TPACK Newsletter, Issue #41: May 2019

Welcome to the 41st 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 Technology

"Science and technology revolutionize our lives, but memory, tradition and myth frame our response."
-Arthur M. Schlesinger

In This Issue

1. TPACK Newsletter Update

The TPACK Newsletter has been published via the tpack.news email list since January 2009. It has 1218 subscribers currently. Subscription numbers have held steady (+ or – 1% to 3%) since October 2011.

To date, the total numbers of TPCK/TPACK-focused or -supported journal articles, chapters in edited books, books, and dissertations that have appeared in all TPACK Newsletter issues are:

Articles: 1054   Chapters: 286   Books: 28   Dissertations: 336

2. Recent TPACK Publications

Below are recent TPACK publications that we know about: **59 articles, 4 chapters,** and **20 dissertations** that have not appeared in past issues of this newsletter. If you know of others that were published within the past several months, please let us know at: tpack.newsletter.editors@wm.edu.

Articles

Agustin, R. R., liliasari, S., Sinaga, P., & Rochintaniawati, D. (2019). Assessing pre-service science teachers' technological pedagogical content knowledge (TPACK) on kinematics, plant tissue and daily life material. *Journal of Physics: Conference Series*, *1157*(2), 1–5. https://doi.org/10.1088/1742-6596/1157/2/022013

Abstract: "The purpose of this study was to examine pre-service science teachers' technological pedagogical content knowledge (TPACK) on integrated science. Ten questions were implemented to 21 pre-service science teachers during school science course. Science topics involved was kinematics, plant tissue and daily life materials. During a semester, PSTs were asked to analyze the science contents demanded by Indonesian Curriculum. Moreover, the questions were given to measure PSTs' seven constructs of TPACK. Data technological content knowledge (TCK) as the best construct posing by PSTs which is 95.24. The lowest construct is content knowledge (CK) which is 20.24. This finding implies the necessity of program promoting PSTs' content in subject matter course specifically for kinematics. The score of pedagogical knowledge (PK) is 71.43. The score of PCK is 38.10. The score of TK, TPK and TPACK are 80.95, 61.90 and 80.95 respectively. Thus, it is essential to prepare the PSTs ability to connect science topics and the nature of science and use of various ways of representation or examples to deliver certain content. Moreover, it is believed that the PSTs low ability to comprehend the context is the most factor influencing their low PCK."

Alnajjar, H. S., & Al-Jamal, D. A. H. (2019). UNRWA EFL in-service teachers' perception of the application of TPACK in teaching listening and speaking. *IUG Journal of Educational and Psychological Sciences*, *27*(2), 56–72. Retrieved from https://journals.iugaza.edu.ps/index.php/IUGJEPS/article/download/3696/2456

Abstract: "The aim of the study is to investigate the English language teachers' perception of Technological Pedagogical and Content Knowledge (TPACK) in the teaching of listening and speaking within the UNRWA (United Nations Relief and Works Agency for Palestine Refugees in the Near East) schools in Jordan. The participants of the study are 69 (39 female and 30 male) full-time English teachers who responded to the TPACK survey questionnaire. The results of the study indicated a lack of Technological Knowledge (TK), a dissociation of Technological Knowledge (TK) with Content Knowledge (CK), a lack of Pedagogical Knowledge (PK) and a lack of Technological Pedagogical and Content Knowledge (TPACK). The study recommends the need for EFL teachers in Jordan to join TPACK-based training workshops, regardless of gender or experience, in order to integrate

technology in their teaching to improve their teaching skills and their students' achievements in listening and speaking."

Al-rsa'i, M. S., & Shugairat, M. F. (2019). Technology driven differentiated instruction in science teaching. *International Journal of Education*, *11*(2), 15–24. https://doi.org/10.5296/ije.v11i2

Abstract: "This study aimed to investigate how to implement Differentiated instruction in Science teaching by using technology. The analytical approach was used and the results showed that technology enhanced Differentiated instruction because of the diversity of technology tools and programs. Moreover, the use of technology in Differentiated instruction requires the hiring of (TPACK) model (Technological Pedagogical content Knowledge) regarding the interrelationship between content, teaching and technology. Technology also helps in applying Differentiated instruction of Science through identifying students' interests, and the degree of readiness, along with the appropriate learning patterns for each of them. The study recommends training science teachers how to implement the differentiated instruction by using technology, and sensitize them to (TPACK) model, increasing opportunities of including this model in the science curriculum."

Anderson, S. E., & Putnam, R. (2019). Special education teachers' experience, confidence, beliefs, and knowledge about integrating technology. *Journal of Special Education Technology*. Advance online publication. https://doi.org/10.1177/0162643419836409

Abstract: "This study investigated the perspectives of elementary special education teachers regarding integrating technology into lessons. Eight special education teachers at a private university laboratory school, who varied in their levels of teaching experience and confidence with using technology, participated in the study. We interviewed each teacher three times, with two of the interviews following our observations of technology-integrated lessons. Qualitative analysis of interview transcripts provided insight into the interrelationships among teachers' technological pedagogical content knowledge, teaching experience, confidence with using technology, beliefs about the role of technology in education, and perceptions of the benefits and challenges associated with using it. Teachers' perceptions of the value of technology in special education classrooms included providing differentiation, offering varied representations of content, enhancing motivation and engagement, facilitating formative assessment, and fostering life skills. Challenges of integrating technology included technology malfunctions and lack of teacher and student technological knowledge."

Asamoah, M. K. (2019). TPACKEA model for teaching and students' learning. *Journal of Academic Ethics*. Advance online publication. https://doi.org/10.1007/s10805-019-09326-4

Abstract: "The framework, Technological Pedagogical Content Knowledge, Ethics and Accomplishment (TPACKEA) provides an extension to a modified TPACK framework by adding 'Ethics' and 'Accomplishment'. The reason is that further theoretical formulations and

deployments need to be carried out on Technological Pedagogical Content Knowledge (TPACK) if TPACK research is to harmonize and constructively strengthen the field of blended/full online learning in higher education. It is a qualitative study that employed in-depth interviews for data collection. The data collection procedure of this study employed a judgmental sampling of twenty (20) lecturers who used Sakai/MOODLE Learning Management System (LMS) for teaching. It was observed that the extension of the modified TPACK framework to include 'Ethics' and 'Accomplishment' needs was in practical terms suitable and necessary for effective teaching and learning in higher education. It has been recommended that universities provide education on academic ethics and appropriate behaviours, sponsor lecturers in their academic careers and create an enabling environment for teaching and learning so that lecturers will get to the state of accomplishment in a blended learning milieu."

