TPACK Newsletter, Issue #34: October 2017

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

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

Gratuitous Quote About Knowledge

"Knowledge is an unending adventure at the edge of uncertainty."
- Jacob Bronowski

In This Issue

1. TPACK Newsletter Update

The TPACK Newsletter has been published via the tpack.news email list since January 2009. It has 1195 subscribers currently. Subscription numbers have held steady (+ or – 1% to 3%) since October 2011.

Below are recent TPACK publications that we know about: 46 articles, 4 chapters, 1 book, 1 special issue of a journal, and 19 dissertations or theses that have not appeared in past issues of this newsletter. If you know of others that were published within the past several months, please let us know at: tpacknews.editors@wm.edu. (You can check to see if a particular TPACK publication has already appeared in previous issues of this publication by viewing past TPACK Newsletters here: http://activitytypes.wm.edu/TPACKNewsletters/index.html.)

2. Recent TPACK Articles, Chapters, Books, and Journal Special Issue

Articles

Adam, A. (2017). A framework for seeking the connections between technology, pedagogy, and culture: A study in the Maldives. *Journal of Open, Flexible and Distance Learning*, *21*(1), 35-51. Retrieved from https://www.researchgate.net/publication/318119664

Abstract: "Educational technology researchers have often overlooked the effect of culture on teachers' use of digital technologies in their pedagogical practice. Several technology integration models, such as the Technology Adoption Model (TAM) and Technological, Pedagogical and Content Knowledge (TPACK), have also failed to explain the connections between technology, pedagogy, and culture. This paper argues that teachers' pedagogical and technological practices cannot be fully understood without considering the social and cultural norms of their specific cultures. An ethnographic methodology, linked to Bourdieu's (1977) habitus, is used to explore teacher educators' practices in the Maldives. The author uses interviews, observations, focus groups, and the hanging-out approach to gather data from eleven teacher educators who work in a Maldivian university. Key findings demonstrate that teacher educators' pedagogical and technological practices are influenced by their own culture, their early learning experiences in the Maldives, and their workplace (institutional context). Through this finding, the paper proposes a framework; namely, Pedagogical and Technological Cultural Habitus (PATCH), for understanding teachers' pedagogical and technological habitus in various contexts. The PATCH framework provides a theoretical basis for designing technology-oriented professional development for professionals in various pedagogical contexts, including virtual and blended pedagogical spaces. It also contributes to the TPACK framework by adding an outer layer to its current theorisation to represent teachers' backgrounds and habitus when examining their practices."

Agrati, L.S. (2017). Contenuti digitali e pratica di insegnamento: Lo studio di caso di un repository di scuola superiore di II grado. *Annali online della Didattica e della Formazione Docente, 9*(13), 195-213. Retrieved from http://annali.unife.it/adfd/article/view/1428

Abstract: "Technological resources offer indisputable opportunities to teachers who want to renew the contents and strategies of their teaching and provide students' active learning processes. An example for everyone is the thematic repository of digital educational content that can be used with active methodologies such as flipped classroom and inquiry-based learning (Bergmann & Sams, 2012; Strayer, 2012; Huang & Chiu, 2015). As suggested by the descriptive model of Technological Pedagogical Content Knowledge – TPCK (Harris, Mishra, & Koehler, 2009; Koehler, Mishra, & Yahya, 2007), all this requires the teacher to rethink the relationship with his knowledge and students themselves (Charlot, 1997, Vincent & Carnus,

2015) as well as a new type of knowledge that specifically deals with the choice and use of digital content, their re-elaboration and protection from the legal point of view. The contribution, retrieving the reflections from the TPCK model, calls for a discus- sion on the type of technological knowledge required today to the teacher for a 'wise use' (Jenkins, 2010, Ri-voltella, 2013) – but also an effective and 'legal' – of digital resources. Through a case study – based on the analysis of a thematic repository in use in a High School of Bari province – will be highlighted, in their didactic implications, aspects such as the computer security, the intellectual property of digital resources by teachers and by others, the access/use by students."

Agustin, R.R., & Lilisari, L. (2016). Pre-service science teachers' readiness to integrate technology (an exploration toward TPACK in preliminary practical context). *Jurnal Pengajaran Matematika dan Ilmu Pengetahuan Alam, 21*(2). doi:10.18269/jpmipa.v21i2.830

Abstract: "The purpose of this study was to capture pre-service science teachers' Technological Pedagogical Content Knowledge (TPACK) that is demonstrated during preliminary practical context in term of peer teaching program- a course conducted prior to teaching practice. Ten pre-service science teachers were involved in a semester long peer teaching program. Descriptive method was employed with the use of teaching artifacts, observation and self-reported survey for representing the way the participant integrate technology into their teaching. TPACK constructs were defined using relevant literature as frameworks. This study found that TPACK of pre-service science teachers were still low and is not sufficient for teaching science in junior high school. Furthermore, it is needed several supporting program to prepare pre-service science teachers' competencies in teaching science with technology. In this case, more sophisticated peer teaching program with better purchase is necessity to improve TPACK competencies of pre-service science teachers."

Arar, K., & Abramovitz, R. (2017). Teacher-related factors in assimilation of technological change in schools: The case of an Arab school in Israel. *International Journal of Educational Management*, *31*(6), 766-779. doi:10.1108/IJEM-03-2016-0057

Abstract: "The purpose of this paper is to explore teachers' attitudes toward the implementation of new computer technology to improve teaching and learning products at a private Arab school in Israel. Specifically, the aim was to individuate teachers' factors associated with higher productivity of this technological change."

Awaited, N., Alkandari, A., & Alhashem, F. (2017). Exploring in-and pre-service science and mathematics teachers' technology, pedagogy, and content knowledge (TPACK): What next? *Eurasia Journal of Mathematics, Science and Technology Education, 13*(9), 6113-6131. doi:10.12973/eurasia.2017.01053a

Abstract: "The call to reform education systems is being heard in many countries around the world. The purpose of this study is to develop and apply a framework that captures some of the

essential qualities of the knowledge required by teachers for effective pedagogical practice in a technology-enhanced educational environment using technology and pedagogy content knowledge (TPACK). A TPACK Short and Quick (TPACK-SQ) survey questionnaire was used to explore and assess 244 in- and pre-service science and mathematics teachers in Kuwait. The results of the survey showed that in-service teachers needed help with some aspects of TPACK. Therefore, a workshop was developed and 57 in-service teachers were enrolled and trained based on the TPACK-SQ model. The results of posttests for their knowledge were significantly positive as against pretests. The workshop thus provides a rich example of how to support the implementation of essential elements of the TPACK-SQ model."

Baran, E., Canbazoglu Bilici, S., Albayrak Sari, A., & Tondeur, J. (2017). Investigating the impact of teacher education strategies on preservice teachers' TPACK. *British Journal of Educational Technology.* Advance online publication. doi:10.1111/bjet.12565

Abstract: "The purpose of this study was to examine preservice teachers' perceptions of the support their teacher education programs provide for developing their technological pedagogical content knowledge (TPACK). The research was conducted with 215 preservice teachers in the last year of teacher education programs and teaching certificate programs in three universities in Turkey. Data sources were the synthesis of qualitative evidence (SQD) scale that was validated in the Turkish context as part of this study and the TPACK-practical scale. The strategies investigated in the SQD-model included: using teacher educators as role models; reflecting on the role of technology in education; learning how to use technology by design; collaboration with peers; scaffolding authentic technology experiences; and providing continuous feedback. The linear regression analysis revealed a positive relation between teacher education strategies and preservice teachers' TPACK. Reflection and teacher educators' as role models were the most frequently used teacher education strategies in teacher education programs included in this study. Results provided recommendations for further research on the connection between the teacher education strategies and the development of preservice teachers' TPACK in teacher education programs."

Bull, G., Spector, J. M., Persichitte, K., & Meier, E. (2017). Preliminary recommendations regarding preparation of teachers and school leaders to use learning technologies. *Contemporary Issues in Technology and Teacher Education, 17*(1), 1-9. Retrieved from https://www.learntechlib.org/p/178221

Abstract: "A national symposium on the role of efficacy research in the development, adoption, and implementation of educational technology will take place in 2017. The Educational Technology Efficacy Research symposium represents the culmination of a year-long collaboration among stakeholders: academic researchers, entrepreneurs, school district and university leaders, investors, philanthropists, K-12 teachers, and college professors. This work is motivated by a belief that technology has unmet potential to improve student outcomes. The goal is to move efficacy to the center of the discourse concerning technology in education and, in doing so, create pathways for innovations that work to scale and make an impact. Ten working groups are investigating the role of efficacy research. This is a report of the initial

efforts of Working Group E, which is investigating the knowledge and competence that faculty members and leaders in educational institutions need to possess with respect to learning technologies in order to prepare competent teachers and school leaders, given the expectation that technologies and societal priorities are likely to change."

Chai, C.S., Tan, L., Deng, F., & Koh, J. H. L. (2017). Examining pre-service teachers' design capacities for web-based 21st century new culture of learning. *Australasian Journal of Educational Technology, 33*(2), 129-142. doi:10.14742/ajet.3013

Abstract: "Although there is an established body of work arguing that teachers' technological pedagogical content knowledge (TPACK) is necessary for designing ICT-integrated lessons, little is known about the relationships among teachers' beliefs about learning, their design dispositions, learning design practices and TPACK. Critical inquiry in this aspect is timely as a new culture of learning is emerging from the informal contexts of learning and challenging how school-based learning should be designed to foster 21st century competencies. In this study, a survey instrument was developed to assess and investigate the relationships among pre-service teachers' beliefs about the new culture of learning and school-based learning, their design dispositions, learning design practices and relevant factors of TPACK. Based on the sample size of 223 pre-service teachers in Singapore, the validation shows that the relevant factors pertaining to TPACK, teachers' beliefs and design were distinctive. The study shows that teachers' beliefs about learning and their design capacities changed along with their TPACK efficacy. It also identified factors that might affect teachers' competencies needed to design lessons that could cultivate a new 21st century culture of learning. Implications of the relationships among teachers' beliefs about learning, their design capacities and TPACK to foster 21st century competencies are discussed."

Ciptaningrum, D. S. (2017). The development of the survey of technology use, teaching, and technology-related learning experiences among pre-service English language teachers in Indonesia. *Journal of Foreign Language Teaching & Learning, 2*(2), 11-26. Retrieved from http://journal.umy.ac.id/index.php/FTL/article/view/3209

Abstract: This study aims to design a survey instrument that can be used to collect information on the relationships between the ICT-related learning experiences of the English language pre-service teachers in Yogyakarta, Indonesia, and their technological pedagogical content knowledge (TPACK). Qualitative and quantitative research methods were used to analyse the degree of the reliability and validity of the instrument. The result suggests that this instrument meets the general requirements to be used in a larger scale of work in investigating the role of pre-service teachers' experiences in learning to use ICT in their pedagogical practice in influencing the development of their TPACK.

Coskun-Setirek, A., & Tanrikulu, Z. (2017). Technological sustainability of mobile learning. *The Online Journal of Science and Technology, 7*(3), 89-97. Retrieved from http://www.tojsat.net/journals/tojsat/articles/v07i03/v07i03-14.pdf

Abstract: "This study aims to investigate and improve factors affecting technological sustainability of m-learning. In addition to literature review, an investigation based on interviews was conducted with 11 heads and systems experts of distance education centers to obtain the technological sustainability factors of m-learning. In order to understand the significance of these factors on m-learning sustainability, another investigation based on survey research was conducted with 75 system staffs from the universities which have m-learning facilities. The data analyzed and evaluated for a technological sustainability model of m-learning. The study may provide guidelines to m-learning initiatives for a sustainable mobile learning."

Dalal, M., Archambault, L., & Shelton, C. (2017). Professional development for international teachers: Examining TPACK and technology integration decision making. *Journal of Research on Technology in Education, 49*(3-4), 117-133. doi:10.1080/15391523.2017.1314780

Abstract: "This mixed-methods study explored the impacts of a semester-long technology professional development for secondary school international teachers from developing nations around the world. We used (a) a survey approach to examine international teachers' perceived technology integration abilities using the technological pedagogical content knowledge (TPACK) framework and (b) a design task to understand their rationale behind technology integration decisions. As a group (N = 16), international teachers reported increased abilities in all TPACK domains. Qualitative analysis of their rationales revealed that though teachers learned to consider the affordances of technology, technology access issues were pivotal in their choice and use of technology in instruction planning. With education becoming increasingly global, the study has implications for the motivation and design of technology professional development programs for international teachers."

