mixed methodology research study supports a Universal Design for Learning (UDL) (Rose, & Meyer, 2002) Infused Technological Pedagogical Content Knowledge (TPACK) (Mishra, & Koehler, 2006) model for teacher preparation. The study examined the impact of the model taught in a secondary general education methods course from 2011 to 2014 on UDL Infused TPACK and teacher efficacy. A small convenience sample participated in one-on-one interviews after completing student teaching and teacher performance assessments (edTPA). The positive quantitative and qualitative results warrant a merged model because the UDL infused TPACK practitioner's model prepares efficacious 21st century teachers to teach all students." (Prepublication version)

Celik, I., Sahin, I., Kiray, S. A., & Simsek, H. (2015). Case studies for educators based on TPACK framework. In M. S. Khine (Ed.), *New directions in technological pedagogical content knowledge: Multiple perspectives* (pp. 357-376). Charlotte, NC: Information Age.

Abstract: None

Chai, C. S., Koh, J. H. L., & Tsai, C. C. (2016). A review of the quantitative measures of technological pedagogical content knowledge (TPACK). In M. C. Herring, M. J. Koehler, & P. Mishra (Eds.), *Handbook of technological pedagogical content knowledge (TPACK) for educato*rs (2nd ed., pp. 87-106). New York, NY: Routledge.

Abstract: "In this chapter, the authors review and summarize important studies carried out to date that employ quantitative measures of TPACK. These include surveys of teachers' perceptions of TPACK, rubrics for evaluating teachers' technology-integrated lesson plans, as well as quantitative content analysis of teachers' lesson design processes. The findings indicate that a substantial number of TPACK surveys have been developed for a variety of contexts. While adequate progress has been made in terms of TPACK construct validation, more surveys contextualized for specific technologies, content, and pedagogies are still needed. In comparison, the development lesson design rubrics as well as measurement of the quality of teachers' lesson design processes need further attention. More work is needed in these areas to validate existing protocols as well as to develop new protocols. Future directions for the development of each of these three kinds of quantitative TPACK measures are discussed." (Prepublication version)

Chandra, V. (2016). Understanding the role of the school principal in setting the context for technology integration: A TPACK perspective. In M. C. Herring, M. J. Koehler, & P. Mishra (Eds.), *Handbook of technological pedagogical content knowledge (TPACK) for educato*rs (2nd ed., pp. 235-246). New York, NY: Routledge.

Abstract: "As educators we are aware of the role that contexts play in technology integration in our classrooms. Contexts can have a direct influence on how teachers' technological, pedagogical, content knowledge (TPACK) manifests in their daily practices. In every context, school principals play a dominant role because they manage and determine how schools are run. The integration of technology is often viewed as part of a reform agenda. School principals' are drivers of such reform – they can make or break initiatives. Digital technologies were introduced to a school in Fiji recently. This chapter reports on the principal's role and his technology journey over a 12-month period." (Prepublication version)

Dobozy, E., & Campbell, C. (2016). The complementary nature of learning design and TPACK. In J. Dalziel (Ed.) *Learning design: Conceptualizing a framework for teaching and learning online.* (pp. 96-116). New York, NY: Taylor & Francis.

Abstract: "This chapter explores the concepts of Learning Design (LD) and Technological Pedagogical and Content Knowledge (TPACK) in an attempt to contribute greater clarity about their epistemological and conceptual similarities and differences. Drawing on LD and TPACK research, we present a conceptual framework that helps to analyze LD and TPACK philosophy and application, specifically targeting designers of teaching and learning activities, educational researchers and administrators. A key goal of this chapter is to illustrate that, although the concepts operate in different paradigms and are designed for a different target audience, they

are complementary. The LD construct based on the Learning Design Framework (LD-F) introduced in the Larnaca Declaration is focusing on pedagogical design and is underpinned by ideas of interdisciplinarity, general applicability and flexibility in epistemology and ontology, whereas TPACK is specifically targeted to the education of schoolteachers, providing a framework that illustrates the relationship between the three components of TPACK, technical (T), pedagogical (P), and (C) content (K) knowledge. Understanding their complementary nature will assist designers of learning and teaching to make better-informed decisions about technology-enhanced learning and teaching provisions."

Everett, S. A., & Otto, C. A. (2015). A graphic model for designing effective lesson plans incorporating technology. In M. S. Khine (Ed.), *New directions in technological pedagogical content knowledge: Multiple perspectives* (pp. 37-56). Charlotte, NC: Information Age.

Abstract: None

Forssell, K. (2016). Making meaningful advances: TPACK for designers of learning tools. In M. C. Herring, M. J. Koehler, & P. Mishra (Eds.), *Handbook of technological pedagogical content knowledge (TPACK) for educato*rs (2nd ed., pp. 247-258). New York, NY: Routledge.

Abstract: "This chapter explores how the TPACK framework guides the work of designers of new learning tools, highlighting key ways for designers to leverage the various domains of teacher knowledge. Further, the TPACK subdomains align with different indicators of successful design. Examples drawn from interviews with teachers demonstrate the potential for the TPACK framework to inform the design of tools that will be both useful and easy to use in the classroom." (Prepublication version)

Geer, R., & White, B. (2015). Using TPACK with pre-service teachers of science. In M. S. Khine (Ed.), *New directions in technological pedagogical content knowledge: Multiple perspectives* (pp. 203-228). Charlotte, NC: Information Age.