Atiquil Islam, A. Y. M., Mok, M. M. C., Gu, X., Spector, J. M., & Hai-Leng, C. (2019). ICT in higher education: An exploration of practices in Malaysian universities. *IEEE Access*, *7*, 16892–16908. https://doi.org/10.1109/access.2019.2895879

Abstract: "Information and communication technologies (ICTs) have been provided by higher education authorities to ensure that teachers use ICT to enhance their teaching, learning, and research outcomes. However, ICT has been found to be underutilized, especially by teachers. To investigate this issue, the technology adoption and gratification (TAG) model was validated and used to examine Malaysian university teachers' adoption and gratification of ICT for teaching and research purposes and then used to investigate the moderating effect of universities in different regions. The 397 teachers from the west and east Malaysian universities were surveyed using a stratified random sampling technique. The research data were analyze during the three-stage structural equation modeling. There were focused use factors: 1) academic purpose;2) research purpose; and 3) teaching purpose. The TAG model was useful in explaining differences in ICT uses. West Malaysian teachers' perceived usefulness and ease of use mediated the relationships between computer self-efficacy, gratification, and intention to use ICT, respectively. However, for east Malaysian teachers, only perceived ease of use did not mediate the relationship between computer self-efficacy and gratification. Finally, west and east Malaysian teachers' intentions to use ICT mediated the relationships between actual use, perceived usefulness, and ease of use. This paper confirms the utility of the TAG model for comparing teachers' adoption and gratification of ICT. In addition, this paper provides a basis for the targeted professional development of teachers in the east and west Malaysian universities which were selected based on the known differences."

Bull, G., & Thompson, A. (2018). Dawn of a new profession: Remembering SITE's founder. *Journal of Technology and Teacher Education*, *26*(4), 519–526. Retrieved from https://www.learntechlib.org/primary/p/207494/

Abstract: "SITE's founder, Jerry Willis, was born in 1943. He died this year just prior to the thirtieth anniversary of the organization that he founded. Television, computers, and the Internet did not exist when Jerry was born. He was a visionary who saw the transformative possibilities of computers in education. He founded SITE to realize this potential."

Bulut, A., & Isiksal, M. (2019). Perceptions of pre-service elementary mathematics teachers on their technological pedagogical content knowledge (TPACK) regarding geometry. *Journal of Computers in Mathematics and Science Teaching*, *38*(2), 153–176. Retrieved from https://www.learntechlib.org/primary/p/173761/

Abstract: "According to the principles of the National Council of Teachers of Mathematics [NCTM, 2000], teaching mathematics needs well equipped teachers in terms of knowledge because of its complex structure. Moreover, teachers' knowledge and technology are an important issue to build up and enhance students' learning. Qualified teachers should know how and why students learn, and how to organize and teach their lessons. Therefore, the aim of this study is to examine pre-service elementary mathematics teachers' perceptions of technological pedagogical content knowledge (TPACK) regarding geometry. The relationships among the components of TPACK and the possible gender and year of enrollment differences related to TPACK components were also examined. In order to collect data, a questionnaire was developed taking into consideration many related studies from the literature. Pre-service elementary mathematics teachers' perceptions of TPACK related to geometry were found to be moderate. In addition, significant correlations between the components of the TPACK framework were detected via correlational analysis. In terms of gender, results revealed that male pre-service teachers had higher scores than females in three components of TPACK, namely technological pedagogical knowledge, technological knowledge, and technological pedagogical content knowledge. The comparison of junior and senior students revealed that although the difference is not significant, senior participants seem to be more competent than junior participants in TPACK dimensions."

Clausen, J. M., Finsness, E. S., Borthwick, A. C., Graziano, K. J., Carpenter, J. P., & Herring, M. (2019). TPACK leadership diagnostic tool: Adoption and implementation by teacher education leaders. Journal of Digital Learning in Teacher Education, 35(1), 54-72. https://doi.org/10.1080/21532974.2018.1537818
Access to full reprint:
https://www.tandfonline.com/eprint/tpwPUpUXZthQiKnWCqCh/full?target=10.1080/21532974.2018.1537818

Abstract: "This case study describes how leaders from three teacher education institutions utilized a technological, pedagogical, and content knowledge (TPACK) leadership diagnostic tool in the design, development, and implementation of technology rich initiatives. Participants were interviewed to find out how the diagnostic tool guided their decision making. Content analysis and a priori coding were used to analyze transcripts along with constant comparative methods to explore elements within the diagnostic tool and identify additional codes. Results indicate that education leaders utilized the TPACK leadership diagnostic tool in different ways to guide the design, development, and implementation of their technology initiatives. Participants also provided recommendations for how the diagnostic tool and its use might be enhanced in order to support change."

Cox, S. R. (2019). Technology to enhance in-class discussions and student participation at a multi-campus program. *Currents in Pharmacy Teaching and Learning*. Advance publication. https://doi.org/10.1016/j.cptl.2019.03.010

Abstract: "The purpose of this paper is to discuss the implementation of a novel approach to using technology in a class taught from a satellite campus via synchronous video teleconferencing and its impact on student participation. A wiki platform was blended with an audience response system and implemented during a one-hour class period. Students provided answers to open-ended discussion questions on the audience-response wiki page. The instructor read responses aloud as they were added and provided explanation and immediate feedback on each response. There were 136 second year student pharmacists enrolled in the class, and 41 (30.15%) students contributed to the audience response wiki during the in-class discussion. The combined four discussion questions had a total of 86 responses, which indicates that some students participated more than once. There are five accepted types of student interaction in distance education, and the audience-response wiki addressed each of them. Additionally, it addressed many barriers to in-class discussion for students on a distance campus including microphone anxiety and fear of interrupting a peer on another campus. Beyond enhanced student participation, it allowed the instructor to provide immediate feedback on a higher volume of student responses. Audience response wiki tools are free, easy to use, and allow students across multiple campuses to overcome barriers associated in-class discussion."

Dag, F. (2019). Prepare pre-service teachers to teach computer programming skills at K-12 level: Experiences in a course. *Journal of Computers in Education*, *6*(2), 277–313. https://doi.org/10.1007/s40692-019-00137-5

Abstract: "Today, teaching computer programing (coding) at the K-12 level is one of the priority areas of many countries. On the other hand, teachers with different levels of knowledge about computer programming face with questions related to what to teach and how to teach in a wide range of settings. Considering that the educational programs related to computer programming skills for K-12 students may be increased in the future, during the pre-service training of teachers, development of their professional skills to teach computer programming skills should be supported. In this research, the design of an elective course organized to teach computer programming skills to the pre-service teachers (PSTs) in a degree program that trains computer teachers for K-12 classes in Turkey was presented. In addition, the factors affecting the PSTs' perceptions and their success in that course were investigated. Additionally, PSTs' opinions about the course and the teaching of coding in K-12 classes were examined. According to the findings of the research, it was determined that the PSTs' perceptions related to the course differed according to their general self-efficacy, whereas they did not show difference according to their gender, level of knowledge about computer programming, and their self-efficacy related to coding. It was also found that their success in this course did not differ according to their gender, their achievements in previous computer programming courses and their general academic achievement. Besides, the opinions of the PSTs related to the teaching of coding in K-12 classes and about the elective course were positive; however, their opinions

about the computer programming environments differed according to the programming environments they experienced. In this article, based on the findings of the research, discussions, and suggestions for future studies regarding the teaching of computer programming at the K-12 level are presented."