Deng, F., Chai, C.S., So, H-J., Qian, Y., & Chen, L. (2017). Examining the validity of the technological pedagogical content knowledge (TPACK) framework for preservice chemistry teachers. *Australasian Journal of Educational Technology, 33*(3), 1-14. doi:10.14742/ajet.3508

Abstract: "While various quantitative measures for assessing teachers' technological pedagogical content knowledge (TPACK) have developed rapidly, few studies to date have comprehensively validated the structure of TPACK through various criteria of validity especially for content specific areas. In this paper, we examined how the TPACK survey measure is aligned with the TPACK lesson plan measure and how they are related to the measure of epistemological beliefs about chemistry. The participants were 280 Chinese preservice chemistry teachers enrolled in a university in China. Both exploratory and confirmatory factory analyses were performed on the TPACK survey measure to help to establish validity, including considerations for convergent and discriminant validity. This was followed by the invariance test to examine factorial validity as related to gender. To establish the predictive validity of TPACK, the relationships among teachers' epistemological beliefs, TPACK, and their capacity for planning technology-integrated lessons were also examined. Overall, the results showed that all

four types of validity looked at in this study (i.e., convergent, discriminant, factorial, and predictive) were satisfactorily established. Implications for TPACK research and teacher education are also discussed."

De Rossi, M. (2017). Methodological demands, soft skill and ICT integration. *Formazione & Insegnamento*, *15*(1), 193-204. doi:107346/-fei-XV-01-17_15

Abstract: "The attention for university didactics and its innovative and qualifying issues, is nowadays at the forefront of the educational discourse and strengthens more and more the opportunity to consider as linked the following complex constructs: methodological demands, ICT integration, and conjunct development of both hard skills (disciplinary) and soft skills (cross-disciplinary). This contribution wants to offer some reflections about methodologies for academic education from a learner-centred perspective considering, among the other factors, ICT usage as a crucial issue. As it is widely acknowledged, it is not enough to act on the level of instrumental equipment or isolated dimensions of teachers' knowledge. Instead, there is the need to foster advanced models aimed at realizing ICT integration in didactics in operative and procedural ways. Moreover, these models should go beyond the link among fundamental knowledge types (disciplinary, pedagogical, technological), to consider students' characteristics (in terms of knowledges, hard and soft skills already owned and the ones to be enhanced), and also educational context (Angeli & Valanides, 2009)."

Farrell, I.K., & Hamed, K.M. (2017). Examining the relationship between technological pedagogical content knowledge (TPACK) and student achievement utilizing the Florida value-added model. *Journal of Research on Technology in Education,* Advance online publication. doi:10.1080/15391523.2017.1328992

Abstract: "Utilizing a correlational research design, we sought to examine the relationship between the technological pedagogical content knowledge (TPACK) of in-service teachers and student achievement measured with each individual teacher's Value-Added Model (VAM) score. The TPACK survey results and a teacher's VAM score were also examined, separately, with respect to teacher attributes. Upon examination of VAM scores and teacher attributes, the subject area, the percentage of economically disadvantaged students at the teacher's school, and the grade level of the teacher were all significantly related to VAM scores. In addition, the TPACK survey results overall and its constructs were examined with teacher attributes. The significant relationships were gender, subject area, the number of certifications, highest degree held by the teacher, years teaching, and teaching in/out of area. The analysis showed no significant relationship between a teacher's VAM score and the TPACK survey overall or its individual constructs."

Harris, J., & Hofer, M. (2017). "TPACK stories:" Schools and school districts repurposing a theoretical construct for technology-related professional development. *Journal of Research on Technology and Education, 49*(1), 1-15*.* doi:10.1080/15391523.2017.1295408

Abstract: "TPACK (Koehler & Mishra, 2008), a theoretical construct that describes the knowledge that teachers use to teach with digital tools and resources, has flourished in university-based teacher education and research. Increasingly, K–12 schools and districts have also appropriated TPACK in their professional development efforts. This study of seven schools and districts explored how the TPACK construct was understood and used in these K–12 organizations. Study results revealed the importance of context and professional culture in appropriating the construct; the use of TPACK as a way to connect disparate professional development initiatives; TPACK conceptualized as applied knowledge; and how educational leaders' beliefs about professional development shape how TPACK is understood and enacted."

Harris, J., Phillips, M., Koehler, M. & Rosenberg, J. (2017). TPCK/TPACK research and development: Past, present, and future directions. *Australasian Journal of Educational Technology, 33*(3), i-viii. doi:10.14742/ajet.3907

Abstract: "Scholarship addressing technological pedagogical content knowledge (TPCK or TPACK) has examined how to develop, apply, and assess it in diverse educational settings and content areas. During the last 12 years, multiple ways to understand this knowledge and support its development have emerged, generating approximately 1,200 publications that utilise the construct, impacting the practice of postsecondary faculty, administrators, and others invested in meaningful educational uses of technology. Perhaps inevitably, TPACK's enthusiastic reception and rapid dissemination have generated multiple points of divergence, which in turn need further study; especially the construct's accurate measurement and validation; how to assist preservice and in-service teachers' TPACK development; contextual influences upon teachers' TPACK; and the relationship of TPACK-based knowledge to teachers' decision-making and action. Given the widespread diffusion of TPACK, research focusing on these and related issues will help to determine the direction of future post-secondary learning and teaching with technologies. Therefore, this special issue of AJET addresses future directions in TPCK/TPACK research and development."

Heitink, M., Voogt, J., Fisser, P., Verplanken, L., & van Braak, J. (2017). Eliciting teachers' technological pedagogical knowledge. *Australasian Journal of Educational Technology, 33*(3), 96-109. doi:10.14742/ajet.3505

Abstract: "This paper starts from the understanding that teachers' knowledge is situated, grounded in knowledge derived from formal training and from experiences in practice. Based on this understanding we examine teachers' reasoning in relation to the pedagogical choices teachers make while using ICT in practice. We argue that teachers' reasoning about pedagogy elicits their technological pedagogical knowledge (TPK). Data from 29 video cases show how elementary teachers used ICT to facilitate specific pedagogical strategies (e.g., activating learning, classroom management, dealing with diversity, fostering learning strategies). Findings indicate that teachers used ICT mostly to promote activation of learning. Many teachers reasoned about using ICT for adapting their teaching to student needs, but this was seldom observed in practice. The few teachers who showed behaviour supporting adaptive teaching and fostering learning strategies almost always used ICT to facilitate these pedagogical

strategies. We argue that for effective teaching with ICT it is important that teachers learn to reason explicitly about how ICT can support specific pedagogical strategies. The results from this study provide suggestions for what is needed in teacher education programs and professional development initiatives to support teachers in acquiring TPK."

Hunter, J. (2017). High possibility classrooms as a pedagogical framework for technology integration in classrooms: An inquiry in two Australian secondary schools. *Technology, Pedagogy and Education.* Advance online publication. doi:10.1080/1475939X.2017.1359663

Abstract: "Understanding how well teachers integrate digital technology in learning is the subject of considerable debate in education. High Possibility Classrooms (HPC) is a pedagogical framework drawn from research on exemplary teachers' knowledge of technology integration in Australian school classrooms. The framework is being used to support teachers who teach various stages of schooling to take 'pedagogical steps' in their practice with technology. This article focuses on the use of the HPC conceptual framework in a study of seven teachers and their students at two secondary schools in New South Wales, Australia. Analysis confirms the practicality of this conceptual framework for technology integration in secondary school classrooms. This inquiry has implications for addressing the reluctance of teachers to integrate technology in curriculum. The article concludes by suggesting that more schools might consider using conceptual frameworks like HPC to support secondary school teachers to enhance student learning with technology."

Incik, E., & Akay, C. (2017). A comprehensive analysis on technopedagogical education competency and technology perception of pre-service teachers: Relation, levels and views. *Contemporary Educational Technology, 8*(3), 232-248. Retrieved from http://dergipark.gov.tr/cet/issue/30468/329167

Abstract: "The main purpose of this research is to identify the competency and the perceptions of pre-service teachers on technopedagogical education. While study group of quantitative dimension is composed of 626 pre-service teachers; study group of qualitative extent is composed of 67 pre-service teachers. The sample represents 35% of the population of 1778 students. The quantitative data were collected through Technopedagogical Education Competency (Tpack-Deep) Scale and Technology Perception Scale and the qualitative data were collected with an open ended-question form. It was concluded that pre-service teachers generally regard themselves at a moderate level in the sense of technopedogogical education competency, have positive perception towards technology and there is a positive correlation between pre-service teachers' technopedogogical educational competency and perception towards technology. According to results of qualitative analysis of the study, pre-service teachers think that educational technologies have contributions to preparing information-communication technologies based upon presentations, developing technology-based materials, preparing homework, doing research, raising awareness about the importance of educational technology use in the learning and teaching process, acquiring information about

their department, developing skill of using technology based on information-communication technologies and having positive attitude."

Karatas, I., Tunc, M.P., Yilmaz, N., & Karaci, G. (2017). An investigation of technological pedagogical content knowledge, self-confidence, and perception of pre-service mathematics teachers towards instructional technologies. *Educational Technology & Society, 20*(3), 122-132. Retrieved from http://www.ifets.info/journals/20_3/10.pdf

Abstract: "Technology provides new methods and approaches for educational activities. Therefore, teachers should improve their ability and knowledge to integrate technology into instruction. The use of technology-based learning environment which is effectively used to improve the technological pedagogical content knowledge of pre-service teachers has a crucial importance for the training of pre-service teachers. In this regard, the purpose of this study is to investigate the technological pedagogical content knowledge (TPACK), TPACK related self-confidence, and perception of pre-service middle school mathematics teachers in terms of instructional technologies. In this study, TPACK Survey, TPACK Self-Confidence Survey, and TPACK Perception Survey were administered to 427 pre-service middle school mathematics teachers in elementary mathematics education program. The data were analyzed quantitatively. The data analysis revealed that there was a significant relationship between gender and perception towards technology. Moreover, it might be concluded that pre-service teachers improve their knowledge and self confidence to use technology in elementary mathematics education programs. Lastly, considering the finding that there was a relationship between the use of technology and self-confidence towards the use of technology, it might be inferred that self-confidence of pre-service teachers towards the use of educational technologies increases with the use instructional tools."

Lin, C-H., Liu, H., & Hu, Y. (2017). Technology and the education of Chinese-language teachers: Where are we now? *Journal of Technology and Chinese Language Teaching, 8*(1), 1-15. Retrieved from http://www.tclt.us/journal/2017v8n1/linliuhu.pdf

Abstract: "Technology is exerting a profound influence on the development of Chinese-language skills and on the education of teachers of that language around the world. This qualitative synthesis of quantitative and qualitative research addressed trends and gaps in the literature related to technology and Chinese-language teacher education. The three main strands of research covered were 1) technology standards in Chinese-language teacher education, 2) the actual application of technology in such education, and 3) factors predicting Chinese-language teachers' technology adoption. Three major findings emerged. First, technology standards need to recognize an urgent need to agree upon and teach specific sets of skills, as theorized in frameworks such as Technological Pedagogical and Content Knowledge (TPACK). Second, while consistent improvements in Chinese-language teachers' technology knowledge and technological-pedagogical knowledge have been reported, three other key components – i.e., training, practice and reflection – need to be better integrated into their teacher-training models. Third, two external factors (resources and support) and three internal factors (pedagogical beliefs, technology knowledge and demographics) emerged as crucial to

technology integration among these teachers. Based on these results, this review offers a series of recommendations to practitioners, policy-makers and teacher educators."

Liuk, P., Taimalu, M., & Suviste, R. (2017). Perceptions of technological, pedagogical and content knowledge (TPACK) among pre-service teachers in Estonia. *Education and Information Technologies,* Advance online publication. Retrieved from https://doi.org/10.1007/s10639-017-9633-y

Abstract: "Most countries stress that preparing quality teachers for twenty-first century students is an essential task for teacher training institutions. Besides the skills for how to teach subjects effectively, teachers should also know how to integrate digital technology into their teaching. Several studies have been done based on the TPACK framework. Some of these studies use this framework for specific subject domains. In this study a generally applicable instrument for measuring TPACK was created. The aim of the paper was to validate the created instrument and to find out how pre-service teachers perceive their technological, pedagogical and content knowledge regarding the TPACK framework in Estonia, in a technologically highly developed country where technology is broadly used in general education. Conducting factor analysis all items with technology merged into one factor meaning that young generation perceives technology already integrated with content and pedagogy. The results indicate that pre-service teachers lack pedagogical knowledge, but they perceive that they are good at integrating technology into their teaching. Differences in perceptions were also found according to gender, age and curricula."