Abstract: None

Harris, J. B. (2016). In-service teachers' TPACK development: Trends, models, and trajectories. In M. C. Herring, M. J. Koehler, & P. Mishra (Eds.), *Handbook of technological pedagogical content knowledge (TPACK) for educato*rs (2nd ed., pp. 191-206). New York, NY: Routledge.

Abstract: "How is experienced teachers' TPCK/TPACK developed? The full range of professional development (PD) models for inservice teachers' TPACK-related professional learning is overviewed in this chapter, classified according to eight process-focused PD approaches and 12 specific strategies, and situated within the larger (non-TPACK) PD literature. Current and probable future trends in TPACK-related PD are documented and hypothesized, mirroring, in

part, nascent assertions made by other researchers that effective PD for teachers is highly contextualized, personalized, and variable in structure, purpose, orientation, and process. Recommendations for future TPACK PD research and development are then made, based upon the trends and models discussed." (Prepublication version)

Herring, M. C., Meacham, S., & Mourlam, D. (2016). TPACK development in higher education. In M. C. Herring, M. J. Koehler, & P. Mishra (Eds.), *Handbook of technological pedagogical content knowledge (TPACK) for educato*rs (2nd ed., pp. 207-224). New York, NY: Routledge.

Abstract: "This chapter introduces TPACK development in higher education that can be applied to any colleges beyond colleges of education. Based on our experience of leadership, faculty development and our literature review, we argue that the creation of sound leadership structures aligned with the TPACK framework can promote sustainable faculty development. There are a growing number of cases that applied the TPACK framework in non-teacher-education programs. The TPACK framework can provide higher education faculty members with a comprehensive vision for technology integration in their face-to-face and online instruction. Learner-centered pedagogy has been emphasized for non-teacher-education faculty members' professional development." (Prepublication version)

Herring, M. C., Koehler, M. J., & Mishra, P., Rosenberg, J., & Teske, J. (2016). Introduction to the second edition of the TPACK handbook. In M. C. Herring, M. J. Koehler, & P. Mishra (Eds.), *Handbook of technological pedagogical content knowledge (TPACK) for educato*rs (2nd ed., pp. 1-8). New York, NY: Routledge.

Abstract: "The handbook is organized into three sections. In the first, theory –how TPACK is conceptualized across the authors' scholarship, as well as the work of others –is explored. Next, in the section on research, the authors describe studies of TPACK, focusing specifically on methodological and analytic approaches. Finally, on application, we investigate the challenges of applying TPACK theory and research to practice." (Prepublication version)

Hofer, M., Lee, J., Slykhuis, D., & Ptaszynski, J. (2016). Opportunities and challenges of TPACK-based professional development on a global scale. In M. C. Herring, M. J. Koehler, & P. Mishra (Eds.), *Handbook of technological pedagogical content knowledge (TPACK) for educato*rs (2nd ed., pp. 225-234). New York, NY: Routledge.

Abstract: "In this chapter, we share the genesis, evolution and ongoing results of a collaborative, TPACK-based faculty development initiative serving university faculty around the world. In contrast to many professional development initiatives that draw on the TPACK construct as an organizing framework for K-12 teacher education, the Microsoft Technology Enriched Instruction program serves higher education faculty from around the world both within and outside schools of education. In this chapter we trace the development of this workshop and report on evaluation findings from around the world." (Prepublication version)

Jaipal-Jamani, K., & Figg, C. (2015). TPACK knowledge supporting design of effective technology-enhanced science instruction for digital learners. In M. S. Khine (Ed.), *New directions in technological pedagogical content knowledge: Multiple perspectives* (pp. 11-36). Charlotte, NC: Information Age.

Abstract: None

Jang, S., & Tsai, M. (2016). Exploring the development of pre-service teachers' ICT-TPACK using a cognitive stimulation tool. In E. Railean, G. Walker, A. Elçi, & L. Jackson (Eds.) *Handbook of research on applied learning theory and design in modern education* (pp. 380-404). Hershey, PA: Information Science Reference. doi:10.4018/978-1-4666-9634-1.ch018

Abstract: "Self-regulated learning (SRL) skills and Technological Pedagogical and Content Knowledge (TPACK) are important issues in current educational studies. Most of SRL studies have highlighted the relationship between self-regulation and academic performances. However, few existing research on the aspect of SRL is seldom applied to the research on TPACK of pre-service teachers. The purpose of this paper was to examine pre-service teachers' development of TPACK with appropriate Information and Communication Technologies (ICT) using cognitive stimulation tool (CST). Pre-service teachers self-rated their ICT-TPACK at two time points, and the statistical analysis indicated significant difference. The analysis of qualitative data showed that pre-service teachers used cognitive regulation strategies to develop their understanding and application skills on ICT-TPACK and were able to use reflective practices to demonstrate their understanding of TPACK at the end of the semester. The research implications of this study and TPACK instrument development are provided along with suggestions."