Djiwandono, P. I. (2019). How language teachers perceive information and communication technology. *Indonesian Journal of Applied Linguistics*, *8*(3), 608–616. http://dx.doi.org/10.17509/ijal.v8i3.15260

Abstract: "The digital technology has permeated almost every aspect of life. Meanwhile, the responses from the field of language teaching in Indonesia to this new development have been scarce. The paper aims to provide an answer to the question whether language teachers perceive Information and Communication Technology (ICT) as a threat or a helpful assistant. To achieve this, a survey was conducted to 110 English teachers in Java, Indonesia. Five closed-ended items and two open-ended items in an online questionnaire asked them several questions about what conditions they see as threats, how they perceive ICT, and what digital facilities they have been using in their work. The results show that most of them perceived ICT positively, seeing it as a beneficial rather than threatening force. To them, ICT has been an attractive source that provides learning resources, fosters communication and collaboration, and spices up teaching-learning activities. Those who expressed their worry over ICT mentioned the importance of teachers' upgrading their ICT skills and called for institutional support for the teachers. Three models, TAM (Technological Acceptance Model), UTAUT (Unified Theory of Acceptance and Use of Technology), and TPACK (Technological Pedagogical Content Knowledge) were then discussed to address the need for helping teachers adapt to the fast-changing digital technology."

Du, W., Liu, D., Johnson, C. C., Sondergeld, T. A., Bolshakova, V. L. J., & Moore, T. J. (2019). The impact of integrated STEM professional development on teacher quality. *School Science and Mathematics*, *119*(2), 105–114. https://doi.org/10.1111/ssm.12318

Abstract: "This study of a state-funded, 3-year implementation of an integrated STEM professional development (PD) program for teachers from two middle schools in the midwestern U.S. examined if participants in the PD were enabled to transform their practice and perceptions of STEM. An integrated STEM approach includes a focus on the STEM disciplines, along with leveraging social studies/history and English/language arts as important context and tools for solving society's biggest challenges. Findings in this study indicated that teachers implemented more effective STEM teaching strategies and had more positive perceptions regarding STEM overall. Further, participants became more aware of their personal needs for resources and support to teach through integrated STEM. Implications for research and practice are discussed."

Fahrman, B., Norstrom, P., Gumaelius, L., & Skogh, I–B. (2019). Experienced technology teachers' teaching practices. *International Journal of Technology and Design Education*. Advance online publication. https://doi.org/10.1007/s10798-019-09494-9

Abstract: "Teachers' teaching practice plays a key role in the learning process of pupils, and for teaching to be successful, teachers must have knowledge in many different fields. This obviously also applies to teaching the subject technology. However, lower secondary school technology education in Sweden has reportedly been described in terms of teaching not following the curriculum along with widespread uncertainty among teachers regarding how to design their teaching practices. To address this national challenge, we need to understand the existing technology teaching practice. The purpose of this study is therefore to explore the considerations experienced technology teachers make. The study is based on interviews with technology teachers who work in lower secondary school (13–15-year-old pupils). The collected data consist of teacher's statements regarding their own expertise and teaching practice. To visualize the described teaching practice, we have analysed collected data through the lens of pedagogical content knowledge (PCK). The results show both similarities and differences in the teachers' descriptions. Speaking in terms of PCK, the purpose and teaching focus expressed by the respondents, framed within the category 'Orientations to teach technology', vary considerably. However, regarding 'instructional strategies', the consensus among those experienced teachers is striking. Experienced technology teachers' teaching practices are proven to provide valuable information about the subject's potential, and the findings offer a basis for the future development of the subject of technology as well as future teacher education and professional development courses."

Guillen-Gamez, F., Lugones, A., & Mayorga-Fernandez, M. J. (2019). ICT use by pre-service foreign languages teachers according to gender, age and motivation. *Cogent Education*, *6*, 1–17. https://doi.org/10.1080/2331186X.2019.1574693

Abstract: "In the area of foreign languages, it is necessary to develop the digital competence of future teachers in order to improve the teaching-learning process that they will carry out with their students. However, different intrinsic variables of teachers can influence their use of information and communication technologies (ICT). The main objective of this study is to analyse the use of ICT by future primary education teachers. The secondary objective is to find out whether age, gender and motivation affect their use of ICT. Non-experimental research has been carried out with a sample of 134 future teachers, specifically those teaching foreign languages. The results show that the future teachers of foreign languages have a pedagogical digital competence in the use of medium-low ICT, their most used technological devices being laptops and projectors. Moreover, they do not use Web 2.0 tools when teaching languages. Regarding gender, it can be seen that there are no significant differences, while the age variable does influence the level of pedagogical digital competence. In addition, it has been confirmed that motivation constitutes an essential variable at the pedagogical digital competence level, both in terms of the use of technological devices, as well as the use of Web 2.0 tools and of Learning Management Systems."

Gyaase, P. O., Gyamfi, S. A., & Kuranchie, A. (2019). Gauging the e-readiness for the integration of information and communication technology into pre-tertiary education in Ghana: An assessment of teachers' technological pedagogical content knowledge (TPACK). *International Journal of Information & Communication Technology Education*, *15*(2), 1–17. https://doi.org/10.4018/ijicte.2019040101

Abstract: "Countries are investing in information and communication technology (ICT) infrastructure and educating their citizens for effective ICT utilization. The attainment of the anticipated benefits hinges on effective integration of ICT in various levels of education. Effective integration of ICT requires educators and teachers who possess the skills to harness the capabilities of ICT into their teaching and learning environments. This article assesses the extent of pre-university teachers' e-readiness to utilize ICT in teaching their various subjects by assessing their technological pedagogical content knowledge (TPACK). Although the ICT literacy of teachers in the pre-university schools in Ghana is high, their ability to utilize ICT to design and deliver subject contents and improve the learning environments of their respective subjects is low. The article suggests a comprehensive retooling of teachers with capabilities to integrate ICT in teaching their subjects."

Havre, S. J., Vakeva, L., Christophersen, C. R., & Haugland, E. (2019). Playing to learn or learning to play? Playing Rocksmith to learn electric guitar and bass in Nordic music teacher education. *British Journal of Music Education*, *36*(1), 21–32. https://doi.org/10.1017/s026505171800027x

Abstract: "This article is based on a case study of how the Rocksmith entertainment music video game can be used in the context of studying electric guitar and bass as part of music teacher training. In empirical terms, we were interested in how music teachers' knowledge becomes articulated in the pedagogical discourse of our participants. As conceptual points of departure, we used play theory, game studies, and the Technological Pedagogical Content Knowledge (TPACK) model of teacher's knowledge. Four ways of approaching the potential role of Rocksmith in music teacher education stand out as a result. In the discussion, we suggest that music gaming can be conceptualised as an activity that expands the reach of what can be considered as 'playful' and 'serious' in music teacher studies. Such an approach can guide our thinking about how different areas of music teachers' knowledge merge into multidimensional competence, paving the way for further discussion about how 'music educatorship' can be constructed in the digital era."