Mourlam, D. (2017). Preparing for infusion: Emergence of a model for faculty TPACK development. *Journal of Technology and Teacher Education, 25*(3), 301-325. Retrieved from https://www.learntechlib.org/p/177836/

Abstract: "As technologies have become ubiquitous in society and within higher education, institutions have begun to invest in the development of faculty to leverage digital technologies during their instruction. This has been especially true in teacher education programs where standalone educational technology courses have been eliminated in favor of an infusion model where candidate TPACK development occurs throughout the entire teacher education program of study. However, faculty development experiences do not always support the development of faculty knowledge in ways that support the dynamic interactions among content, pedagogy, and technologies that is needed to effectively teach with digital tools. In response to this gap in the field, using a mixed method approach this study sought to characterize a faculty development experience grounded in both TPACK and adult learning theory that was guided by a faculty developer. Findings suggest faculty found value in the ongoing nature of the development experience, and valued faculty developer support in meeting their goals. Findings also indicated that both participating faculty and teacher education candidates enrolled in their courses both had increases in their TPACK. Implications are discussed within the context of teacher education and faculty development opportunities in higher education."

Mouza, C., Yang, H., Pan, Y-C., Ozden, S. Y., & Pollock, L. (2017). Resetting educational technology coursework for pre-service teachers: A computational thinking approach to the development of technological pedagogical content knowledge (TPACK). *Australasian Journal of Educational Technology, 33*(3), 61-76. doi:10.14742/ajet.3521

Abstract: "This study presents the design of an educational technology course for pre-service teachers specific to incorporating computational thinking in K-8 classroom settings. Subsequently, it examines how participation in the course influences pre-service teachers' dispositions and knowledge of computational thinking concepts and the ways in which such knowledge can be combined with content and pedagogy to promote meaningful student outcomes. Data were collected from a self-reported survey and case reports focusing on the design, implementation, and outcomes of computational thinking related lessons in K-8 classrooms. Results indicated that the course positively influenced pre-service teachers' knowledge of computational thinking concepts, tools, and practices. Yet, some participants demonstrated only surface understanding of computational thinking and were unable to design lessons that meaningfully integrated computational thinking concepts and tools with disciplinary content and pedagogy. Findings have implications for the design of teacher education experiences that help prepare pre-service teachers develop technological pedagogical content knowledge in relation to computational thinking concepts and practices."

Mumuni, A. A. O., & Aderonmu, T. S. B. (2017). Integration of mobile technology for science teaching in Port Harcourt metropolis. *Reiko International Journal of Science and Technology Research, 8*(1), 17-30. Retrieved from https://www.researchgate.net/publication/317585733_INTEGRATION_OF_MOBILE_TECHNOLOGY_FOR_SCIENCE_TEACHING_IN_PORT_HARCOURT_METROPOLIS

Abstract: "The revolutionization brought by mobile technology (m-technology) in the process of communication, interactions, access and transmission of knowledge in all endeavour of life, especially in the enterprise of science teaching cannot be ignored for its dynamic value. Science teachers' integration of mobile technology for science teaching was investigated in Port Harcourt metropolis. A sample size of 150 science teachers (50 biology, 50 chemistry and 50 Physics teachers) used were obtained through stratified random sampling technique from 36 Secondary Schools (8 Government and 28 Private Secondary Schools) in Port-Harcourt Metropolis. Data collecting instrument was titled "m-technology Integration Questionnaire for Science Teachers" (MIQST) designed to diagnose science teachers m- technology devices utilization in instruction, extent of integration of in- built app, on- line science resources, on-line net-work platform and barriers to usage. The instrument was validated by experts in computer science, educational technology, science educators and test and measurement. Test-re-test was used to obtain data for the reliability and a reliability coefficient index of 0.78 was gotten using Person Product Moment Correlation statistics. Five research questions and two hypotheses which guided the study were answered and tested with percentage, mean, standard deviation (SD) and analysis of variance (ANOVA). The findings reveal that out of the 150 science teachers, 141 (94.0%) of them own m- technology devices that are internet enabled while 9(6.0%) do not own m-technology internet enabled device; 48.9% of science teachers use

m-technology in-built apps for teaching science; Only 10.2% science teachers use Online Science Resources (OSRs) through their m-technology device; science teachers do not effectively use online social network/media platforms through their m-technology device for science teaching [average weighted mean value = 1.44; Decision–Never used] with a retained null hypothesis at [$F_{(2,147)}$ = 2.996, P < 0.05] and stated certain impediments towards the integration of m-technology for teaching science [aggregate weighted mean of 3.07; Decision-Accepted] with a retained null hypothesis at [$F_{(2,147)}$ = 2.996, P < 0.05]. Based on the findings of the study, recommendations were posited that will ensure and enhance effective integration of mobile technology for science teaching."

Murugan, A., Teoh Boon Sai, G., & Liau Wei Lin, A. (2017). Technological readiness of UiTM students in using mobile phones in the English language classroom. *Malaysian Online Journal of Educational Technology, 5*(2), 34-50. Retrieved from http://files.eric.ed.gov/fulltext/EJ1142394.pdf

Abstract: "Mobile Assisted Language Learning (MALL) by using devices such as mobile phones is an ideal learning platform for learners to acquire language and share knowledge beyond the confines of a fixed location. By utilizing the mobile applications available via smartphone, learners can engage in collaborative networks and find information in a variety of diverse environments. This article shares the findings of a research at Mara University of Technology (UiTM) in Malaysia to determine the technological readiness of the students by measuring their digital skills using the Digital Competence Framework (EU). Some 50 students from the English language proficiency course were purposively sampled because they have been exposed to MALL by their lecturer. Their responses were collected through an online questionnaire. The findings showed that all 50 of the students owned a smartphone. While 82.6% of the students did not attend any training on how to use the smartphones, 80.4% of them have their own storing strategies and nearly 90% of them reported having technological skills in operating their smartphone such as accessing applications, ability to record, share and produce technological resources. The findings suggest that to ensure successful MALL, educators need to be aware of the background and technological skills of learners before embedding m-learning into the English Language lessons."

Niess, M. L., Gillow-Wiles, H. (2017). Expanding teachers' technological pedagogical reasoning with a systems pedagogical approach. *Australasian Journal of Educational Technology, 33*(3), 77-95. doi:10.14742/ajet.3473

Abstract: "A systems approach provides insight for expanding teachers' pedagogical reasoning for integrating multiple technologies in inquiry, communication, and collaboration. An online learning trajectory supports the integration of a systems pedagogical approach for guiding teachers in developing their technological pedagogical thinking and reasoning so they in turn are able to implement a systems pedagogical approach with their own students. Specific instructional strategies guide teachers in refining their mental models for integrating multiple technologies in teaching mathematics through their increasingly complex technological pedagogical understanding as they learn about the technologies and teaching with those

technologies. This study focuses on the impact that a system of multiple technologies as pedagogical tools has on teachers' technological pedagogical reasoning as they integrate multiple technologies in their classrooms. A systems pedagogical understanding is at the core of teachers' enhancement of their technological pedagogical reasoning, and supports the transformation of their knowledge called technological pedagogical content knowledge."

Oskay, O.O. (2017). An investigation of teachers' self-efficacy beliefs concerning educational technology standards and technological pedagogical content knowledge. *Eurasia Journal of Mathematics, Science and Technology Education, 13*(8), 4739–4752. doi:10.12973/eurasia.2017.00961a

Abstract: "This study aims to investigate the technological pedagogical content knowledge levels of teachers and their self-efficacy in educational technology standards. Also, the difference between the mean scores of the teachers in different branches from the Scale of Technological Pedagogical Content Knowledge (TPACK) and its sub factors and Scale for Educational Technology Standards (ETS) and its sub factors were analyzed. The distribution and correlation of teachers' TPACK scores and their self-efficacy in educational technology standards in terms of sub-factors and general averages were analyzed. The sample was composed of 54 teachers at various schools located in Ankara. The descriptive statistics showed that the teachers' scores were above the average for all TPACK and ETS scales, including the scale sub-factors. Also a significant difference between the mean scores of the teachers in different branches from TPACK and ETS scales and their sub factors was not determined. Further, moderate positive and significant correlations were found between ETS and TPACK total scores."

Papanikolaou, K., Makri, K., & Roussos, P. (2017). Learning design as a vehicle for developing TPACK in blended teacher training on technology enhanced learning. *International Journal of Educational Technology in Higher Education.* Advance online publication. doi:10.1186/s41239-017-0072-z

Abstract: This paper presents a framework for constructivist pre-service teacher training in Technology Enhanced Learning, adopting a view of teachers as designers of innovative content, working individually and/or collaboratively, discussing and interacting with the instructor, technology and their peers. In such a context, a challenging issue is the content and structure of appropriate activities for cultivating various types of synthetic knowledge combining technology, pedagogy and content through asynchronous collaboration. In this paper, we elaborate on the social orchestration of a training course around collaborative design activities and on the emerging challenges from two successive cycles of implementation. We highlight the elements used to expand and augment online interaction, drawn from two known approaches in teacher training and online learning, the TPACK (Technological, Pedagogical and Content Knowledge) framework and the CoI (Community of Inquiry) model. We specifically examine a) the impact of synthetic design activities to the development of pre-service teachers' synthetic knowledge (of Technology, Pedagogy and Content) and b) the relationships among specific elements of TPACK and CoI. Findings drawn from the examination of pre-service

teachers' perspectives through two structured questionnaires reveal important potential of synthetic activities for teachers' TPACK development and highlight specific connections among elements of the TPACK and CoI frameworks.

Poitras, E.G., Doleck, T., Huang, L., Li, S., Lajoie, S.P. (2017). Advancing teacher technology education using open-ended learning environments as research and training platforms. *Australasia Journal of Educational Technology, 33*(3), 32-45. doi:10.14742/ajet.3498

Abstract: "A primary concern of teacher technology education is for pre-service teachers to develop a sophisticated mental model of the affordances of technology that facilitates both teaching and learning with technology. One of the main obstacles to developing the requisite technological pedagogical content knowledge is the inherent challenge faced by teachers in monitoring and controlling certain aspects of their own learning while navigating the web and designing a lesson plan. This paper reviews preliminary findings obtained in our research with nBrowser, an intelligent web browser designed to support pre-service teachers' self-regulated learning and acquisition of technological pedagogical content knowledge. Case examples of data mining techniques are presented that allow the discovery of knowledge regarding pre-service teachers' information-seeking and acquisition behaviours and how to support them. The first case illustrates the use of simulated learner experiments, while the second involves the creation of a model to detect learner behaviours. We discuss the implications in terms of design guidelines recommendations for nBrowser as well as the broader impacts for future research on technological pedagogical content knowledge research and development."

Reinsfield, E., & Williams, P.J. (2017). New Zealand secondary teachers' perceptions: "technological" or "technical" thinking? *International Journal of Technology and Design Education*. Advance online publication. doi:10.1007/s10798-017-9418-z

Abstract: "Technology education in the New Zealand context has seen significant change since it's inception as a technical subject. The changing nature of the subject in New Zealand secondary schools is influenced by some teachers' preoccupation with the making of quality product outcomes, rather than their enactment of the curriculum, which conceptualises a wider remit. Research into the perceptions of technology teachers' interpretation and enactment of the curriculum suggests that to enable change, teachers need to adopt a form of "technological thinking", in support of their "technical thinking". Technological thinking is a notion presented to support teachers to explore a range of differing pedagogical approaches and learning outcomes, reflective of the intent of the New Zealand curriculum, which aims to foster learning environments that are innovative and responsive to students' social and academic needs."

Reyes, V.C., Reading, C., Doyle, H., & Gregory, S. (2017). Integrating ICT into teacher education programs from a TPACK perspective: Exploring perceptions of university lecturers. *Computers & Education, 115*(December 2017), 1-19. doi:10.1016/j.compedu.2017.07.009

Abstract: "Three distinct clusters were identified from a survey study of a sample of 127 unit coordinators from a regional Australian University. The clusters emerged after a survey that explored perceptions of pedagogical practices that incorporated the use of Information Communication and Technology (ICT). The key components of the survey were based on seven constructs derived from the Technological Pedagogical and Content Knowledge (TPACK). For future investigations of TPACK application in university contexts, a three-cluster configuration of teacher-practitioners is proposed that requires empirical confirmation. Alongside the theorised clusters of university lecturers according to their perceived engagement with ICT, several layers of technology policy disconnect have also been discovered. The relevance of the findings of the inquiry and their implications on universities that conduct ICT intensive courses are also discussed, especially in relation to improving teaching practices."