Janssen, N., & Lazonder, A. W. (2016). Support for technology integration: Implications from and for the TPACK framework. In M. C. Herring, M. J. Koehler, & P. Mishra (Eds.), *Handbook of technological pedagogical content knowledge (TPACK) for educat*ors (2nd ed., pp. 129-130). New York, NY: Routledge.

Abstract: "This chapter reports on two studies in which the TPACK framework was used to design lesson plan support. Two types of support were developed that differed with regard to the integration of pedagogical and content information. Study 1 revealed that pre-service and in-service teachers generally prefer integrated support over separate support. Study 2 further showed that integrated support enables pre-service teachers to consider pedagogy and content in tandem when designing a lesson plan. These results suggest that integrated support is more effective than separate support in assisting teachers to integrate pedagogy and content during lesson planning." (Prepublication version)

Jimoyiannis, A. (2015). TPACK 2.0: Towards a framework guiding Web 2.0 integration in educational practice. In M. S. Khine (Ed.), *New directions in technological pedagogical content knowledge: Multiple perspectives* (pp. 83-108). Charlotte, NC: Information Age.

Abstract: None

Kadijevich, D. M., & Madden, S. R. (2015). Comparing approaches for developing TPCK. In M. S. Khine (Ed.), *New directions in technological pedagogical content knowledge: Multiple perspectives* (pp. 125-146). Charlotte, NC: Information Age.

Abstract: None

Khan, S., Meyers, E., Gowen, E., & Bergman, K. (2015). "I learned that online": A study of science teachers and new forms of professional development. In M. S. Khine (Ed.), *New directions in technological pedagogical content knowledge: Multiple perspectives* (pp. 229-266). Charlotte, NC: Information Age.

Abstract: None

Khine, M. S. (2015). Technology-enhanced learning and TPACK. In M. S. Khine (Ed.), *New directions in technological pedagogical content knowledge: Multiple perspectives* (pp. 3-10). Charlotte, NC: Information Age.

Abstract: None

Maeng, J. L., & Gonczi, A. L. (2015). Developing science teachers' TPCK: Technology integration is only the tip of the iceberg. In M. S. Khine (Ed.), *New directions in technological pedagogical content knowledge: Multiple perspectives* (pp. 165-202). Charlotte, NC: Information Age.

Abstract: None

McLoughlin, C. (2015). How teachers develop technological pedagogical content knowledge (TPACK) for contemporary learning environments: Exemplars of effective practice. In M. S. Khine (Ed.), *New directions in technological pedagogical content knowledge: Multiple perspectives* (pp. 147-164). Charlotte, NC: Information Age.

Abstract: None

Mouza, C. (2016). Developing and assessing TPACK among pre-service teachers: A synthesis of research. In M. C. Herring, M. J. Koehler, & P. Mishra (Eds.), *Handbook of technological pedagogical content knowledge (TPACK) for educato*rs (2nd ed., pp. 169-190). New York, NY: Routledge.

Abstract: "This chapter provides a synthesis of research on promising approaches used to develop and assess pre-service teaches technological, pedagogical, content knowledge (TPACK). The review begins by examining pre-service teachers' characteristics and experiences with

technology. Subsequently, it presents types of instruments used to assess pre-service teachers' TPACK and specific pathways and strategies used to develop pre-service teachers' TPACK. The focus is on empirical studies that make explicit the ways in which the TPACK framework informed teacher preparation efforts, data collection and analysis. Based on this synthesis remaining questions and directions for future research are presented." (Prepublication version)

Mroziak, J., & Bowman, J. (2016). Music TPACK in higher education: Educating the educators. In M. C. Herring, M. J. Koehler, & P. Mishra (Eds.), *Handbook of technological pedagogical content knowledge (TPACK) for educato*rs (2nd ed., pp. 285-296). New York, NY: Routledge.

Abstract: "This chapter highlights the need to help music education professors develop their TPACK in order to model pedagogical uses of technology in music education courses. It reviews typical pedagogical problems involved in technology integration within pre-service music education programs, offers ways to address those issues through a peer coaching professional development model focused on small, readily achievable tasks, and describes a successful implementation of the model. It concludes with an outline of a systematic plan for peer coaching, including an exploratory survey, a planning meeting, a learning session, an implementation plan, and ongoing assistance." (Prepublication version)

Niess, M. L. (2016). Transforming teachers' knowledge for teaching with technologies: An online learning trajectory instructional approach. In M. C. Herring, M. J. Koehler, & P. Mishra (Eds.), *Handbook of technological pedagogical content knowledge (TPACK) for educato*rs (2nd ed., pp. 131-142). New York, NY: Routledge.

Abstract: "This empirically-supported learning trajectory provides an "ordered network of experiences" teacher participants encountered in the online course directed toward TPACK development with respect to the role of teaching and learning with multimedia technologies. The learning trajectory used a social metacognitive constructivist framework, including tools (community of learners, reflection) and learning processes (inquiry, shared/individual knowledge development) as the platform for the course content and outcomes (TPACK development). The online instruction engaged participants in a pedagogical systems approach through ongoing inquiry, collaboration, communication, and reflection for thinking about teaching with technologies. The research study provided multiple case descriptions revealing three important themes." (Prepublication version)

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

Abstract: None

Pamuk, S. (2015). TPACK as a technology integration framework: Understanding and

measurement of the TPACK development process. In M. S. Khine (Ed.), *New directions in technological pedagogical content knowledge: Multiple perspectives* (pp. 109-124). Charlotte, NC: Information Age.