Hew, K. F., Lan, M., Tang, Y., Jia, C., & Lo, C. K. (2019). Where is the "theory" within the field of educational technology research? *British Journal of Educational Technology*. Advance online publication. https://doi.org/10.1111/bjet.12770

Abstract: "Critics often characterise the study of educational technology as under-theorised. To test this assertion and to determine the extent of this criticism, the present paper reports an in-depth analysis of the 503 most recent empirical articles published in three selected education-technology-related journals (Computers & Education; Learning, Media and Technology; and

British Journal of Educational Technology). These journals were selected because they publish studies related to all education settings rather than focusing on only a certain segment such as higher education; they have broad geographical catchment; and they were the most highly ranked journals in terms of their 2017 journal citation impact factor. The present paper examines how explicitly existing theory was identified in previous research, how theories were applied and how often these theories were advanced in education technology research. In the majority of cases, explicit engagement with theory was absent. Many studies either were wholly bereft of theories or made vague use of theory. Where theory was explicit, the articles were more likely to use theory to conceptualise the research, to inform the data collection or analysis process and to discuss the results. Very few articles reported findings that help us to learn something new about a particular theory (ie, little evidence of theory advancement)."

Hossain, S. F. A., Nurunnabi, M., Hussain, K., & Saha, S. K. (2019). Effects of variety-seeking intention by mobile phone usage on university students' academic performance. *Cogent Education*, *6*(1), 1–18. https://doi.org/10.1080/2331186x.2019.1574692

Abstract: "The purpose of this study is to explore the effects of variety-seeking (VS) intention arising from mobile phone usage on students' academic performance (AP). The study identified how students are affected by mobile phone usage, revealing in particular an increased social networking-usage tendency among younger students and how students are continually enthralled by and attracted to VS, which affects their AP. Data were collected from five major universities in Bangladesh via a questionnaire (311 valid responses from 322 completed questionnaires). The methodology adopted was based on multiple theoretical frameworks including technology acceptance model, information systems (ISs) continuance theory, social cognitive theory, and ISs success model. Results from structural equation modelling revealed that VS tendency, arising from mobile phone usage, has a strong positive relationship with AP. The study also highlights theoretical and practical implications for university students, academicians, education managers, and educational policymakers."

Howard, N. R. (2019). Edtech leaders' beliefs: How are K-5 teachers supported with the integration of computer science in K-5 classrooms? *Technology, Knowledge and Learning*, *24*(2), 203–217. https://doi.org/10.1007/s10758-018-9371-2

Abstract: "Educational Technology Leaders' support of computer science teachers in K-5 classrooms are influenced by their beliefs about school-based program implementation criteria, available district-level support, and state mandates on the integration of computer science. The researcher in this study examines the beliefs about Computer Science teacher support, and training in five different Educational Tech Leaders' districts, to determine sustainable implementation practices for K-5 schools. In order to effectively integrate computer science in K-5 instruction, administrators and program decision-makers must be aware of the beliefs Educational Technology Leaders hold related to the implementation process of programs, specifically related to the training of K-5 teachers who facilitate the computer science curricula in classrooms. Information reported in this study may inform school-level, district-level, and state-level decisions related to sustainable computer science program implementations."

Kaplon-Schilis, A., & Lyublinskaya, I. (2019). Analysis of relationship between five domains of TPACK framework: TK, PK, CK math, CK science, and TPACK of pre-service special education teachers. *Technology, Knowledge and Learning*. Advance online publication. https://doi.org/10.1007/s10758-019-09404-x

Abstract: "This long-term single group study was conducted with pre-service special education elementary teachers taking a required graduate level course on integrating technology into mathematics and science instruction in a New York City public University. The purpose of this study was to explore whether Technological Knowledge (TK), Pedagogical Knowledge (PK), Content Knowledge in mathematics and science (CKM and CKS) and Technological Pedagogical Content Knowledge (TPACK) are independent constructs in the TPACK framework and to develop instruments for assessment of each basic domain of the theoretical TPACK framework. Exploratory and confirmatory factor analyses of the developed instruments suggest that the TPACK construct is independent from TK, PK, CKM and CKS. Further analysis using multiple linear regression showed that TK, PK, and CK are not predictors of TPACK. These findings provide an opportunity for independent assessment of different types of teacher knowledge defined by the TPACK framework. This could help teacher preparation programs to evaluate effectiveness of courses that prepare teachers for integration of technology."

Khine, M. S., Afari, E., & Ali, N. (2019). Investigating technological pedagogical content knowledge competencies among trainee teachers in the context of ICT course. *Alberta Journal of Educational Research*, *65*(1), 22–36. Retrieved from https://journalhosting.ucalgary.ca/index.php/ajer/article/view/56399

Abstract: "The Technological Pedagogical Content Knowledge (TPACK) framework developed over a decade ago is still valid and applicable in educational contexts when dealing with the use of technology in teaching and learning. With widespread availability of devices and prolific use of technology among students, teachers need to be conversant with various technologies that can be integrated and enhance the teaching and learning process. Most teacher education programmes equip trainee teachers with the integration of technology in the lessons and introduce them to instructional design that would align to the curriculum and make their teaching attractive and effective. It is important to establish the level of TPACK among trainee teachers and prepare them appropriately with necessary domain of knowledge to enable them to function well in future classrooms. This study was conducted with trainee teachers to determine the validity and reliability of the TPACK questionnaire and to identify trainee teachers' perceived pathways to TPACK. Data were analysed using the maximum likelihood estimation (MLE) procedure, and the measurement model was assessed using confirmatory factor analysis (CFA). The structural model was developed and the path coefficients and their statistical significance were tested to determine the correlations between TPACK competencies."

Koh, J. H. L. (2019). TPACK design scaffolds for supporting teacher pedagogical change. *Educational Technology Research and Development*, *67*(3), 577–595. https://doi.org/10.1007/s11423-018-9627-5

Abstract: "Many empirical studies show that teachers have difficulty designing technology-integrated lessons for student-centered learning. Supporting teachers to change their pedagogical practice is a challenge faced in teacher professional development for technological pedagogical content knowledge (TPACK). This study describes how teachers' conceptions of pedagogical change can be supported through the use of different kinds of TPACK design scaffolds—a meaningful learning rubric, lesson design heuristics and TPACK Activity Types. The impact of these design scaffolds on the TPACK confidence and lesson design confidence of 47 teachers and instructors who were attending a graduate course in educational technology were assessed through pre and post course surveys. Expert ratings of technology-integrated lesson plans designed at the beginning and end of the course were also used to determine the extent of pedagogical change enacted. It was found that these design scaffolds had positive effects on teachers' TPACK confidence and were useful for helping the teachers to articulate pedagogical change in their lesson designs. Participants' feedback for improving the TPACK design scaffolds as well as guidelines for using these to support pedagogical change through TPACK professional development programmes are discussed."