Sulaimani, A. O., Sarhandi, P. S. A., & Buledi, M. H. (2017). Impact of CALL in-house professional development training on teachers' pedagogy: An evaluative study. *Cogent Education*, *4*(1), 1355646. doi:10.1080/2331186X.2017.1355646

Abstract: "This study examines the impact of computer-assisted language learning (CALL) in-house professional development trainings based on Technological Pedagogical Content Knowledge in-Action (TPACK-In-Action) model on female teachers' pedagogy at a Saudi Arabian university. Data were collected using survey questionnaires to gather participants' pre-workshops and post-workshops responses followed by semi-structured interviews to understand aspects that determined the effect of the training workshops on teachers' pedagogy. The findings show that despite having sound pedagogy and teaching qualifications, participants could not successfully utilize their skills to incorporate technology effectively in their teaching. Institutional policies regarding technology integration and complex pacing guide which directed learning objectives and course materials could not give teachers the freedom to integrate learned skills in class, thus, the trainings provided to them became ineffective. The findings of the study suggest arranging training workshops according to the needs of the teachers who want to integrate technology in teaching. The study also recommends that an informed institutional policy regarding the use of technology is important which will ultimately result in effectiveness of the training workshops. Such decisions should be taken in accordance with the teaching syllabus and its pacing guide, and technology integration should be prescribed as a part of syllabus."

Swallow, M. J. C., & Olofson, M. W. (2017). Contextual understandings in the TPACK framework. *Journal of Research on Technology in Education.* Advance online publication. doi:10.1080/15391523.2017.1347537

Abstract: "The technological, pedagogical, and content knowledge (TPACK) framework considers the role of technology in teaching. Although TPACK is grounded in context, one limitation is the lack of understanding about the interactions between particular contexts, knowledge development, and instruction. This qualitative multiple-case study was designed to explore the contextual factors that contribute to teachers' development of technological, pedagogical, and content knowledge and practice. Researchers focused on the Catholic

educational environment to develop a more refined understanding of specific, and unique, contextual factors within the TPACK framework. Individual case analysis of interview and observation data pointed toward microlevel, or teacher-centric, factors, including background, attitudes, and personal conceptualization of contemporary education, to be primary influences of the development and use of technological knowledge. Recommendations are made for educators to think about how changes in context influence the distinct overlapping components of the TPACK framework, and accordingly their individual TPACK."

Talib, N., Yassin, S. F. M., Nasir, M. K. M., & Bunyamin, M. A. H. (2016). Integrating technological pedagogical and content knowledge in computer programming courses: Issues and challenges. *Journal of Advanced Research Design, 27*(1), 1-13. Retrieved from http://www.akademiabaru.com/doc/ARDV27_N1_P1_13.pdf

Abstract: "The purpose of this study is to explore the issues and challenges in integrating technological pedagogical content knowledge (TPACK) for computer programming courses. This study employed the triangulation method of the case studies and Grounded Theory (GT). Twenty-five computer programming educators were interviewed via online such as e-mail, media social's chatting and messaging application like WhatsApp and Telegram. The main issue discovered in this study is the misconception in using technology for teaching and learning computer programming. Besides that, there were two major challenges found in this study. The challenges are the instructors were not able to explore the rapid development of technology and this may cause the lack of technological pedagogical knowledge among them. They also showed the lack of knowledge about pedagogy and assessment for teaching and learning computer programming that relevant to the programming content. The research that has been done showed that TPACK model is very suitable to guide exploration about how educators make use of technology appropriate to the pedagogy and content. However, the exploration that has been done has limitation on how educators integrate student's assessment on affective and instructional design implementation with TPACK. Therefore, this paper suggesting for the future study, in order that more exploration should be doing about how assessment on student's affective and instructional design would be integrate with technology, pedagogy and content knowledge via TPACK model."

Tao, T., Nengfeng, Z., Jiyu, J., & Xiaochun, X. (2017). Application of practical curriculum for college specialty of economic management under TPACK framework: Taking "enterprise operation and decision simulation system" curriculum as an example. *International Journal of Emerging Technologies in Learning, 12*(7), 124-135. doi:10.3991/ijet.v12i07.7223

Abstract: "As a new types of educational knowledge integration framework under the appeal for informatization, Technological Pedagogical and Content Knowledge (TPACK) has become a prerequisite for teachers to integrate technologies into their teaching effectively. A comprehensive analysis of the current challenges faced by practical curriculums on economic management is presented in this paper. A curriculum design model was constructed based on the TPACK theoretic framework and the constructivism learning theory. The curriculum

'Enterprise Operation and Decision Simulation System' was taken as an example, and the practical curriculum system for economic management under the TPACK framework was designed from three aspects, namely, teaching content, teaching methodology, and teaching technique. On this basis, an econometric analysis software was used to analyze the effects of curriculum implementation. Research indicates that TPACK plays a significant role in improving teaching quality, elevating student satisfaction, and cultivating students' professional application and practice abilities. The research conclusion is of certain reference value to the practical teaching reform and development in universities."

Tondeur, J., Scherer, R., Siddiq, F., & Baran, E. (2017). A comprehensive investigation of TPACK within pre-service teachers' ICT profiles: Mind the gap! *Australasian Journal of Educational Technology, 33*(3), 46-60. doi:10.14742/ajet.3504

Abstract: "This study aims to identify profiles of pre-service teachers in order to explore their readiness to integrate technology in education. The assumption is that pre-service teacher characteristics such as technological pedagogical content knowledge (TPACK), go together with the influence of their teacher training. Specifically, this study examines whether pre-service teachers can be clustered on the basis of their TPACK, a typical set of ICT-related characteristics (e.g., general ICT attitudes, attitudes towards ICT in education, ease of use, ICT self-efficacy), and the perceived support at their training institution to adequately integrate ICT in education. Data were collected from a sample of 688 last-year pre-service teachers in 18 teacher training institutions in Flanders (the Dutch-speaking part of Belgium). Using correlational and latent profile analysis, the results suggest that: (1) two profiles can be distinguished, (2) TPACK and other individual ICT-related characteristics are positively correlated, and (3) pre-service teachers in a profile with strong TPACK, attitudes, and self-efficacy scores also report high scores on the support they perceive at their teacher training institution. Implications for the role of teacher training institutions are discussed with a specific focus on how to close the gap between the two identified profiles."

Turgut, Y. (2017). Tracing preservice English language teachers' perceived TPACK in sophomore, junior, and senior levels. *Cogent Education, 4*(1), 1368612. doi:10.1080/2331186X.2017.1368612

Abstract: "Many teacher education institutes (TEI) are expected to provide preservice teachers (PTs) with the necessary knowledge, skills, and attitudes to teach with information and communication technology (ICT). To address this challenge, many TEIs have included introductory ICT courses in their curriculum to develop technological knowledge and skills. Although several existing studies have focused on detecting whether a course or a short-term training program can make an improvement on PTs' TPACK, none of the existing studies have attempted to investigate in a longitudinal process whether PTs' perceived development of TPACK skills follow an increasing linear pattern through years as planned in four-year-long teacher education programs, especially in ELT. This study therefore intends to address this gap in the literature. Based on TPACK survey with open-ended questions, results of the study indicated a nonlinear pattern of TPACK development over time. In line with these findings,

suggestions for teacher educators, policy-makers, and future research were made."

Urbina, A. & Polly, D. (2017). Examining elementary school teachers' integration of technology and enactment of TPACK in mathematics. *The International Journal of Information and Learning Technology.* Advance online publication. doi:10.1108/IJILT-06-2017-0054

Abstract: "**Purpose**
This study examined how elementary school teachers integrated technology into their mathematics teaching in classroom settings that were one-to-one computer environments for most of the day. Following a series of classroom observations and interviews, inductive qualitative analyses of data indicated that teachers felt that technology supported students' mathematics learning and prepared them for their future where technology was important. However, observations indicated that despite teaching in one-to-one environments, students only used technology on rare occasions or if they finished activities early. Further, these technology-based activities were low-level review of mathematics computations. Implications include the need to provide effective support to teachers about integrating technology in meaningful ways.
Design/methodology/approach
This study involved classroom observations of two third grade teachers.
Findings
Findings indicate that teachers used Chrome books in one-to-one classrooms to provide students with extra practice on computational skills.
Research limitations/implications
There is a need for future studies to look at teachers' use of technology and its influence on student learning.
Practical implications
Teacher education programs and school leaders should provide opportunities for current and future teachers to learn about technology with content specific examples.
Originality/value
This study provided an examination of all of the third grade teachers in a school who all were teaching mathematics in one-to-one classroom environments. "

Valtonen, T., Sointu, E., Kukkonen, J., Kontkanen, S., Lambert, M.C., Makitalo-Siegl, K. (2017). TPACK updated to measure pre-service teachers' twenty-first century skills. *Australasia Journal of Educational Technology, 33*(3), 15-31. doi:10.14742/ajet.3518

Abstract: "Twenty-first century skills have attracted significant attention in recent years. Student of today and the future are expected to have the skills necessary for collaborating, problem solving, creative and innovative thinking, and the ability to take advantage of information and communication technology (ICT) applications. Teachers must be familiar with various pedagogical approaches and the appropriate ways to use ICT to support the development of their students' twenty-first century skills. The technological pedagogical content knowledge (TPACK) framework provides a theoretical model for studying the ways in which teachers use ICT in education. Still, the TPACK framework faces certain difficulties,

especially concerning the instruments currently used for studying TPACK. These challenges are primarily related to the psychometric properties of the instruments and areas of pedagogical knowledge. Within this paper we introduce a new TPACK questionnaire, the TPACK-21 questionnaire which is grounded on twenty-first century skills. The TPACK-21 questionnaire is validated using confirmatory factor analysis (CFA). Results provide a six factor CFA model aligning with the TPACK theoretical framework. Also, the associations among TPACK sub-constructs, and the weak and strong areas of pre-service teachers' TPACK will be discussed."

Willermark, S. (2017). Technological pedagogical and content knowledge: A review of empirical studies published from 2011-2016. *Journal of Educational Computing Research.* Advance online publication. doi:10.1177/0735633117713114

Abstract: "Technological Pedagogical and Content Knowledge (TPACK) has been introduced as a conceptual framework for the knowledge domains teachers need to master to teach successfully using technology, and has drawn much attention across the educational field. Yet, the framework has been criticized for not being practically useful, due to inaccurate and insufficient definitions. To better understand the critics and the usefulness of the framework, an investigation of how the framework has been applied to show teacher TPACK is needed. This study is a systematic literature review of 107 peer-reviewed journal articles concerning the use of TPACK in empirical studies published from 2011 to 2016. The study supplements previous review studies with more recent work on general characteristics of TPACK studies as well as contributes an analysis of how the framework has been applied to identify teacher TPACK in recent literature. Findings show a variety of approaches and instruments to examine teacher TPACK. Most common is to identify teacher TPACK via self-reporting, while performance evaluations of teaching activities are rare. Additionally, the ways TPACK is operationalized as a measuring instrument are often implicit and make comparison of results difficult. Future directions for research are discussed."

Yenmez, A. A. (2017). An examination of the effectiveness of instruction in which pre-service mathematics teachers use technology to overcome student difficulties. *Journal of Education and Practice, 8*(5), 1-21. Retrieved from https://eric.ed.gov/?id=EJ1143989

Abstract: "It is seen that students face certain difficulties when learning the concepts and the relationships between them in the mathematics education that aims at enabling students to learn on the highest level. Identifying and eliminating these difficulties, helping students in the learning process and guiding them are among teachers' tasks. Overcoming the difficulties experienced by students is considered one of the contributions of the technological use to the mathematics education. Yet, the efficient use of information and communication technologies in overcoming student difficulties is possible through bringing teachers and pre-service teachers in basic knowledge and skills. To this end, the effectiveness of the instruction in which pre-service teachers benefit from information and communication technologies to overcome the difficulties regarding a given concept was investigated. The participants were 32 third-year pre-service teachers attending at the elementary mathematics education of a state university. The effectiveness of pre-service teachers' micro-instructions and their opinions on the role and

effect of technology in their instructions were analyzed within the framework of specified themes. The instructional plans, observation sheets, self-evaluations, and the inventory of the interviews performed in regard to self-evaluations which affected the change in the process were analyzed with the content analysis. Consequently, the findings obtained in the study showed how the pre-service teachers performed effective instructions and revealed the positive change in their perspectives, possible means that technologies can offer to students in the mathematics education, and their positive contributions to their own learning. As for the components and recommendations of this pre-service educational program, it will be effective in the planning of instructional process in future studies."

Yenmez, A.A., Ozpinar, I., & Gokce, S. (2017). Examining preservice mathematics teachers' technological pedagogical content knowledge from their microteaching. *Educational Sciences: Theory and Practice.* Advance online publication. doi:10.12738/estp.2017.5.0454

Abstract: "Microteaching is regarded as an effective method that allows preservice teachers to gain the experience of instructional processes and is used to improve teaching skills in an environment similar to a real classroom. Microteaching, which is utilized as a method for increasing the quality of a teacher's education, is also used in research studies conducted within the scope of Technological Pedagogical Content Knowledge (TPCK). Accordingly, the purpose of this research is to observe changes in preservice teachers' TPCK from their microteaching practices conducted under a conceptual TPCK framework. The participants are 52 third-year preservice teachers. An analysis was performed based on specific themes from the application, which had been developed to reveal the changes in preservice teachers' conceptual framework of TPCK components. Content analysis was used to analyze the observation forms, self-evaluations, and transcriptions from the interviews on the self-evaluations for the effects over their procedural changes within the context of the themes. The study's findings indicate that preservice teachers use the technological tools to attain what they had specified in their instructional plans. Also when considered in terms of the TPCK components, preservice teachers made remarkable progress."