Abstract: None

Polly, D., & Orrill, C. H. (2016). Designing professional development to support teachers' TPACK in elementary school mathematics. In M. C. Herring, M. J. Koehler, & P. Mishra (Eds.), *Handbook of technological pedagogical content knowledge (TPACK) for educato*rs (2nd ed., pp. 259-270). New York, NY: Routledge.

Abstract: "The TPACK framework provides fertile ground to consider approaches to professional development experiences for teachers related to mathematics teaching and learning. In this chapter we synthesize TPACK, the construct of learner-centered professional to examine various ways that professional development has been designed to support teachers' development of TPACK as it relates to mathematics. Implications for the design and implementation of TPACK Mathematics professional development opportunities are also provided." (Prepublication version)

Price, G. P., & Hubbard, J. D. (2015). Enhancing a teaching methods course with a TPACK-based integrated triadic model. In M. S. Khine (Ed.), *New directions in technological pedagogical content knowledge: Multiple perspectives* (pp. 313-338). Charlotte, NC: Information Age.

Abstract: None

Schmidt-Crawford, D. A., Tai, S-J. D., Wang, W., & Jin, Y. (2016). Understanding teachers' TPACK through observation. In M. C. Herring, M. J. Koehler, & P. Mishra (Eds.), *Handbook of technological pedagogical content knowledge (TPACK) for educato*rs (2nd ed., pp. 107-128). New York, NY: Routledge.

Abstract: "A descriptive case study approach was used to identify observable TPACK teacher characteristics. Data were collected using observations and interviews, and data analysis was guided by the Data Analysis Spiral. Teacher participants were found to exhibit all seven TPACK knowledge domains in their teaching. In addition, 53 TPACK characteristics (i.e., codes) were identified and categorized into 11 themes. These findings support taking a systematic approach for assessing teachers' TPACK by triangulating data from multiple sources." (Prepublication version)

Smart, V., Finger, G., & Sim, C. (2016). Developing TPACK: Envisioning technological pedagogical reasoning. In M. C. Herring, M. J. Koehler, & P. Mishra (Eds.), *Handbook of technological pedagogical content knowledge (TPACK) for educato*rs (2nd ed., pp. 53-62). New York, NY: Routledge.

Abstract: “Shulman (1987) provided the language to describe how teachers develop their knowledge base with what he termed pedagogical reasoning. He suggested that through the development of content knowledge, educational studies and the wisdom of practice, teachers develop their pedagogical content knowledge (PCK). In revisiting PCK, Koehler and Mishra (2005) have added technology to propose TPACK as the ‘new’ teacher knowledge category. This chapter considers the significance of exploring the reasoning and actions associated with teaching with technology. Could this be termed technological pedagogical reasoning? This chapter will provide a basis for the importance of exploring this question.” (Prepublication version)

Spyros, D. (2015). Exploring undergraduate student-teachers’ transformation of technological pedagogical content knowledge in mathematics regarding pupils’ assessment. In M. S. Khine (Ed.), *New directions in technological pedagogical content knowledge: Multiple perspectives* (pp. 287-312). Charlotte, NC: Information Age.

Abstract: None

Voogt, J., Fisser, P., Tondeur, J., & van Braak, J. (2016). Using theoretical perspectives in developing an understanding of TPACK. In M. C. Herring, M. J. Koehler, & P. Mishra (Eds.), *Handbook of technological pedagogical content knowledge (TPACK) for educato*rs (2nd ed., pp. 33-52). New York, NY: Routledge.

Abstract: “It has been suggested that the TPACK framework, despite its successes, is under-theorized. Specifically it does not clearly specify the nature of relationship between technology and teacher knowledge. In this paper we bring together three theoretical perspectives to advance our understanding of TPACK and how it can be developed. Specifically, we use philosophy of technology as a lens to develop a deeper conceptualization of what we mean by technology and its relationship to us. We follow that with insights from the theory of situated cognition to developing a rich understanding of TPACK as a form of teacher knowledge. Finally, we integrate these two approaches by positioning teaching as a design science thus providing a context for the idea of learning TPACK by design. Through this we seek to elaborate and provide a foundation for the active and constructive role played by the teacher in the successful integration of technology.” (Prepublication version)

Wang, A. Y. (2016). The impact of digital storytelling on the development of TPACK among student teachers in Taiwan. In M. C. Herring, M. J. Koehler, & P. Mishra (Eds.), *Handbook of technological pedagogical content knowledge (TPACK) for educato*rs (2nd ed., pp. 297-308). New York, NY: Routledge.

Abstract: “Digital storytelling appears to be a feasible tool for developing Technological, Pedagogical and Content Knowledge (TPACK) among future teachers in the domain of language arts. This chapter describes quasi-experiment empirical research that observed the development of English language TPACK among student teachers in an EFL context. Data collected from the 58 participants included the pretest and posttest scores of a TPACK survey,

open-ended questions in the survey, and digital assignment files. The chapter concludes that digital storytelling had important impact on the development of TPACK, and suggests English TPACK research and practices in EFL contexts." (Prepublication version)

Yeh, Y.-F., Hsu, Y. S., Wu, H.-K., & Chien, S.-P. (2015). A rubric for science teachers' TPACK: Evaluating teachers' analytical comments to video-based questionnaire. In M. S. Khine (Ed.), *New directions in technological pedagogical content knowledge: Multiple perspectives* (pp. 267-286). Charlotte, NC: Information Age.