Kola, A. J., Gana, N. N., & Olu, A. M. (2019). The trajectories of science education in Nigeria and its challenges to sustainable development. *Cross-Currents: An International Peer-Reviewed Journal on Humanities & Social Science*, *5*(3), 53–61. Retrieved from http://crosscurrentpublisher.com/ccijhss-53/#

Abstract: "The paper reviewed science education in Nigeria from the pre-independent era to date and its challenge to sustainable development. The various efforts of the government and other stakeholders at developing science education were highlighted in the paper. It was argued that science education is crucial to the sustainable development of a nation. However, achieving sustainable development in Nigeria has been difficult due to the challenge of the quality teacher. Most teachers have poor knowledge of integrating technologies in teaching and also do not have an adequate understanding of authentic learning in science. The review considered the teacher as a link between science education and sustainable development. The article was of the view that the solution to the challenge is teacher possessing adequate technological pedagogical content knowledge (TPACK). Others include teacher enhancing the scientific literacy of students and critical thinking skills."

Konysheva, A. V., Chirkina, S. E., & Vasbieva, D. G. (2019). Features of forming students' reflective position while studying mathematics at university by means of information and communication technologies. *Eurasia Journal of Mathematics, Science and Technology Education*, *15*(3), 1–10. https://doi.org/10.29333/ejmste/103049

Abstract: "Modern professional education takes into account the didactic potential of disciplines and modern educational technologies while searching, developing and implementing new resources and mechanisms in the process of preparing a competitive creative personality with the need for continuous self-improvement and self-development. Studying and analyzing the multicomponent composition of professional training, researchers note the pedagogical potential of information and communication technologies and mathematical disciplines as well

as skills of self-determination, self-organization and reflection in the process of forming professional competence. Thus, the purpose of the article is to study features of forming students' reflective position while studying mathematics at university by means of information and communication technologies. The leading method is the design of a methodical system for teaching mathematics at university, including didactic tools which contribute to increasing students' interest to the subject, as well as the development of skills in self-determination, self-organization and self-analysis. As a result of the research, the authors of the article defined the didactic potential of information and communication technologies in the process of forming students' reflective position while studying mathematics. They pointed out methodical aspects of including various forms of interaction of subjects of the educational process while studying mathematics at university through the use of information and communication technologies. Moreover, the authors developed the method "I am learning myself" in order to form students' reflective position."

Kozikoglu, I., & Babacan, N. (2019). The investigation of the relationship between Turkish EFL teachers' technological pedagogical content knowledge skills and attitudes towards technology. *Journal of Language and Linguistic Studies*, *15*(1), 20–33. https://doi.org/10.17263/jlls.547594

Abstract: "The technology has entered our life day by day and the effects of this are felt in English language teaching and learning, as well as it does in the education. In this study, it is aimed to investigate the relationship between English teachers' technological pedagogical content knowledge (TPACK) skills and attitudes towards technology. This research also examined whether English teachers' TPACK skills and their attitudes towards technology differs according to the gender, FATIH project training and professional experience. This research was conducted with 721 English teachers working in 81 provinces of Turkey. Correlational survey model was used in this study. "TPACK Implementation Scale" and "Attitude Scale towards Technology" were used as data collection tools. Arithmetic mean, standard deviation, t test, ANOVA and Pearson Product Moment Correlation Coefficient were used in data analysis. As a result of the study, it was determined that English teachers' TPACK skills and attitudes towards technology were at high level. While the attitudes of English teachers towards technology did not show a significant difference according to gender, FATIH project training and professional experience, the female teachers and the teachers who got the FATIH Project training had higher TPACK skills. However, it was found that TPACK skills of the teachers did not differ significantly according to the professional experience. In addition, it was concluded that there is a low, positive and significant relationship between teachers' TPACK skills and attitudes towards technology."

Kraglund-Gauthier, W., & Moseley, J. (2019). Building teaching–learning capacities of online nurse educators: Using TPACK to frame pedagogical processes and identify required supports. *Canadian Journal of Learning and Technology*, *45*(1), 1-21. http://dx.doi.org/10.21432/cjlt27595

Abstract: "Quality teaching includes reflective practice, dialogue, and curiosity and depends on personal, institutional, and community assets and constraints, as well as on the individual's definitions of the roles of education in society. Based on an environmental scan and action research with instructors in an online distance Bachelor of Science, Nursing program for registered nurses, participants identified five "big ideas" involving community, instructors, class, interpersonal relationships, and supports to build capacity around the three elements of technological pedagogical content knowledge, or TPACK (Koehler, Mishra, Akcaoglu, & Rosenberg, 2013)."

Kul, U., Aksu, Z., & Birisci, S. (2019). The relationship between technological pedagogical content knowledge and web 2.0 self-efficacy beliefs. *International Online Journal of Educational Sciences*, *11*(1), 198–213. https://doi.org/10.15345/iojes.2019.01.014

Abstract: "The aim of the present study was to investigate the development of technological pedagogical content knowledge (TPACK) and Web 2.0 self-efficacy beliefs (W2SEB) and to determine the relationship between them for middle school pre-service mathematics teachers through their involvement in a course designed using a Web 2.0 tools. To achieve this aim, thirty pre-service teachers participated in forty two hours of the course in which they could interact with Web-based applications. In the course, pre-service mathematics teachers were requested to develop and present e-content related to the use of these applications for learning outcomes determined in 5-8th grade mathematics curriculum. In order to collect the required data, the TPACK and W2SEB scale were applied to pre-service teachers at the beginning and end of the course. The data obtained from these scales were quantitatively analyzed. Within this scope, while there were positive developments in terms of the technological pedagogical knowledge levels and self-efficacy beliefs, there was a significant relationship identified between them. Additionally, when the regression results related to the post-test are investigated, the TPACK sub-factors of technological and mathematical knowledge were shown to be significant predictors of Web 2.0 rapid content development self-efficacy beliefs."

Liu, C., & Elms, P. (2019). Animating student engagement: The impacts of cartoon instructional videos on learning experience. *Research in Learning Technology*, *27*, 1–31. https://doi.org/10.25304/rlt.v27.2124

Abstract: "This mixed research aims at the planning, construction and implementation of a web application to facilitate the educational process on the Normal Distribution through the technological, pedagogical and content knowledge of the Technological Pedagogical Content Knowledge (TPACK) model. This study proposes the use of the PHP programming language (technological knowledge), the topics of Normal Distribution (content knowledge) and computer simulation (pedagogical knowledge) to create the Web Application on the Educational Process of Statistics (WAEPS). The sample consists of 61 students who took the subject Statistical Instrumentation for Business during the 2018 school year. The results of the linear regression (machine learning with 50% and 70% of training) indicate that the WAEPS facilitates the educational process on statistics. In fact, the WAEPS promotes the active role in

the student, develops mathematical skills and facilitates the assimilation of knowledge about the calculation of upper and lower limits in the Normal Distribution by means of data simulation, interactivity and navigation. Even students consider that this web application is innovative and useful for the educational field. In addition, data science (decision tree technique) identifies various predictive models on the impact of the WAEPS in the educational process. Finally, the TPACK model is an ideal frame of reference to innovate the teaching–learning process through technological, pedagogical and content knowledge."