Yorulmaz, A., Can, S., & Cokcaliskan, H. (2017). The relationship between the pre-service classroom teachers' technopedagogical instructional competencies and epistemological beliefs. *Journal of Education and Training Studies, 5*(9), 27-35. Retrieved from http://redfame.com/journal/index.php/jets/article/view/2110/2695

Abstract: "The purpose of the current study is to determine the relationship between the pre-service classroom teachers' epistemological beliefs and techno pedagogical subject-area competencies. While the universe of the study is comprised of a total of 187 senior pre-service teachers attending the Department of Classroom Teacher Education in Mugla Sıtkı Kocman University in 2014-2015 academic year, the sampling consists of 141 pre-service teachers selected through the random sampling method from among the universe. The reason for selecting the senior students for the universe of the study was that they had already taken the

subject-area, pedagogical and general culture courses. In the collection of the research data, The Techno Pedagogical Competency Scale and Epistemological Belief Scale and a personal information form were used. The data were analyzed by using IBM SPSS 21.0 program package. During the analysis process, first it was tested whether the data display a normal distribution and after it was determined that the data show a normal distribution, from among the descriptive statistics, t-test and one-way ANOVA were used to reveal the differences and Pearson-product Moment Correlation Coefficient analysis was used to elicit the correlations. The analyses revealed that the pre-service classroom teachers' level of techno pedagogical competencies is high and their level of epistemological beliefs is medium. Gender and academic grade point average were found to be not leading to significant differences in their techno pedagogical subject-area competencies. Moreover, a negative and significant correlation was found between the pre-service classroom teachers' techno pedagogical subject-area competencies and epistemological beliefs."

Zainuddin, N., & Idrus, R.M. (2017). From TPACK to learning buffet: Developing a new model for open and flexible learning. *Saudi Journal of Humanities and Social Sciences, 2*(4), 344-347. doi:10.21276/sjhss

Abstract: "Open and Flexible Learning is an excellent method of reaching all types of learners. It is truly a medium that helps to democratize education to all. Today, we are currently experiencing a time of constant evolution in the field of education in which students require more resources and tools to obtain the information and construction of knowledge. One such resource is the use of open and distance learning environment, where the lecturer assigns additional activities for the understanding of the concepts seen before. But there are times when the student does not understand the content because of the form it represents, making it necessary to have more options to facilitate the understanding of content through different ways that may be more attractive to the students, achieving more active participation in the subject and an affinity that leads to a better learning experience. This is the goal of the study, which proposes a model called "Learning Buffet Model" for designing Open and Flexible Learning content adaptable to the student´s learning style. This learning buffet model can be used as a fundamental model and applied in any area or discipline of education as it forces the consideration of four components (leaning style, content, pedagogy and technology) in the design of the lesson plan and subsequently enrich the learning environment with more specific learning objects the subjects taught."

Zhou, Y., Chai, C.S., Liang, J-C., Jin, M., & Tsai, C-C. (2017). The relationship between teachers' online homework guidance and technological pedagogical content knowledge about educational use of web. *The Asia-Pacific Education Researcher*, *19*(5), 239-247. doi:10.1007/s40299-017-0344-3

Abstract: "The development of e-learning and digital campus has prompted more and more teachers to assign online homework to students. Consequently, teachers need to provide sufficient and relevant guidance for such homework. Teachers' online homework guidance

(TOHG) is conceptually connected with their level of technological pedagogical content knowledge about educational use of Web (TPACK-W). This study employed two questionnaires: a self-developed questionnaire for TOHG and a revised TPACK-W questionnaire to study how TOHG is associated with TPACK-W through correlation and regression analysis. Two hundred and eighty-four teacher participants from China who had experience in assigning online homework were asked to complete the questionnaires. This study validated the questionnaires and established significant relationship between the TOHG and TPACK-W. The study expanded current understanding of TPACK through the factors associated with online homework. The findings showed that the level of teachers' online homework guidance was significantly related to their TPACK-W, and the two factors of Web-Pedagogical Knowledge and Web-Pedagogical-Content Knowledge in the TPACK-W questionnaire could predict the TOHG. Future teachers' professional development for the construction of TPACK-W should include discussions and guidelines of online homework."

Chapters

Bower, M. (2017). The technology pedagogy and content knowledge (TPACK) framework and its implications. In M. Bower, *Design of technology-enhanced learning - Integrating research and practice* (pp. 17-33). Bingley, UK: Emerald Publishing. doi:10.1108/9781787141827

Abstract: "This chapter introduces the Technology Pedagogy and Content Knowledge (TPACK) model as it relates to technology-enhanced learning design. The key features of the framework are unpacked, along with a brief examination of what TPACK looks like in practice. Approaches to developing TPACK capacity are considered, with learning-by-design emerging as the most promising technique. Issues relating to TPACK are also critically discussed, including those relating to measurement and the capacity of the framework to support educational design practice."

Krahenbuhl, K.S. (2017). Principles of learning in the technology-enhanced classroom. In A. A. Khan & S. Umair (Eds.), *Handbook of research on mobile devices and smart gadgets in K-12 education*. Hershey, PA: IGI Global Information Science Reference.

Abstract: "This chapter presents a contextual overview of common misconceptions, challenges, and conceptual frames of importance with respect to learning with technology. Having explored these foundational elements, it adapts principles of learning and multimedia informed by empirical research in cognitive science for the technology-enhanced classroom. The chapter concludes with areas for future research expanding on this synthesis of research and a discussion of its implications and applications for educators in these technologically rich learning environments."

Phillips, M. (2017). The influence of an international context on a teacher educator's knowledge, practice, and identity. In A. Fitzgerald, G. Parr, & J. Williams (Eds.),

Narratives of learning through international professional experience (pp. 125-138). Singapore: Springer Singapore. doi:10.1007/978-981-10-4867-8

Abstract: "The knowledge required by pre-service teachers has been explored by a range of researchers with many agreeing that contemporary pre-service teachers require technological, pedagogical and content knowledge. This chapter explores the influence of specific contexts on the forms of knowledge required for effective practice and suggests that teachers in the making need to be aware of the ways in which different contextual elements shape the use of knowledge as well as classroom practices."

Powers, J. R., Musgrove, A. T., & Lowe, J. A. (2017). Technology shaping education in rural communities. In V. C. Bryan, A. T. Musgrove, & J. R. Powers (Eds.), *Handbook of research on human development in the digital age* (pp.184-204). Hershey, PA: IGI Global Information Science Reference.

Abstract: "This chapter examines how technology has shaped the teaching and learning process for individuals residing in rural areas. Research on the history and unique needs of rural communities and the impact of technology in these areas is discussed. Educational experiences of students across all grade levels, from early childhood though post-secondary education, is examined. Examples of innovative and creative uses educational technologies in distance and face-to-face settings are described from the perspective of rural teachers and students."

Book

Tavares, R., & Moreira, A. (2017). *Implications of open access repositories quality criteria and features for teachers' TPACK development*. Cham, Switzerland: Springer International Publishing. doi:10.1007/978-3-319-57916-0.

Abstract: "This brief will explore how open access repositories are being developed and maintained, in order to provide, disseminate and promote the development of digital educational resources. The main objective is to analyse open access repositories quality criteria and features, and how these can improve teachers' Technological Pedagogical Content Knowledge (TPACK) development. It is organized in six major sections. Section one addresses an historical overview of open access repositories. In section two the authors present the objectives and the methodology used in the present study. Sections three, four and five analyse namely (i) the prevalence of European Science Education open access repositories and teachers' perceptions of those same repositories, (ii) the most common European Science Education open access repositories features and their implications, and (iii) the impact of open access repositories usage on teachers' TPACK development. The last section focuses on the analyses of a selected open access repository [House of Sciences (originally Casa Das Ciências)], addressing its characteristics and features, the impact of social media features in digital educational resources (re)use, and the relationship between repository quality criteria and teachers' TPACK development."

Journal Special Issue

Harris, J. B., Phillips, M., Koehler, M. J., & Rosenberg, J. M. (Eds.). (2017). TPCK/TPACK
    research and development: Past, present, and future directions [Special issue].
    Australasian Journal of Educational Technology, 33(3). Retrieved from
    https://ajet.org.au/index.php/AJET/issue/view/124

3. Recent TPACK-Related Dissertations and Theses

Abdussalam, K.M. (2016). *Technology integration in teaching literature* (Master's thesis,
    University of Khartoum, Khartoum, Sudan). Retrieved from
    http://khartoumspace.uofk.edu/handle/123456789/19487

Abstract: "This study examined the impact of implementing technology in teaching and learning the literature component in the Department of English, Faculty of Arts, University of Khartoum. A mixed methodology involved thirty 3rd year students and 14 teachers in the department of English in the process of data collection. Two sets of questionnaires were distributed among the teachers and students to examine their use, attitudes and reasons for which they might not use technology in teaching and learning as well as the way the teachers integrate technology. Interviews were set with two literature teachers to detect the problems encountered when teaching literature, in addition to an interview with the head of the department to provide a general idea about the situation of technology integration in teaching in the department. A classroom observation rubric was utilized, examining three literature lectures, to highlight the techniques used by teachers in teaching literature. A case study involved the thirty students in an investigation of the impact of technology on teaching and learning literature. The findings concluded that technology has a positive impact on the teaching and learning process. However, literature teachers use traditional techniques when teaching literature though results indicated the teachers' as well as the students' high positive attitudes towards using technology. Nevertheless, the students' use of technology is higher than that of their teachers' in the department. Therefore, the research suggested that the literature syllabus should be rewritten adopting more innovative techniques in teaching. It also suggested that the Department of English should consider providing the necessary equipment as well as teacher training programs to ameliorate the teaching and learning situation and to enable both teachers and students to cope up with the requirements of the 21st century rapidly changing world."

Alcoser, M. E. (2017). *Intentional implementation: A self-study examining and evaluating
    instructional implementation of digital tools to foster academic writing in the English
    secondary classroom* (Doctoral dissertation). Available from ProQuest Dissertations &
    Theses Global database. (UMI No. 10275103)

Abstract: "This self-study examines the planning, practices, policies, and procedures present in a blended learning classroom environment to develop academic writing with tenth and

eleventh grade public high school students. Digital technology is a prevalent and powerful force intertwined with most aspects of the human experience in the twenty-first century. As school systems, educators, and teacher educators try to respond to and within this rapidly evolving climate, they are confronted with challenges on many fronts, including infrastructure, professional development, teaching practice, policy, and further compounded by fiscal limitations. This effort is additionally challenged by a high-stakes testing climate in which state exam scores are used to evaluate the performance of the student, teacher, school, district, and state levels.

Technological Pedagogical Content Knowledge (TPACK) is the frame predominantly used in academic literature to articulate, explore, and understand the aspects in play in the 21st-century classroom. Two practices implemented with digital tools to support academic writing development, discussion boards and digital document submissions/revisions were studied. Digital document submission/revision was found to have a positive relationship with fostering improved attitudes towards revision and about students' own writing efficacy. This practice was most successful when classroom policies were modified to account for the shift in the nature of the task and its role in student learning.

This self-study suggests a fourth dimension of knowledge is necessary to understand and implement digital technology in the classroom. Organizational knowledge (OK) includes: classroom policies, the arrangement of physical and virtual spaces, and classroom management in physical and virtual spaces. Technological Organizational Pedagogical Content Knowledge (TOPACK) would integrate OK into the framework, allowing for a more comprehensive understanding of what teachers need to know when implementing instructional technology in their classrooms. While some have included classroom management under the pedagogical knowledge branch of TPACK, I suggest that this fails to acknowledge the larger OK needed beyond the knowledge of how best to teach and is a limited perception of the purpose of classroom management. Navigating institutional and procedural considerations also impact classroom operations. Additional research is needed in the area of OK and how its components are impacted by the inclusion of digital technologies in the 21st-century classroom and to confirm the findings."