Abstract: None

Yelken, T. Y., Konokman, G. Y., & Sancar Tokmak, H. (2015). A survey study characterizing Turkish prospective primary school teachers' TPACK competencies. In M. S. Khine (Ed.), *New directions in technological pedagogical content knowledge: Multiple perspectives* (pp. 339-356). Charlotte, NC: Information Age.

Abstract: None

3. Recent TPACK-Related Dissertations and Theses

Chewning, R. (2015). *Secondary English teachers' dispositions toward technology integration in one-to-one environments* (Doctoral dissertation). Available from ProQuest Dissertations and Theses Global database. (UMI No. 3745350)

Abstract: "This study examined how high school English teachers define technology integration and how teacher beliefs regarding technology integration impacts teacher and student use of digital technologies for instructional purposes. Thirty-nine teachers from three high school English departments in their initial year of a one-to-one device implementation participated in this study. Qualitative and quantitative data were collected and analyzed to examine how high school English teachers define technology integration and to examine if teacher beliefs informs technology integration practices. Quantitative data included the use of the TPACK formative assessment tool and an instructional technology use survey. Qualitative data included open-ended survey questions, interviews, and observation notes. Analysis of the qualitative data identified five themes as to what it means to teachers in their first year of a one-to-one device implementation program to integrate technology into their instructional practices. The potential impact of professional development on teachers' reported TPACK scores, as well as the reported frequency of technology use by teachers and students are discussed."

Damick, J. M. (2015). *Implementing technology in an algebra classroom* (Master's thesis, College at Brockport). Retrieved from http://digitalcommons.brockport.edu/cgi/viewcontent.cgi?article=1629&context=ehd_theses

Abstract: "The drive to place technology in the secondary mathematics classrooms has been on the rise and has shown overtime to improve learning outcomes. How to support teachers with the implementation of technology in the midst of the Common Core State Standards (CCSS) reform and teacher accountability is important. This thesis provides varied use of technology along with different technological instructional strategies for an Algebra I course. Presenting technological pedagogical content knowledge (TPCK) in the Algebra I context can support teachers' implementation of technology into their instruction."

Fontanilla, H. S. (2016). *Comparison of beginning teachers' and experienced teachers' readiness to integrate technology as measured by TPACK scores* (Doctoral dissertation). Available from ProQuest Dissertations and Theses Global database. (UMI No. 3740148)

Abstract: "Despite a growing awareness of the importance of technology in education, increased investment and attention to preparing teachers to integrate technology into the classroom, research shows that technology continues to fail to live up to its potential for transforming education. As schools move from standards based testing to implementation of the Common Core State Standards, an expectation exists that teachers will be using technology to transform their teaching practices. There is also an expectation that schools are providing students with 21st century skills, including the use of technology. In exploring the reasons teachers are not using technology effectively, much of the research focuses on teacher beliefs. One of the biggest barriers identified by the research is that teachers lack confidence in their own abilities to use technology. Because younger teachers are more comfortable with the use of technology, there is an assumption that new teachers will be better equipped to integrate technology. The purpose of this study was to use the Technological Pedagogical and Content Knowledge (TPACK) framework to compare the readiness of beginning teachers to integrate technology with the readiness of experienced teachers. The survey, measuring their knowledge in the different TPACK domains, was administered to teachers within six school districts in Contra Costa County, CA. The results of the survey were then analyzed to examine the differences between the TPACK scores of beginning teachers and those of more experienced teachers. The study found that there was a negative correlation that was statistically significant between years of teaching experience with technology knowledge, and a positive correlation that was statistically significant in the TPACK domains of content knowledge, pedagogy knowledge, and pedagogical and content knowledge. The data also showed that there was a significant difference in the TPACK scores of beginning teachers and experienced teachers in the TPACK domains of technological knowledge, content knowledge, pedagogical knowledge, and pedagogical content knowledge. Finally, the data showed that there were significant differences in the correlations between TPACK scores of beginning teachers and experienced in some but not all of the TPACK domains."

Memon, M. (2015). *An investigation of primary school teachers' technological pedagogical content knowledge in district Matiari, Sindh* (Master's thesis, Aga Khan University). Abstract retrieved from http://ecommons.aku.edu/theses_dissertations/660/

Abstract: “This work purported to investigate the 'technological pedagogical and content knowledge' of public and private primary school teachers in district Matiari, Sindh. Quantitative data were gathered through a cross-sectional survey with a sample of 97 teachers teaching at primary level in district Matiari. TPACK survey instrument by Schmidt et al. (2009) was used after translation into the national nomenclature, i.e., Urdu and the local language of Sindh, i.e., Sindhi to fit the milieu of Sindh. Data was analysed using descriptive statistics, correlation and MANOVA. The survey discovered that teachers rated themselves higher on TPACK while in the sub domains of TPACK, they received the highest scores in 'Pedagogical Knowledge' (PK). All teachers generally scored lowest in 'Technological Knowledge' (TK) and 'Technological Content Knowledge' (TCK). A comparative analysis was executed between the two groups of the teachers and it was found that teachers from government schools scored more than their counterparts from the private sector. From a gender position, female primary school teachers scored more than their counterparts and female teachers from private school scored higher than their male counterparts as well as teachers from public school.”