Mercado, M. G. M., & Ibarra, F. P. (2019). ICT-pedagogy integration in elementary classrooms: Unpacking the pre-service teachers' TPACK. *Indonesian Research Journal in Education*, *3*(1), 29–56. https://doi.org/10.22437/irje.v3i1.6506

Abstract: "This study aimed to investigate the Technological Pedagogical Content Knowledge (TPACK) self-efficacy and ICT integration skills of elementary pre-service teachers in elementary classrooms. The respondents were fifty-two (52) elementary pre-service teachers enrolled in the student teaching program at the Central Luzon State University. Results revealed that most of respondents perceived themselves to be highly proficient in all domains of TPACK framework: Technology Knowledge (TK), Content Knowledge (CK), Pedagogical Knowledge (PK), Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK) and Technological Pedagogical Content Knowledge (TPCK). Most of them were found to be good in integrating ICT in classroom instruction, particularly in terms of planning and implementation. Respondents' GPA in Educational Technology and ICT-related courses was found to have negative significant relationship with their planning and implementation of ICT-Integrated instruction. Their TPACK self-efficacy had a highly significant relationship with their planning and implementation of ICT-integrated instruction."

Mishra, C., Ha, S. J., Parker, L. C., & Clase, K. L. (2019). Describing teacher conceptions of technology in authentic science inquiry using technological pedagogical content knowledge as a lens. *Biochemistry and Molecular Biology Education*. Advance online publication. https://doi.org/10.1002/bmb.21242

Abstract: "Technology has become an indispensable component of both modern life science and life science education. However, due to inadequate knowledge and experience, teachers are often unable to include technology essential for practicing science in their teaching. In this regard, professional development workshops for in-service and preservice teachers are beneficial. In this study, we described the role of a professional development workshop in enhancing teachers' technological, pedagogical, and content knowledge through the lens of Technological Pedagogical Content Knowledge framework. Our study is also an example of how teachers can be informed about the current trends in modern research and technology and trained to bring similar research into their classroom."

Muhaimin, M., Habibi, A., Saudagar, F., Pratama, R., Wahyuni, S., Sadikin, A., & Indrayana, B. (2019). A sequential exploratory investigation of TPACK: Indonesian science teachers' survey and perspectives. *Journal of Technology and Science Education*, *9*(3), 269–281. https://doi.org/10.3926/jotse.662

Abstract: "This sequential explanatory design aims at exploring science teachers' perceptions of technology integration regarding technological pedagogical content knowledge (TPACK) which focused on quantitative findings (survey) supported by qualitative findings (interview). The study involved 356 respondents for the survey and eight participants for the interview. Descriptive statistics, t-test and ANOVA were used in the quantitative data analysis while for the qualitative data analysis, a thematic process was conducted. Findings show that the science teachers' perception of their technological-based knowledge is lower than non-technological knowledge namely pedagogical and content knowledge. Further, qualitative findings informed in-depth information about technology integration referred to TPACK namely problems in technology integration, advantages of technology integration, students centered learning, knowledge of new technology and its classroom integration, and peer collaboration. Policy recommendation was established for the betterment of ICT integration in instruction, especially for developing countries."

Nelson, M. J., Voithofer, R., & Cheng, S–L. (2019). Mediating factors that influence the technology integration practices of teacher educators. *Computers & Education*, *128*, 330–344. https://doi.org/10.1016/j.compedu.2018.09.023

Abstract: "While the United States federal government and the main teacher education accreditation organization push for the inclusion of technology in teacher education across the curriculum, little attention has been paid to understanding the technology competencies and behaviors of teacher educators. This study explores this gap by investigating what direct and mediating factors predict technological pedagogical content knowledge (TPACK) in teacher educators, and how these factors along with TPACK influence the adoption of the ISTE technology standards in teacher education. The findings from a sample of 806 teacher educators across the United States indicate that there are significant differences in both TPACK and ISTE standard alignment across subject areas, and that experience levels positively predict ISTE standard alignment to a small degree. More significant, however, is the finding that technology knowledge and institutional support are important mediators, predicting TPACK and ISTE standard alignment. Additionally, TPACK strongly predicts ISTE standard alignment. These findings suggest that institutions should provide targeted support to teacher educators across disciplines and should adopt coherent technology frameworks for their programs. Highlights • TPACK and ISTE standard alignment vary across teacher educators' subject areas. • Technology knowledge and institutional support mediate the above effects. • TPACK is a strong predictor of ISTE standard alignment. • Math teacher educators feel less supported to integrate technology than their peers."

Ocak, C., & Baran, E. (2019). Observing the indicators of technological pedagogical content knowledge in science classrooms: Video-based research. *Journal of Research on Technology in Education*, *51*(1), 43–62. https://doi.org/10.1080/15391523.2018.1550627

Abstract: "The purpose of the study was to observe the indicators of science teachers' technological pedagogical content knowledge (TPACK) using a video-based research method. The study was conducted with four in-service science teachers who taught at a school that offered tablet-based education in primary and secondary levels. Data sources included video-recorded classroom teaching sessions and pre- and post-video teacher interviews. In addition to the in-depth contextual information provided, the findings from the qualitative analysis of teacher cases revealed indicators of teachers' TPACK in their lesson design and actual teaching processes. Design indicators included technology selection, curriculum planning, lesson preparation, and assessment. Actual teaching indicators included lesson entry behaviors, teaching methods and strategies, technology-enhanced classroom management, troubleshooting, and assessment."

Oda, K., Herman, T., & Hasan, A. (2018). Features and methods of designing effective GIS professional development through the technological pedagogical content knowledge (TPACK) framework. *Research in Geographic Education*, *20*(1), 11–25. Retrieved from https://rge.grosvenor.txstate.edu/Issues/Volume-20-Number-1.html

Abstract: "This article reports on the development and implementation of professional development (PD) based on the Technological Pedagogical Content Knowledge (TPACK) framework, as well as the subsequent assessment of the PD. Twenty-four middle- and high-school teachers attended our PD and studied teaching with a geographic information system (GIS), with the aim of deepening student engagement and learning in social science and science. We collected and analyzed attendees' reflective journals. Results suggested that teachers understood the significance of GIS in terms of both benefits for their teaching and for student learning. Furthermore, the participants learned how geospatial technological knowledge could interact with pedagogical content knowledge to create meaningful integration of GIS with classroom instruction. The findings of this study provide implications useful for further research on PD in the GIS domain. The insights on features and methods of designing effective PD should contribute to building the capacity of geography education and research."

Ozudogru, M., & Ozudogru, F. (2019). Technological pedagogical content knowledge of mathematics teachers and the effect of demographic variables. *Contemporary Educational Technology*, *10*(1), 1–24. https://doi.org/10.30935/cet.512515

Abstract: "With increasing global requirements for the use of technological tools and resources in K-12 settings, there is a need to examine the technological pedagogical content knowledge (TPACK) levels of mathematics teachers because technology use in class may enhance students' engagement and motivation in learning mathematics. Hence, the purpose of this study was to develop and validate a TPACK scale to be used in investigating mathematics teachers'

knowledge levels in TPACK components and investigate if mathematics teachers' TPACK levels differed in terms of gender, teaching experience and level of school. This study is based on survey research design. Data were collected from 202 mathematics teachers in the spring semester of 2016-2017 academic year. MANOVA was used for data analysis. As a result of exploratory and confirmatory factor analysis, the TPACK instrument was developed as a valid and reliable 39-item 5-point Likert scale consisting of six scales: 1. Technological Knowledge, 2. Pedagogical Knowledge, 3. Content Knowledge, 4. Technological Content Knowledge, 5. Pedagogical Content Knowledge and 6. TPACK. The results also revealed that there were significant differences between gender and technological knowledge domain in favor of male teachers. However, it was found that teaching experience and level of school had no significant effect on TPACK domains."