Cross, A. (2017). *Tinkering in K-12: An exploratory mixed methods study of makerspaces in schools as an application of constructivist learning* (Doctoral dissertation). Available from ProQuest Dissertations and Theses Global database. (UMI No. 10265494)

Abstract: "Makerspaces have experienced a surge in popularity in recent years, resulting in an influx of Maker education in K-12 settings. While Makerspaces have been studied abundantly in museums, libraries, and in after-school programs, little research has been conducted inside the K- 12 school day. The goal of this study is to discover insights of established Makerspaces inside the K-12 school environment. In this exploratory mixed methods study, educators were survised, examining school and participant demographics, Makerspace setup, as well as intersections of technology, content and pedagogy. Next the researcher conducted a follow-up interview with selected participants based on diversity in the following key demographic areas:

teacher gender, professional background, and school environment. In order to better understand K-12 implementation of Makerspaces, the study examines seven characteristics of Makerspaces: setting, computational thinking, participant structures, teacher training, gender and racial issues, assessment, and sustainability. The data was examined through TPACK framework with a constructivist approach.

Makerspaces can empower students to invent, prototype, and tinker with low-cost technology tools such as microcircuits and fabrication tools such as 3d printers. The goal of this study is to add to the body of literature regarding the role and potential value of Makerspaces in school environments. This exploration of Makerspaces in K-12 setting could be generalized to serve as a guide for teachers who want to establish their own Makerspace."

Davis, E.B. (2017). *A mixed-methods study of a teacher preparation program: Preservice teachers' perceived preparedness to integrate technology effectively* (Doctoral dissertation). Available from ProQuest Dissertations and Theses Global database. (UMI No. 10278387)

Abstract: "The purpose of this study was to examine the extent to which preservice teachers within a teacher preparation program perceived themselves to be prepared to integrate technology, specifically examining the level of confidence preservice teachers perceive themselves to have towards TPACK-related skills needed to integrate technology into their instruction. Participants in this research study were solicited based on their enrollment in the selected teacher preparation program within the last 5 years; also included were current seniors enrolled in their final semester before degree completion. This research study contains a sample size of 20 participants from a small, private university in western North Carolina. All of the participants were preservice teachers either presently employed in a public education setting after graduation or currently enrolled in the teacher preparation program at the university; and all sought or are seeking certification in grades kindergarten through twelfth grade. Like many other teacher preparation programs across the United States, this university focuses on continued improvement in preparing preservice teachers to enter future classrooms equipped with technology as part of the learning environment.

Three questions were addressed in this study: (1) To what extent does the teacher preparation program adequately prepare the preservice teachers to integrate technology in their classroom pedagogical practices? (2) To what extent does modeling by instructors influence the disposition preservice teachers have towards integrating technology into their classroom practice? (3) To what extent does technology knowledge play a role in the preservice teacher's confidence towards technology integration?

A mixed-methods research design was used to explore the preparation of preservice teachers who received their training at a small, private, western North Carolina university. The Survey of Pre-service Teachers' Knowledge of Teaching and Technology (Schmidt et al., 2009) was used to gather both quantitative as well as qualitative data pertaining to the participants. The quantitative data gathered were analyzed by grouping 5-point Likert-scale responses into

positive and negative responses using percentages to identify overall perceptions based on the seven domains of Mishra and Koehler's (2006) TPACK framework. Additionally, the researcher utilized the qualitative responses given by participants from the open-ended questions at the end of the survey as well as during a focus group to strengthen the quantitative data and formulate answers to the posed research questions.

Each set of data was analyzed separately, which allowed for triangulation (Creswell, 2009). The positive results produced by the survey results and focus-group responses conveyed how preservice teachers perceive they have been prepared to effectively integrate technology in their classroom lessons; however, the researcher recommends further research into preservice teachers' capacity to integrate technology through continuous assessment and reflection."

Green, W.L. (2017). *Educator technological pedagogical content knowledge and student achievement* (Doctoral dissertation). Available from ProQuest Dissertations and Theses Global database. (UMI No. 10249516)

Abstract: "The purpose of this study was to develop a typology of teachers within the Technological Pedagogical Content Knowledge (TPACK) framework and to identify the groups of teachers that perform better in regards to student achievement as measured by state mandated standardized assessment. A sample of 252 educators from a rural Georgia school district completed a 50- question TPACK survey. The survey data were used as input for k-means cluster analysis, which yielded three teacher profiles: a) High-TPACK, b) Mid-TPACK, and c) Low-TPACK. Demographic data of educators, years of experience, level of education, age, were tabulated by cluster. Results showed that the High-TPACK cluster (N=96) were made up of typically younger teachers, and predominately male. The Mid-TPACK (N=143) cluster skewed older with a majority of female educators. The Low-TPACK cluster (N=14) was made up of educators towards the end of their careers. A chi-square test showed that levels of student achievement differed significantly across the three clusters with a score of $\chi2(8)=$ 15.851 with *p=.045* due to more students performing at a higher level on standardized assessment from the High-TPACK Cluster. Further, a *t*-test showed that the average percentage of students meeting and exceeding standards was significantly higher in the High-TPACK cluster than in the Mid-TPACK cluster ($t(97)=-3.045$, *p=.004*).

These results indicate that teachers with higher levels of TPACK have students who perform better on standardized assessment. These teachers' types consisted of teachers that skewed younger and were more willing to take risks to explore technology integration. Suggestions were made for teacher preparation programs as well as professional development to target skills needed to get all teachers to the level of High-TPACK."

Hallikainen, C. (2017). *Pre-service primary teachers' technological pedagogical knowledge analysis of pre-service teachers' lesson plans* (Master's thesis, University of Eastern Finland, Joensuu, Finland). Retrieved from http://epublications.uef.fi/pub/urn_nbn_fi_uef-20170905/urn_nbn_fi_uef-20170905.pdf

Abstract: "The march of technology creates new learning goals and challenges teachers to improve their technological skills. Teacher education's task is to prepare pre-service teachers to confront these challenges and guide them to make use of the new digital learning environments. By studying pre-service teachers' technological pedagogical knowledge one can find out what kind of guidance do pre-service teachers need to work as an innovative in-service teacher. This thesis discusses lesson plans made by pre-service primary teachers from the perspective of technological pedagogical content knowledge. Theories of conceptions of teaching and learning, the national core curriculum for basic education implemented in fall 2016, previous research in educational technology and visions of future technology are also taken in to account as underlying theories. The data consists of 60 lesson plans, which included 238 different teaching activities. Qualitative content analysis was used to determine technological and pedagogical knowledge in the activities. Pedagogical knowledge was described through used teaching methods as conceptions of teaching and learning. Technological knowledge was described through the devices and software used. Technological pedagogical knowledge is combined from the results of TK and PK with ATLAS.ti software. The most often mentioned technologies in the lesson plans were tablets and office tools. It appears that pre-service teacher planned to use more student-centered activities than teacher-centered activities. Teaching methods used by pre-service teacher seemed to be mostly congruent with the core curriculum. Based on the results it appears that pre-service teachers were able to plan instructions with common educational ICT tools, but there were still some areas of improvement on pre-service teachers' technological pedagogical content knowledge. The results and previous studies suggest that teacher education should encourage pre-service teacher to make use of the new innovative technologies. Teacher education should also help pre-service teachers to find suitable pedagogical solutions through practical experience."

Hooker, M. (2017). *A study on the implementation of the strengthening innovation and practice in secondary education initiative for the preparation of science, technology, English, and mathematics (STEM) teachers in Kenya to integrate information and communication technology (ICT) in teaching and learning* (Doctoral dissertation, Queens University Belfast, Belfast, UK). Retrieved from http://pure.qub.ac.uk/portal/files/130672931/EDD_DISSERTATION_MARY_HOOKER_FINAL_2_.pdf

Abstract: "The Strengthening Innovative Practice in Secondary Education (SIPSE) project was conceptualized to enhance teacher capacity in ICT competencies and skills to teach Science, Technology, English and Mathematics (STEM) subjects in Kenya secondary schools. The aim of this research study was to critically appraise the innovation model in relation to teacher development for ICT use in classroom practice associated with the SIPSE project over two cycles of the pilot phase implementation. The model integrated an ICT Competency Framework for Teachers (ICT-CFT) and Technology Pedagogy and Content Knowledge (TPACK) frameworks into a phased modular approach (ICT-CFT-TPACK-in-practice) for teacher professional development. The research addressed key questions related to: the object of ICT use as perceived by head teachers and teachers; and the characteristics of teacher design for ICT use in STEM teaching

and learning as evidenced in classroom activities at different stages of their professional learning journey in the SIPSE intervention. The study used a qualitative design basedresearch (DBR) methodology that was enhanced with the use of a 'TPACKtivity' lens combining TPACK and Activity Theory (AT) to explore, explicate and communicate the findings. The study was conducted with a purposive sample of twenty-four teachers, four head teachers and four schools drawn from the wider SIPSE programme intervention. The research data was collected over three field visits carried out between September 2014 and February 2016. The qualitative research methods included individual interviews and focus group discussions with the teachers and the head teachers. Data were also drawn from documentation of lesson plans and peer-to-peer lesson observations. The findings were illuminating. They presented participant accounts of tensions and dissonances with the introduction of technology into their school and classroom practices that reflected similar issues revealed in the literature. However, the findings elucidated some nuanced shifts and unexpected teacher design narratives for technology use to support, improve and innovate STEM teaching and learning processes. They further revealed the importance of classroom processes as the centre stage for fostering teacher collective and continual design conversations for framing and reframing ICT use solutions appropriate to the affordances and realities of their classroom and school contexts. In this the findings contribute to the current discourse by offering a TPACKtivity framework centred on authentic classroom settings as a basis for developing and appraising models of professional development for ICT use that can inform practice, policy and research."

Janssen, N. (2017). *Supporting teachers' technology integration in lesson plans* (Doctoral dissertation, University of Twente, Enschede, Netherlands). Retrieved from https://research.utwente.nl/en/publications/supporting-teachers-technology-integration-in-lesson-plans

Abstract: "Lesson planning offers rich opportunities for teachers to consider and implement technology in the classroom. This dissertation investigated the design and effectiveness of supplementary information to assist pre-service teachers during the lesson planning process. Based on the Technological, Pedagogical, And Content Knowledge (TPACK) framework, several sets of support materials were developed. All materials contained information about technology, pedagogy, and content, but differed with regard to how these types of information were organized. Some materials presented each type of information in a separate section whereas other materials used an integrated format in which multiple types of information were combined. These different configurations were compared in four experimental studies. The main findings indicate that pre-service teachers prefer and benefit most from integrated support when thinking about the use of technology in their lessons. However, additional support or sustained practice seems needed to ensure high-quality technology integration."

Lavadia, L. (2017). *Technological, pedagogical, and content knowledge (TPACK): An educational landscape for tertiary science faculty* (Doctoral dissertation). Available from ProQuest Dissertations and Theses Global database. (UMI No. 10280318)

Abstract: "Earlier studies concluded that technology's strength is in supporting student learning

rather than as an instrument for content delivery (Angeli & Valanides, 2014). Current research espouses the merits of the Technological Pedagogical Content Knowledge (TPACK) framework as a guide for educators' reflections about technology integration within the context of content and instructional practice. Grounded by two theoretical frameworks, TPACK (Mishra & Koehler, 2006; 2008) and Rogers' (1983, 1995) theory of diffusion of innovation, the purpose of this mixed-methods research was two-fold: to explore the perceived competencies of tertiary science faculty at higher education institutions with respect to their integration of technology within the constructs of pedagogical practice and content learning and to analyze whether these perceived competencies may serve as predictive factors for technology adoption level. The literature review included past research that served as models for the Sci-TPACK instrument. Twenty-nine professors of tertiary science courses participated in an online Likert survey, and four professors provided in-depth interviews on their TPACK practices. Quantitative analysis of data consisted of descriptive and reliability statistics, calculations of means for each of the seven scales or domains of TPACK, and regression analysis. Open-ended questions on the Likert survey and individual interviews provided recurrent themes of the qualitative data. Final results revealed that the participants integrate technology into pedagogy and content through a myriad of TPACK practices. Regression analysis supported perceived TPACK competencies as predictive factors for technology adoption level."

Malkoc, U. (2017). *Students' understanding of salt dissolution: Visualizing animation in the chemistry classroom* (Doctoral dissertation). Available from ProQuest Dissertations and Theses Global database. (UMI No. 10268627)

Abstract: "The present study explored the effect of animation implementation in learning a chemistry topic. 135 high school students taking chemistry class were selected for this study (quasi-experimental groups = 67 and control groups = 68). Independent samples *t*-tests were run to compare animation and control groups between and within the schools. The over-arching finding of this research indicated that when science teachers used animations while teaching salt dissolution phenomena, students will benefit the application of animations. In addition, the findings informed the TPACK framework on the idea that visual tools are important in students' understanding of salt dissolution concepts."