Omohundro, T. (2015). *First-year secondary teachers’ perceptions of their preparedness to integrate 21st century skills into the technology-rich classroom*. (Doctoral dissertation, Virginia Commonwealth University). Retrieved from http://scholarscompass.vcu.edu/etd/4047/

Abstract: “School districts continue to integrate emerging technologies and expectations for 21st century teaching and learning. This movement began with release of Goals 2000 (1994) and has continued through National Education Technology Plan (2010) that noted the challenge for our education system is to leverage technology to create relevant learning experiences that mirror students’ daily lives and the reality of their futures. In order to meet that challenge, schools must enlist teachers who are prepared to teach 21st century skills in the technology-rich classroom. Teacher education programs also need to align their preparation models to prepare teachers for that challenge. There are a variety of models – stand-alone instructional technology courses, online courses, content methods courses, practicum and student teaching experiences used to achieve this. Several grant programs provided financial support in the early 21st century to help institutions implement new models of instruction for preservice teachers. Also, several frameworks emerged to guide classroom instruction as teachers implemented 21st century skills into technology-rich classrooms. The purpose of the current study was to understand teachers’ perceptions of their preparedness to teach 21st century skills in the technology-rich classroom.

The study was driven by research questions which sought to understand (a) teacher preparation models in the areas of technological, pedagogical, and content knowledge, (b) teachers‘ perceptions of their teacher education programs effectiveness for teaching 21st century skills in the technology-rich classroom, (c) teachers‘ feelings of efficacy and self-confidence for first-year implementation, and (d) if relationships exist between particular teacher preparation models and teachers‘ perceptions of effectiveness and adequacy. A mixed method design was used to explore the research questions. Twenty-nine first-year high school teachers in a technology-rich school district with a framework for 21st century skills integration

participated in a survey. Six teachers participated in follow-up focus groups at the end of their first-year of teaching. The researcher used quantitative analysis for the survey and qualitative coding for the focus group interviews. The two analyses were reported together to develop findings in response to the research questions."

Ozden, S. Y. (2015). *Designing and validating a survey to measure technological, pedagogical, and content knowledge among pre-service teachers.* (Doctoral dissertation). Available from ProQuest Dissertations and Theses Global database. (UMI No. 3730255)

Abstract: "This Executive Position Paper (EPP) presents the development of a survey to measure pre-service teachers' Technological Pedagogical Content Knowledge (TPACK). The survey was designed considering the transformative approach to the TPACK framework and was developed and vetted by professionals in the field. It was administered to 124 pre-service teachers within the context of an educational technology course at a Mid-Atlantic University. In order to investigate the construct validity and reliability of the survey, an exploratory factor analysis (EFA) was conducted. EFA results revealed a two-factor solution: Knowledge of Technology and Knowledge of Teaching with Curriculum Based Technology. The findings of this EPP provide support for the transformative approach to examining TPACK and suggest that pre-service teachers perceive TPACK as a unique body of knowledge as described in the transformative approach. Findings provide implications for researchers and teacher educators."

Urbina, A. C. (2015). *Access and barriers: Technological pedagogical content knowledge in elementary mathematics.* (Thesis, University of North Carolina, Charlotte). Retrieved from http://honorscollege.uncc.edu/sites/honorscollege.uncc.edu/files/media/docs/Urbina,%20Angela%20-%20Layperson%20Summary.pdf

Abstract: "While research has shown that there are effective ways to integrate technology, few have expressed the ways in which elementary teachers have been able to overcome the barriers that exist, effectively implement technology in their math instruction, or provide an explanation for their decision-making processes. This study serves two purposes. First, I will examine the ways that teachers overcome barriers and find ways to effectively implement technology in elementary math classrooms. Second, I will also look at the ways in which technology integrated instruction in elementary classrooms meets the TPCK criteria. I will use the following questions to guide my research. What are the ways in which elementary teachers are able to overcome the existing barriers, adapt their content knowledge, and adapt their instructional strategies, in order to implement technology in their math classrooms? In what ways do elementary teachers purposefully integrate technology in their math curricula? How do they decide which technology works best? How does TPCK guide their decision-making? What systematic issues and barriers influence teachers' decisions?"