Paciga, K. A. (2019). Emergently digital in grade two: Another case of "3.6 minutes per day?" *Journal of Literacy and Technology Special Edition*, *20*(1), 119–149. Retrieved from http://www.literacyandtechnology.org/uploads/1/3/6/8/136889/jlt_v20_1_paciga.pdf

Abstract: "This case study examines the presence of digital tools and the inclusion of digital activities in a grade two classroom for one unit of study on the countries of the world. The researcher sought to: identify the range of web literacy activities and digital skills; describe the ways in which the teacher and students balanced analog and digital texts; and, present the features of the tools and texts used in literacy instruction in the classroom. Data were collected across six hours of classroom observation time spanning three days of instruction. Field notes, photographic stills, and audio-recorded and transcribed teacher interviews served as data sources for the study. 100 randomly selected entries in the field notes and the remaining data from the stills and interviews were coded using a constant comparative method for a range of variables related to the users, tools, texts, modes of meaning in the texts, curricular places, and web and digital skills and competencies. Results indicate 1) there were limited opportunities for children to participate in web literacies, despite the many opportunities to write/compose and read/consume digital media; 2) there is a balance between printed and analog text, and students move fluidly between the paper and the screen; 3)more modes of meaning are utilized in reading/consuming texts than in writing/composing them."

Purwaningshi, E., Nurhadi, D., & Masjkur, K. (2019). TPACK development of prospective physics teachers to ease the achievement of learning objectives: A case study at the State University of Malang, Indonesia. *Journal of Physics: Conference Series*, *1185*, 1–7. https://doi.org/10.1088/1742-6596/1185/1/012042

Abstract: **"**In today's Industry 4.0 era, the development of science and digital technology is progressing so fast. In the context of education, multimedia technology plays a crucial role. The use of internet and digital technology in the teaching and learning activities is incredibly helpful for accelerate and facilitate student learning, so that the learning objectives can be more easily accomplished. The implementation of ICT-assisted instruction in physics will be meaningless if it is not integrated with the subject-matter knowledge of physics and instructional strategies used. This study aimed to reveal the efforts made by prospective physics teachers in helping

students gain better understanding of the course material using the TPACK framework. The type of research was qualitative with a case study approach conducted in the Physics Education program at the State University of Malang in Indonesia. The results showed that the efforts of physics teacher candidates in using ICT in the TPACK framework to achieve the learning objectives have been quite varied, but further development work and testing involving students are still required."

Redmond, P. & Peled, Y. (2018). Exploring TPACK among pre-service teachers in Australia and Israel. *British Journal of Educational Technology.* Advance online publication. https://doi.org/10.1111/bjet.12707

Abstract: "The ubiquitous nature of technology in the world has not yet translated into the ubiquitous use of technology to transform learning and teaching. Teachers lack the confidence and competence to integrate technology across a broad range of tools within a range of contexts. Technological pedagogical content knowledge (TPACK) has become a common framework to explore technology within teaching and teacher education. However, little research exists to explore the similarities and differences of TPACK between different teacher education programmes, within different countries or even different disciplines, especially in a secondary context. Using a self-report online survey, this study sought to compare and contrast TPACK results from pre-service teachers studying in secondary teacher education programmes in Australia and Israel. Findings suggest that TPACK is higher in Australia, and in both countries for those students who were aged over 26. There were no significant differences between gender and disciplines reported. The paper also discusses broad-scale implications for the future of research in TPACK."

Rolf, E., Knutsson, O., & Ramberg, R. (2019). An analysis of digital competence as expressed in design patterns for technology use in teaching. *British Journal of Educational Technology*. Advance online publication. https://doi.org/10.1111/bjet.12739

Abstract: "Teachers cannot presume that their learners have the competence to use the technology brought to the classroom. Therefore, the learners' abilities to use technology may be a concern for teachers. This paper reports on digital competence through an analysis of designs for learning in design patterns, written by upper secondary teachers. Learning activities found in the design patterns were analysed with the aim to understand how teachers perceive the learners' digital competence when using technology. A framework that compromises digital competence was utilised for inferring the digital competencies. The qualitative analysis of these learning activities reveals that competences of information and data literacy, and of communication and collaboration predominate. By analysing the characteristics of learning activities and hence the teachers' ideas of technology use in teaching, it is concluded that design patterns can be used to identify the competences teachers believe are relevant for the learners to acquire. The result therefore involves aspects of how teachers perceive learners' digital competence when using technology in teaching."

Rust, J. (2019). Toward hybridity: The interplay of technology, pedagogy, and content across disciplines at a small liberal arts college. *Journal of the Scholarship of Teaching and Learning*, *19*(2), 102–129. https://doi.org/10.14434/josotl.v19i1.23585

Abstract: "Through semi-structured interviews with sixteen faculty members representing a variety of experience levels and departments, this piece illuminates faculty theories and ideas about digital pedagogy through the conceptual lens of TPACK (Mishra & Koehler, 2006), which delineates the overlapping considerations teachers in designing learning through technological knowledge, pedagogical knowledge, content knowledge. Findings reveal widespread similarities in attitudes toward teaching and learning across all different departments and indicate that, while faculty members had a range of content knowledge, pedagogical knowledge, and technological knowledge inferences, the greatest tensions and successes were articulated when faculty discussed issues located at the nexus of technological knowledge, content knowledge, and pedagogical knowledge."

Sarı, M. H. & Bostancıoğlu, A. (2018). Application of technological pedagogical content knowledge framework to elementary mathematics teaching: A scale adaptation study. *Kuramsal Eğitimbilim Dergisi [Journal of Theoretical Educational Science], 11*(2), 296-317. http://dx.doi.org/10.30831/akukeg.368836

Abstract: "The present study aimed to adapt the Technological Pedagogical and Content Knowledge (TPACK) for mathematics teaching questionnaire into Turkish for classroom teachers who work in public schools. There were three stages in the questionnaire adaptation process. The questionnaire's language validity was established in the first stage, validity in the second and reliability in the third stage. Exploratory Factor Analysis (EFA, n= 372) and Confirmatory Factor Analysis (CFA, n= 310) have been utilized in establishing the validity of the questionnaire. A four-factor solution emerged as a result of EFA: 1) Knowledge of Teaching Mathematics with Technology (KTMT); 2) Knowledge of Teaching Mathematics (KTM); 3) Content Knowledge for Mathematics (CKM); and 4) Technology Knowledge (TK). Those four factors explained 62.20 % of the total variation in the questionnaire. In addition, the results of CFA suggested a good model fit and the internal consistency (α) for the whole questionnaire was calculated as .97. Total item correlation coefficients of all items were higher than .30. Evaluation of these results suggests that a valid and reliable Technological Pedagogical Content Knowledge questionnaire, which consists of 47 items under four subscales (KTMT, KTM, CKM, and TK), was developed."