Marshall, J. (2017). *Technology integration in context* (Doctoral dissertation). Available from ProQuest Dissertations and Theses Global database. (UMI No. 10252595)

Abstract: "This study employed an ecological framework to examine how multiple contextual variables from the state biosphere, district biome, school habitat and classroom niche impact how teachers decide to integrate technology. It was an opportunity to observe how a teacher's Technological Pedagogical Content Knowledge operates in a classroom in response to the building, district and state contexts. It was conducted in multiple classrooms in one school and with science teachers. It included a self-study component. It provided an opportunity to directly observe the interactions between students and teacher as distinct species in the classroom when technology integration occurred. This allowed me to determine how observing other teacher's technology integration efforts impacted my own use in my classroom. I hope to

provide an emic perspective on technology integration and broaden the definition of effective technology integration."

Merritt, J. (2017). Individualized instruction as a faculty training strategy for technology integration (Doctoral dissertation). Retrieved from http://nsuworks.nova.edu/gscis_etd/1013/.

Abstract: "It is inevitable that campus-based higher education will adopt some form of a hybrid learning approach. For schools and their faculty members, this means the acknowledgment and acceptance of these changes are required. Campus-based higher education faculty members wish to change how they teach courses due to societal demands to better suit the next generation of students. Initially, schools began offering new technology to faculty that wished to use the technology; however, over the years, due to the demands of competition with other schools and next generation, tech-savvy students entering academia, schools are starting to require the use of technology that was once only an option for faculty members. This implementation of incorporating technology into the classroom has faced several roadblocks because what was once considered a simple transition has become more complex due to faculty resistance to new technology, which stems from various limitations, barriers, and perceptions, such as low computer self-efficacy, high computer anxiety, and time to learn new technology. The purpose of this study was to understand how in-service faculty experience individualized training as a method of teaching faculty how to use the technology and integrate it into their courses. The lived experiences and perceptions of in-service faculty regarding individualized training were specifically focused on to determine how individualized instruction was perceived to help or hinder integrating technology into their courses. The focus was the experience Harper College and McLennan Community College's in-service faculty, who experienced training through the group training currently offered by the schools, as well as the proposed individualized training. Higher education faculty from general study areas, such as English, math, and science were invited to participate. The study consisted of a 6-week individualized training program for 12 in-service faculty members (seven completed the study) who previously participated in a group training program about Blackboard. The study was a phenomenological approach in that used interviews to gather information regarding the lived experiences as the basis of analysis. The data for this study were gathered, horizonalized, and analyzed through a 7-step data processing method for phenomenology studies. After the data were analyzed, the findings show how developing a good individualized training program can help in-service faculty members not only integrate technology into their course designs but address any of the limitations or barriers the faculty faced. These findings coincide with the recommendations that training programs need to be developed into a phased approach in which the existing group training should continue but a secondary training program should be developed that incorporates andragogy-based principles and the technological pedagogical content knowledge (TPACK) framework."

Miller, S.B. (2017). *Teachers' use of instructional moves during technology-based mathematical activities* (Doctoral dissertation). Available from ProQuest Dissertations and Theses Global database (UMI No. 10270262).

Abstract: "This study investigates instructional moves by teachers in mathematics classrooms in which technology-based activities (i.e., student-oriented simulations) and features of those simulations influence classroom practices. Four teachers were studied over the course of a year as an exploratory study to build interpretive cases that described instructional practices in technology- based lessons. Teachers developed lessons using PhET simulations designed to support algebraic reasoning. Data sources included teachers' process of selecting and designing lessons, observations of teachers' non-technology and technology-based mathematical activities, and teacher interviews and reflections.

This work was based on a conceptual framework blending the ideas of Mathematical Tasks (Stein, Smith, Henningsen, & Silver, 1998), Mathematical Pedagogical Content Knowledge (Ball, Thames, & Phelps, 2008), and Technological Pedagogical Content Knowledge (Mishra & Koehler, 2006), in which teachers' instructional practices are determined by teachers' mathematical pedagogical content knowledge, task selection and design, and use of technology.

Results indicated that teachers see simulations as having significant benefits in the classroom. Teachers leveraged these opportunities by increasing class discussions, engaging in higher levels of thinking and reasoning, and focusing on mathematical representations. When teachers used simulations, the teachers spent less time in direct instruction, focused more on the mathematics, and focused more on investigations rather than drill-oriented tasks.

Technology in the classroom, however, was problematic for some teachers. The very nature of students working independently with their own devices meant that student-student interactions decreased in some lessons. Furthermore, teachers' discomfort in managing technology seems to limit ongoing use.

Specific features of the simulations that prompted instructional moves included the ability to support conceptual understanding and build student engagement. Simulations also provided a 'low floor, high ceiling,' supporting differentiation, and a dynamic responsiveness, facilitating connections between representations. On the other hand, teachers raised concerns that some features of the simulation could do the math for the students. Furthermore, the perception of simulations as being a game may impact how and when simulations are used.

The emergent use of technology in math classrooms is under-supported. For simulations to be used in a more extensive fashion in mathematics classes, professional development and curricular materials are needed to support implementation."

Mohamed, M. E. I. M. (2016). *The impact of science teachers' metacognition on their planning choice of technology-mediated inquiry-based activities* (Doctoral dissertation, University of Ottawa, Ottawa, Canada). Retrieved from https://ruor.uottawa.ca/handle/10393/35229

Abstract: "This study investigated the conditions for developing science teachers' Technological Pedagogical Content Knowledge (TPACK). It also explored the opportunities offered by two

strategies to enhance science teachers' ability to design technology-based inquiry activities for science learning: Experiencing Inquiry Model (EIM) and Metacognitive Scaffolding (MS). These strategies were adopted to support the processing necessary for developing teachers' knowledge and for negotiating the integration of computer technology in science instruction. Situated Cognition Theory was used as a theoretical framework for learning, and TPACK was used as a conceptual framework for technology integration. 33 science teachers from four intermediate and high schools participated in the study. 17 and 16 teachers were conveniently assigned to EIM and MS, respectively. The study employed a mixed method of quantitative and qualitative evidence. As per the quantitative method, a quasi-experimental design that employed the 2 Teaching Strategy (EIM or MS) × 2 Time (pre- and post-intervention) of learning split-plot factorial design was applied in the study. Concurrently with the quantitative data collection, the qualitative evidence was collected from the researcher's logbook, participants' written documents, and interviews. The findings suggested that there were no significant differences between EIM and MS for developing the knowledge components embodied in TPACK. Nevertheless, the participants who learned through the MS strategy outperformed their counterparts in designing technology-based inquiry activities for science learning. The latter result suggested that teachers who received metacognitive scaffolding were more equipped to connect curriculum goals with technology and instruction."

Montes, S. T. (2016). *Integrating one-to-one technology in the classroom: Three different approaches* (Doctoral dissertation). Retrieved from https://uh-ir.tdl.org/uh-ir/handle/10657/1723?show=full

Abstract: "The purpose of this qualitative, multiple case study was to examine the decisions three teachers made while planning to integrate portable technology in technology-rich elementary classrooms. The three participants were selected by their district's Digital Learning Coordinator because of their high level of technology integration. The study investigated these teachers' planning habits for instruction incorporating portable technology, such as Chromebooks. Observations, interviews, and lesson plan reviews constituted the qualitative data collected during approximately eight weeks. Peer debriefing, along with member checks, guaranteed that themes did not have a limited point of view, establishing credibility and dependability (Anney, 2014, Carspecken, 1996; Day, 2015). The Technological Pedagogical and Content Knowledge (TPACK) model was a useful descriptor for each teacher's technology planning level, and each used their own level of TPACK to drive their integration of technology in their classrooms and in their planning. The three participants utilized one-to-one (1:1) technology with varying degrees of effectiveness, and each planned differently for its use. The cross-case analysis guided the formation of four assertions: a) Experienced teachers with technology at their disposal are unlikely to change their planning, but will simply include technology when they deem it an appropriate and convenient tool to achieve their ends; b) Standardized technology does not necessarily lead to standardized uses or planning; c) Observable high and even skillful use of technology does not necessarily indicate strong planning; and d) Teachers are not motivated to change the way they plan when their students consistently excel at high stakes tests. The study findings have implications for teacher educators, teachers, and school and district leaders. Understanding how one's own level of

TPACK and beliefs affect the choices teachers make during planning for technology integration can guide teachers and districts to identify teachers' specific needs in order to make a 1:1 initiative successful."

Montgomery, M.C. (2017). *Factors that influence technology integration in the classroom* (Doctoral dissertation). Available from ProQuest Dissertations and Theses Global database. (UMI No. 10268357).

Abstract: "Education is one area where the use of technology has had great impact on student learning. The integration of technology in teaching and learning can significantly influence the outcome of education in the classroom. However, there are a myriad of factors that influence technology integration in the classroom. The purpose of this study was to investigate the variation of teacher integration of technology into classroom instruction. Factors that teachers perceive as being the most influential will be analyzed. The investigation also serves to inform school leaders about specific ways to ensure maximum use of instructional technology by all staff members.

The study involved a comprehensive high school centrally located in a suburban county in Maryland with an on-time graduation of above 95%. This study surveyed 49 teachers who are employed at this high school and represent various years' experience. Their teaching assignments range from standard level to advanced placement courses in one of the following content areas: English, science, social studies, or math. The research design in this study is quantitative in nature and was conducted through an on-line anonymous, eleven question survey using the Qualtrics platform.

A total of 44/49 participants, or 90%, provided responses to all of the questions asked on the anonymous survey. Results indicated that content, grade, skill level of student, and years' experience had no effect on the integration of technology in the classroom as 84% reported daily integration. Smart Boards and Laptops were the most frequently used while responders/clickers and the document camera were the least frequently used. Teachers reported using the Internet to develop lessons, Moodle, and video clips from the Internet were the most common uses of technology. Furthermore, results indicated that personal interest, availability, and professional development had the greatest influence over a teacher's decision to integrate technology."

Mulder, D.J. (2017). *Pre-service teachers' perceptions of their abilities for technology integration: A mixed-methods case study* (Doctoral dissertation). Retrieved from http://scholarworks.boisestate.edu/cgi/viewcontent.cgi?article=2336&context=td

Abstract: "This case study was developed to understand pre-service teachers' perceptions of their abilities to integrate technology into the classroom, and to understand their perceptions of how those abilities developed. The case that was investigated in this study is the teacher preparation program at a small comprehensive college located in the upper Great Plains region of the United States. Utilizing a convergent parallel mixed-methods design, both a survey as

well as semi-structured interviews provided data to understand pre-service teachers' perceptions of their preparation for technology integration. The TPACK framework for technology integration (Mishra & Koehler, 2006) and self- efficacy theory (Bandura, 1986, 1997) were used as a theoretical framework for understanding pre-service teachers' self-efficacy for technology integration.

The results of this study indicate that pre-service teachers generally feel confidence with regard to their abilities to integrate technology, but also feel a sense of pressure to be able to teach with technology. The results further suggest that there are a variety of things teacher educators can do to support pre-service teachers in their learning to integrate technology, including modeling technology integration, providing both formal and informal learning opportunities to develop technological knowledge and skills, and helping pre-service teachers understand the link between technological knowledge, pedagogical knowledge, and content knowledge. Additionally, the pre- service teachers participating in this study indicated that they believe a practical course in technology integration would help to prepare them for teaching in contemporary classrooms. Based on the findings of this research, a plan of action is suggested for teacher educators interested in fostering pre-service teachers' abilities to integrate technology in the classroom."

Rios-Parnell, A. (2017). *Professional and technological development (PTechD) program for online remote adjunct instructors for higher education: The evaluation process* (Doctoral dissertation). Available from ProQuest Dissertations and Theses Global database. (UMI No. 10273052)

Abstract: "Researchers agreed with the fact that online learning will continue for a long time and that its growth will continue for many years. However, a concern exists regarding training that is offered to online higher education instructors based on the professional and technological skills they should master as online instructors. Based on an increased and continue reliance on online remote adjunct faculty members, it is imperative for leaders at higher education institutions to assess not only how the instructors feel about their jobs, duties, and responsibilities and what aspects contribute most to their level of satisfaction with professional and technological development (PTechD) received, but to have a PTechD with an effective evaluation process in place to ensure the online remote adjunct instructors receive the necessary professional and technological skills to be successful online remote adjunct instructors. The main goal of the current study was to formulate some characteristics for a professional and technological development (PTechD) program for online remote adjunct instructors and for the instructors' evaluation processes after a PTechD is received. The study was used to examine how instructors perceived their level of preparedness with received PTechD. The qualitative descriptive case study involved the topic of a PTechD program for online remote adjunct instructors in a higher education institution. Data were collected using a survey methodology, an instructor self-reflection assessment, and an interview process to describe the level of satisfaction online-adjunct instructors have with the professional and technological development (PTechD) program at their institution."