Weatherford, B. M. (2015). *The preparation of preservice teachers for integrative technology use*. (Doctoral dissertation). Available from ProQuest Dissertations and Theses Global database. (UMI No. 3741538)

Abstract: “Technology use continues to be an integral component of 21st-century education. Educational leaders and teachers are tasked with using technology as an approach to forge new ways of thinking, effectively connecting educational content with real-world understanding. This new era of technology-driven teaching and learning includes new skill development and applications of 21st-century technology concepts. The use of technology within educational practice is critical, and understanding how to best prepare future educators for effective technology use will impact future generations of learners. The technological, pedagogical, and content knowledge (TPACK) framework supports educators with effectively integrating technology into their teaching as a way to deepen understanding and mastery of the subject matter. Teacher education programs need to adequately prepare future teachers for effective technology integration into the classroom, as well as to address the gap that exists between future teachers and 21st- century teaching and learning practices. The literature supporting this study examined 21st-century skills and learning, the TPACK framework, and actions currently taking place within teacher education programs supporting technology integration into the teaching and learning environment. This study was a mixed-methods design, including survey responses and focus group interviews. Data were collected from one university and analyzed via the lens of the literature and the theoretical framework of phenomenology. Research findings included preservice teacher candidates feeling adequately prepared for technology integration, based on a combination of preservice teachers’ prior knowledge and the preparation and organization of the university faculty. The use of informal mentoring proved important for validation and support of technology use in the teaching and learning environment, and the value of face-to-face instruction for the learning, acquisition, and use of digital tools and resources surpassed digital instruction. Areas for future research include longitudinal studies at multiple universities, the use of the TPACK framework within university-level programs for the instruction of pedagogy and methods courses, single standalone technology course versus an integrative approach to teaching and instruction at the university level, and university partnerships for facilitating and supporting best practices toward technology use for effective 21st- century teaching and learning.”

4. Recent TPACK Presentations

Alqallaf, N., & Williams, M. (2015, October). *Teachers’ perception about their competency in integrating technology in elementary classrooms using the technological pedagogical content knowledge framework (TPACK)*. Paper presented at the World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education, Kona, HI.

Abstract: “Teachers realize the importance of technology to promote enhancement in the transferring content knowledge. The problem exists around the effectiveness from integrating technology in educational context. Thus, understanding teachers’ perception about their ability to sufficiently integrate new technology such as digital white board is significant for their teaching effectiveness. Therefore, the purpose of this study is to examine teachers’ perception about their ability to effectively integrate digital white board technology in elementary classroom in public school under the technological pedagogical content knowledge framework

(TPACK). The participants of this study were 71 teachers from public schools in Colorado. The study's results indicated that there are no relationships between teachers' demographics (i.e., gender, age, and teaching experience) with teachers' TPACK perceptions."

Dinh, H., Jordan, K., & Elsden-Clifton, J. (2015, June). *Measuring TPACK in Vietnam: Issues still remain.* Paper presented at the World Conference on Educational Media and Technology, Montreal, Quebec.

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."

Eren, B., & Alkan, V. (2015, November). *Investigation of the relations between pre-service teachers' technological pedagogical content knowledge and web pedagogical content knowledge by structural equation modeling.* Paper presented at the 7th International Conference of Education, Research and Innovation, Seville, Spain.

Abstract: "The aim of this study is to examine the relations between the pre-service teachers' self-perception of technological pedagogical content knowledge (TPACK) and self-perception of web pedagogical content knowledge (WebPACK). On the respect of this aim, there has been constructed a structural equation model according to the literature reviews, and model was tested and examined for the goodness of fit indices. It is hoped that the findings of the study is going to give a general idea to the education implementers about the classroom applications of those variables; and lead the researchers about future studies.

This research is a correlational survey model. The research group of this study was 453 education faculty students at the beginning of the research. Because of the assumptions of the applied statistical method, structural equation modeling, the number of research group decreased to 342. As data collection tools, WebPACK Scale which is adapted to Turkish by Horzum (2011) and TPACK Scale which is adapted to Turkish by Şahin (2011) were used. To examine the relations between the variables, before the main analysis of the structural equation modeling, the assumptions of the analysis were checked by using SPSS 20.0 computer program. After all the assumptions were met, the main analysis to evaluate the constructed model was done by using LISREL 8.7 computer program.

Findings of the research shows that Tpack effects WebPack positively and TPACK explains 31% of the variance in WebPack. When TPACK and the path coefficients of other factors examines, the highest coefficient is found as .93 with the factor of technological content knowledge.

When WebPack and the path coefficients of other factors examines, the highest coefficient is found as .87 with the factor of pedagogical web knowledge. In addition, all t-values belongs to path coefficients of the model were found as significant ($p<.05$), so there was no need to do any modification about the paths in the model. The modification indices of the model show that the model has high goodness of fit indices. At the end of this study, the results show that in the area of education in order to increase the web pedagogic content knowledge perception of teacher candidates in a positive way, pre-service education need to be supported with more technology integrated pedagogical content knowledge courses."

Fang, F. (2015, October). *Designing a tool to support teachers with the TPACK framework.* Paper presented at the World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education, Kona, HI.

Abstract: "As intended by Mishra and Koehler (2006), the TPACK framework has value in supporting teachers in teaching practices. However, it has been used primarily for teacher educators and researchers. Answering the call for a broader use of the TPACK framework (Brantley-Dias & Ertmer, 2013), this work describes an in-progress project to design a tool that uses TPACK framework to support teachers in teaching practices. The tool supports teachers' metacognition and self-evaluation with a checklist and an embedded assessment. Building on two highly complementary instruments, the checklist covers both understandings of the framework and teaching artifact analysis. Especially, the checklist's use in teaching practices brings context-specific environment, which is considered valuable for relieving many critics on the two instruments. The embedded assessment presents graphic visualizations and tracks progresses for individual teaching practices. Restrictions are also discussed."