Yun, L.C. (2017). *Developing elementary mathematics teacher self-efficacy scale of teaching mathematics with ICT in Malaysia context* (Master's thesis, National Taichung University of Education, Taichung, Taiwan). Retrieved from http://ntcuir.ntcu.edu.tw/bitstream/987654321/12264/2/cy-ntcu%E5%8A%A0%E5%AF%86.pdf

Abstract: "Technology integration in teaching had receive growing attention in the digital age and many studies had shown positive results in promoting students learning. However, most of the studies emphasized on the outcome of students' learning but less research about the teachers' competency to integrate technology in teaching. Additionally, majority of the elementary school teachers are not teaching as per their subject expertise. Teachers with non-science background and lack of technological pedagogical content knowledge (TPACK) may have low self-efficacy toward teaching with technology. Therefore, developing an appropriate instrument is needed for assessing and measuring self-efficacy of elementary in-service teachers in teaching mathematics with information and communications technology (ICT). This instrument can serve as foundation in teachers training and teacher professional development for improvement of teacher education and the future of mathematics education. This study aims to develop a new self-efficacy scale, namely Self-efficacy in Teaching Mathematics with ICT for in-service mathematics teacher. Besides, current study presents the results of exploratory factor analysis of elementary in-service mathematics teachers."

4. Recent TPACK Presentations

Christofides, E.M., & Angeli, C. (2017, July). *A design methodology for investigating domain-specific aspects of technological pedagogical content knowledge through the teaching of music: The importance of affect.* Paper presented at the International Conference on Information Communication Technologies in Education, Rhodes, Greece.

Abstract: "The present study addresses the lack of a theoretical framework for the integration of technology in music teaching and learning, and explores, within the framework of Technological Pedagogical Content Knowledge (TPCK), the importance of affect in instructional design. The study extends the theoretical framework of TPCK to a design framework and proposes a methodology and instructional design guidelines that address both the cognitive and the affective domains of learning. The research has both practical and theoretical significance as it provides teachers with explicit guidance on how to design music lessons based on TPCK principles and examines interactions among content, technology, and affect." (Abstract retrieved from
http://www.icicte.org/ICICTE_2017_Proceedings/SSP1_Macride%20Christofides%202017.pdf)

Dasgupta, C., Magana, A.J., & Chao, J. (2017, June), *Investigating teacher's technological pedagogical content knowledge in a CAD-enabled learning environment.* Paper presented at the 2017 ASEE Annual Conference & Exposition, Columbus, Ohio.

Abstract: "There has been an increased emphasis on the integration of engineering design with science learning across all grades in the school curriculum. A critical aspect of this integration process is understanding teacher preparedness and their knowledge about the technology, content, and pedagogy relevant for the effective implementation of such integrated curriculum. Prior research suggests that teachers may not be prepared to integrate technologies and other scaffolds that are crucial for students' productive engagement with engineering design. Teaching technology skills isolated from the classroom context in which they need to be implemented does not help. Thus, the need of the hour is classroom environments that provide teachers opportunities for engaging deeply and meaningfully with the technology and scaffolding the implementation of technology to support science and engineering learning. We present findings from a study that investigates teachers' technological pedagogical content knowledge in the context of a project-based unit using a CAD tool. We discuss ways in which teachers' orchestrated their classroom instruction and interactions with the students." (Abstract retrieved from https://peer.asee.org/28586)

Debbagh, M. & Jones, W.M. (2017, June). *Examining English language teachers' TPACK in oral communication skills teaching.* Paper presented at EdMedia: World Conference on Educational Media and Technology, Washington, DC. Retrieved from https://www.learntechlib.org/p/178383/.

Abstract: "This case study utilized the Technological Pedagogical Content Knowledge (TPACK) theoretical framework (Mishra & Koehler, 2006) as a lens to examine the instructional strategies of four English as a second language (ESL) teachers and their rationales for incorporating technology into their instructional practices in teaching oral communication skills. The four teachers taught adult learners at the intermediate and advanced levels of an English Language program at a university in the Southeastern United States in spring of 2015. The survey results reported low mean scores in teachers' technological knowledge but higher mean scores for the constructs of technological content knowledge, technological pedagogical knowledge, and TPACK. The data gathered from class observations and interviews suggested that teachers' pedagogical approaches determined the extent to which technology was used in class."

Moundridou, M., & Papanikolaou, K.A. (2017, April). *Educating engineer educators on technology enhanced learning based on TPACK*. Paper presented at the Global Engineering Education Conference, Athens, Greece.

Abstract: "A main issue in educating engineer educators on how to integrate technology in teaching is to make them (a) appreciate pedagogical theories as a guide for designing effective learning contexts, as well as (b) approach technology as a cognitive tool instead of a learning outcome - as they usually do due to the close connection of their discipline with technological advances. It is especially challenging but necessary for integrating technology in a constructivist context, to stimulate conceptual and instructional changes, preparing teachers to focus on pedagogy, content, and technology as well as on the way they need to appropriately combine them in order to design learner-centered, technology enhanced contexts. In this paper, we

propose an approach for educating engineer educators on TEL that uses WebQuests as the main methodological tool for cultivating technological pedagogical content knowledge (TPACK). Through WebQuests we aim to cultivate pedagogical and technological skills to student engineers. At the same time, we aim at stimulating them to reflect and elaborate on their subject matter and on how to design learning in an authentic context." (Abstract retrieved from http://ieeexplore.ieee.org/abstract/document/7943007/)

Rahman, S. M. M., Chacko, S. M., & Kapila, V. (2017, June), *Building trust in robots in robotics-focused STEM education under TPACK framework in middle schools.* Paper presented at the 2017 ASEE Annual Conference & Exposition, Columbus, Ohio.

Abstract: "Nonetheless, based on our experience, we believe that despite its tremendous potential robotics cannot be widely incorporated into STEM education curricula until teachers and students develop trust in the robotics. Here, trust of teachers and students in robotics indicates their willingness to believe in the solutions provided by robots and to rely on the contributions of robots in STEM teaching and learning. Human trust in robots is extensively explored in fields such as service, manufacturing, etc. However, trust of teachers and students in robots in robotics-focused STEM education has not been studied yet.

This paper is based on our collaboration with 20 teachers of 8 urban, inner-city schools and observations of over 200 students in their robotics-focused STEM lessons under TPACK framework. Using appropriate questionnaire techniques, we develop a 'trust vocabulary' that contains what the teachers and the students mean by trust in the robots for their lessons, and what factors and features of the robotics may affect their trust. Next, we develop a qualitative trust assessment method using a Likert scale and derive a quantitative trust computational model. We compare the qualitative and quantitative trust measurements and validate the quantitative trust model. We propose several hypotheses and investigate whether there are statistically significant differences in trust in robots between teachers and students, teaching subjects such as science and math, and participants' genders. We analyze whether the level of trust of the teachers in robotics effects their pedagogy and the level of trust of the students effects their learning methods. Based on the trust assessment results, we conduct a survey with the teachers and students and offer recommendations that may help enhance the trust levels of the teachers and students in the robotics for STEM education.

The results are novel that may advocate using robotics as a trust-worthy pedagogical tool under the TPACK framework, argue incorporating robotics into STEM education curricula in middle schools, and help maintain appropriate levels of trust of teachers and students in robots, which may increase the overall learning outcomes." (Abstract retrieved from https://peer.asee.org/27990)

Rahman, S. M. M., Jayasree Krishnan, V., & Kapila, V. (2017, June), *Exploring the dynamic nature of TPACK framework in teaching STEM using robotics in middle school classrooms.* Paper presented at the 2017 ASEE Annual Conference & Exposition, Columbus, Ohio.

Abstract: "TPACK (technological-pedagogical-content knowledge) is a conceptual framework that reflects the status of technological, pedagogical, and content knowledge of educators. The TPACK framework allows teachers to use technology as an effective pedagogical tool to present disciplinary knowledge in readily accessible ways to students, promote active learning, and assist students in comprehending content that is pedagogically challenging. Recent proliferation of robotics as a technology component to facilitate effective pedagogy requires further investigation into TPACK because the teachers not only need to know how to operate robotics under TPACK, but also to incorporate it into teaching their assigned curriculum. Furthermore, situated cognition theory can help guide the development of robotics-focused TPACK, which is dynamic in nature and various factors and contexts may affect its efficacy. However, prior research has not devoted significant effort to explore the dynamic nature of TPACK for teaching STEM in robotics-focused classrooms. In this paper, we explore the dynamic nature of TPACK for teaching STEM with robotics in middle school classrooms. We collaborate with 20 teachers in eight urban, inner-city schools and observe their teaching of robotics-focused STEM lessons under TPACK. Using questionnaires, we identify the ideal requirements of teachers' TPACK to effectively teach STEM lessons using robotics. We also determine the relative importance of the various domains of TPACK. Next, using questionnaires and brainstorming, we identify the factors that may affect the requirements of the technological, pedagogical, and content knowledge and their relative importance. We investigate different strategies and awareness levels of TPACK in different schools. We develop an assessment method to assess the self-efficacy of the teachers to teach robotics-focused STEM lessons under TPACK. We analyze the reasons behind the deficits in the self-efficacy scores and provide recommendations to improve TPACK self-efficacy of the teachers. The results are novel and fundamental that may contribute to expand the conceptual horizon of TPACK, develop and maintain a balanced TPACK for teaching STEM with robotics in middle schools, and also maintain appropriate self-efficacy levels of the teachers, which may enhance the overall learning outcomes of the students." (Abstract retrieved from https://peer.asee.org/28336)

Setiyanti, A.A., & Hunt, J. (2017, July). *Towards measuring TPACK in Indonesian elementary pre-service teachers.* Paper presented at the International Conference on Information, Communication Technologies in Education, Rhodes, Greece.

Abstract: "Technological and Pedagogical Content Knowledge (TPACK) has, in recent years, been the focus of considerable research, particularly in subject specific domains. This paper explores the ideas of TPACK and its relationship to Indonesian elementary pre-service teachers. Links are drawn between Hunt's (2015) use of graphic organisers to explore teaching practices, curriculum connectedness, attributes of the teacher and use of ICT artifacts and a theoretical planning tool, TRIM, the Technological Reflective Integration Matrix (Setiyanti & Hunt, 2016). The outcomes outlined here are preliminary, but encourage the researchers to improve the TRIM model as a way to capture a broader picture of TPACK in a domain not well researched -- elementary pre-service teachers." (Abstract retrieved from
 http://www.icicte.org/ICICTE_2017_Proceedings/2.3_Setiyanti__Hunt_.pdf)

5. Recent TPACK Open Educational Resources

Hofer, M., & Harris, J. (2017, June). *Learning first; tools last: Curriculum-based planning with technology* [online short course for inservice teachers]. Retrieved from College of William & Mary, School of Education, Learning Activity Types Website: http://activitytypes.wm.edu/shortcourse/

Hofer, M., & Harris, J. (2016, March). *Learning activity types online short course for elementary preservice teachers.* Retrieved from College of William & Mary, School of Education, Learning Activity Types Website: http://activitytypes.wm.edu/shortcourse/

Hofer, M., & Harris, J. (2016, March). *Learning activity types online short course for secondary preservice teachers.* Retrieved from College of William & Mary, School of Education, Learning Activity Types Website: http://activitytypes.wm.edu/shortcourse/

6. Call for Teachers' Participation in a TPACK Study

Do you know teachers who currently use the TPACK-based learning activity types (LATs) taxonomies (hyyp://activitytypes.wm.edu) to plan instruction? If so, we have a favor to request. Judi Harris and Mark Hofer (at the College of William & Mary in Virginia, USA) are currently planning a research study about how the LATs are used in instructional planning and classroom practice. Participants will be asked to complete an online survey in late October or November, and a subgroup of survey respondents will be asked to also participate in two interviews in early 2018, scheduled at their convenience. We ask that teachers who may (tentatively) be interested in participating in this study please email Judi (judi.harris@wm.edu) with their name, subject(s) and grade(s) that they teach. If you are willing to help us to find possible participants for our study, please send a copy of this paragraph to all potentially interested teachers. Many thanks for your assistance!

7. TPACK Newsletter Suggested Citation

Our thanks to Lisa Winebrenner, who wrote to recommend 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., & Wildman, A. (Eds.). (2017, October 7). TPACK newsletter issue #34: October 2017 [Electronic mailing list message]. Retrieved from http://bit.ly/TPACKNewslettersArchive

8. 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.org website at: http://tpack.org/
- Join the TPACK SIG at: http://site.aace.org/sigs/tpack-sig/
- Read past issues of the newsletter at: http://activitytypes.wm.edu/TPACKNewsletters/index.html
- 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
- Access and/or adapt TPACK online short courses at: http://activitytypes.wm.edu/shortcourse/

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 (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, please 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 & Amelia

…for the SITE TPACK SIG leadership:
Mamta Shah,   Co-Chair, Drexel University
Teresa Foulger,   Co-Chair, Arizona State University

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