Juniu, S., Scrabis-Fletcher, K., Zullo, E., & Russo, D. (2015, October). *Relationship between pre-service teachers' level of technology integration and technological pedagogical content knowledge (TPACK) in physical education teacher education programs.* Paper presented at the World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education, Kona, HI.

Abstract: "Physical education teacher education (PETE) programs have become responsible for creating opportunities for PETE candidates to utilize technology within their classes. Research has shown that the more exposure to technology the greater the affinity for implementing it. This study examined pre-service PE teachers' beliefs about, and implementation of technology in their classes in an effort to assess which methods of instruction about technology might provide the greatest learning. The data analyses revealed that there is a significant association between the amount of TPACK pre-service teachers perceived having, and the technology that physical PETE faculty modeled including various methods for implementation. These results are supported by 50% of the students' agreeing that over 60% of the PETE faculty provide an effective model of combining content, technologies, and teaching approaches in their teaching."

Oyanagi, W. (2015, October). *A study on building capacity for pre-service teachers regarding technological pedagogical content knowledge (TPACK).* Paper presented at the 10th East Asia International Symposium on Teacher Education, Nagoya, Japan. Retrieved from http://www.cie.aichiedu.ac.jp/icues2015/files/proceedings/151101g1_8.pdf

Abstract: "It has been thought that "Pedagogical Content Knowledge (PCK)"is important to acquire and improve teaching skills. However, recently, teachers are required to improve students learning skills through ICT, too. When designing such learning that recognizes its quality and deepening including use of ICT, etc., for example, a wider range of skills will be required of teachers. Thus, teachers are also required for enhancement of "Technological Pedagogical Content Knowledge (TPACK)." Therefore, it is believed that it is necessary for preservice teacher students to get opportunities to learn TPACK in the period of the teacher training. This presentation reports that we explored the way for analyzing and assessing changes of TPACK of preservice teacher students during practicum by using MindMap. And this study aimed at expressing clearly the terms and environment which would benefit having TPACK in the guidance programs for preservice teacher students. The trial program then aims to obtain clues to program preparation related to the process of pedagogical content knowledge concerning technology during actual student practice in the training process (practicum) through analysis of the details of these changes and the conditions and the environment that caused them."

Philipsen, B., Tondeur, J., & Zhu, C. (2015, October). *Using TPACK to examine teacher professional development for online and blended learning*. Paper presented at the European Conference on E-Learning, Hatfield, UK.

Abstract: "Given the current rise of educational technology, more and more teachers are able to deliver their courses partially or fully online. This demands a new way of looking at teaching and learning, and raises many questions (e.g. how to become an online teacher). Therefore, many institutions and professionals try to meet such demands by offering professional development initiatives, aiming to provide teachers with new knowledge, skills, and attitudes towards teaching in an online setting. The technological, pedagogical, and content knowledge (TPACK) framework provides meaningful insights into teachers' necessary knowledge requirements for technology integration. Using the TPACK framework, this paper presents an overview and first analysis of the emphases placed by different teacher professional development approaches. This study will investigate the teacher professional development approaches of research articles by conducting a content analysis of each article, and by comparing the teacher professional development approaches. The analysis consists of sorting the textual data into different categories, and identifying different patterns and themes, which will be held against the TPACK framework. This is done for each individual study (within-case analysis) and between the studies (cross-case analysis). Furthermore, the initial results of this study will be discussed and the first recommendations for future research and practice will be formulated. Moreover, the results can be beneficial for practitioners involved in teacher professional development with regard to online and blended learning, to guide the design,

development, implementation, and evaluation of a professional development approach. Therefore, the findings of this article can be of use to teachers, institutions, and professionals who wish to gain more insight into the current trends of existing professional development approaches, and provide them with a more thorough understanding of the initiatives that support teachers to become effective in online and blended learning. Further research could investigate if there is a link between the addressed TPACK elements in a teacher professional development approach and the retained results."

Yi, J., Choi, J., & Lee, Y. (2015, October). *A survey on the perceptions of South Korea elementary school teachers' competency about technology, pedagogy, and content knowledge (TPACK).* Paper presented at the World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education, Kona, HI.

Abstract: "This research analyzed investigation by collecting 140 elementary school teachers' response through survey based on google web from June to July 2015 for seeing the point in time standard by researching and analyzing elementary school teacher recognition of TPACK competency. According to the research, the average recognition of TPACK competency was shown 3.72. The average for PCK was 3.81, and TPACK was 3.68. From the subsection, TPCK had the lowest standard by having average of 3.43. This shows that Korean elementary school teachers have to put effort in personally and socially to let the technology and pedagogy content knowledge influence dynamically together, and to increase competency to synthesize generally."

5. 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.). (2016, February 23). TPACK newsletter issue #26: February 2016 [Electronic mailing list message]. Retrieved from http://www.matt-koehler.com/tpack/tpack-newsletters/

6. 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/
- Subscribe to the tpack.research, tpack.teaching, tpack.grants and/or tpack.future discussion lists at: http://site.aace.org/sigs/tpack-sig/
- 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.news FirstName LastName (of course, substituting their own first and last names for 'FirstName' and 'LastName' — unless their name happens to be FirstName LastName, 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

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Candace Figg,	Rocking Chair, Brock University
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