Seralidou, E., & Douligeris, C. (2019). Learning with the AppInventor programming software through the use of structured educational scenarios in secondary education in Greece. *Education and Information Technologies*. Advance online publication. https://doi.org/10.1007/s10639-019-09866-7

Abstract: "The continuous technological development nowadays acts ancillary and supportively in student-centered learning, in both formal and informal education settings. Effective learning environments, such as the AppInventor software, could spark the students' interest and allow them to develop programming skills and strengthen their algorithmic capabilities. In this paper,

we present a study on the use of eight educational scenarios for the use of the AppInventor software into a secondary education lesson's context. These scenarios were initially evaluated by secondary education informatics teachers. After that, they were implemented in two public Lyceums in Greece gathering teachers' and students' opinions. The results were very positive for the use of AppInventor during the teaching and learning process through the structured educational scenarios that were provided. According to the students' and teachers' opinions the content of these educational scenarios is presented with clarity and helps in learning the lesson's content without being related with any previous knowledge of programming languages or environments."

Spyropoulou, N., Pierrakeas, C. J., & Kameas, A. (2019). Experience gained from applying a team-based approach for MOOC development. *International Journal of Web-Based Learning and Teaching Technologies*, *14*(2), 15–30. https://doi.org/10.4018/ijwltt.2019040102

Abstract: "Massive open online courses (MOOC) constitute an emerging technology for distance and open education while interest in incorporating them in higher education is constantly growing. Due to the free and open access learning opportunities that they offer, they attract an immense number of learners from all over the world. Additionally, because of their openness, they present major challenges, including network co-creation within communities and new forms of communication and collaboration for both students and educators. In this article, the authors present a methodology for a team-based development of MOOCs with the use of a recognized design model that they applied in Hellenic Open University. The main objective is to illustrate the lessons learnt during this MOOC development."

Tseng, S-S., & Yeh, H-C. (2019). Fostering EFL teachers' CALL competencies through project-based learning. *Educational Technology & Society*, *22*(1), 94–105. Retrieved from https://www.j-ets.net/ETS/journals/22_1/8.pdf

Abstract: "Project-based learning (PBL), a learning-by-doing practice, has been used for enhancing English as a Foreign Language (EFL) students' language skills. However, the extent to which and how EFL teachers develop or improve Computer-Assisted Language Learning (CALL) competencies while experiencing PBL remain unexplored. For this study an 18-week PBL project was designed to improve EFL teachers' CALL competencies. A total of 12 EFL prospective teachers were recruited to participate in a sequence of activities: class observations, group discussions, and the design of lesson plans. Pre-and post-TPACK (technological pedagogical content knowledge) surveys were administered to measure participants' improvement of CALL competencies. Qualitative data, including class observation notes, lesson plans, group discussion records, and reflective essays, were collected to triangulate and complement survey results. The survey results showed that the prospective teachers demonstrated higher levels of CALL competencies after the PBL project. Using the qualitative data, this study explicitly documented the benefits which prospective teachers may obtain and the problems they may face when participating in a PBL project. The findings can help future teacher educators

understand how to design and implement effective teaching training for CALL competency development."

Tsouccas, L. F., & Meletiou-Mavrotheris, M. (2019). Enhancing in-service primary teachers' technological, pedagogical and content knowledge on mobile mathematics learning. *International Journal of Mobile and Blended Learning*, *11*(3), 1–18. https://doi.org/10.4018/ijmbl.2019070101

Abstract: "This article reports on the main insights from a study aimed at equipping a group of in-service teachers with the knowledge, skills, and practical experience required to effectively integrate tablet devices within the mathematics curriculum. A professional development program focused on mobile mathematics learning and based on the Technological Pedagogical and Content Knowledge (TPACK) framework was designed and implemented in Cyprus. Six primary school teachers participated in the program. Participants experimented with different ways in which coding apps, and other types of constructivist mobile applications could help students internalize key mathematical concepts across the primary curriculum. They also worked together to develop and/or deliver instructional interventions integrating the use of mobile devices. Findings indicate a positive impact on in-service teachers' perceptions regarding mobile-enhanced mathematics, and on their competence in productively utilizing mobile apps as an instructional tool."

Turgut, T., Aydin, F., & Kanturk Yigit, G. (2019). Technological pedagogical content knowledge competencies of social studies teachers: The case of the city of Karabuk. *International Online Journal of Educational Sciences*, *11*(1), 255–287. https://doi.org/10.15345/iojes.2019.01.017

Abstract: "The basic purpose of the present study was to examine the Technological Pedagogical Content Knowledge (TPCK) qualifications of social studies teachers in terms of some variables. A total of 77 social studies teachers who worked in Karabük city center and in its districts in 2015-2016 Academic Year participated in the present study. The quantitative and qualitative data collection tools were employed in the study. To collect the quantitative data, the Technological Pedagogical Content Knowledge (TPCK) Scale that was developed by Pamuk, Ergun and Ayas (2012) was used. The interview form that was developed by Aksin (2014) was used as the qualitative data collection tool. The SPSS 20.0 Program was used in analyzing the quantitative data. Frequency and percentage values, Mann Whitney U-test, Kruskal Wallis H-test, Independent Sample t-test, One-Way Variance Analysis (ANOVA) were employed in the analyses of the study data. The results of the present study showed that social studies teachers considered themselves as competent at a moderate level in the Technological Knowledge sub-dimension of the TPCK, and they considered themselves as competent at a high level in other sub-dimensions of the scale. The TPCK scores of the social studies teachers who participated in the study did not show significant differences according to the gender and occupational service years variables; however, there were significant differences in the knowledge and skills levels in using technology dimension and in the weekly average time spent on computer dimension. As a result of the research, it was determined that social studies teachers considered themselves

adequate in all sub-dimensions of the TPCK. However, as a result of the semi-structured interviews conducted with teachers, teachers also had positive attitudes towards the use of technology in the teaching process, and they faced some problems in the effective use of the TPCK in the teaching process."

Valtonen, T., Sointu, E., Kukkonen, J., Makitalo, K., Hoang, N., Hakkinen, P., … Tondeur, J. (2019). Examining pre-service teachers' technological pedagogical content knowledge as evolving knowledge domains: A longitudinal approach. *Journal of Computer Assisted Learning*. Advance online publication. https://doi.org/10.1111/jcal.12353

Abstract: "The aim of this study is to outline the development and changes in pre-service teachers' technological pedagogical content knowledge (TPACK) assessments during the first 3 years in teacher education. Specifically, research was conducted at three measurement points over a 3-year teacher education period. The target group consisted of pre-service teachers (N= 148) from three Finnish universities. Results indicate a growth in confidence related to all TPACK areas during the research period. The strongest gains were in pedagogical content knowledge. In addition, the gains were larger in other areas related to pedagogical knowledge than areas related to technology or content knowledge. In areas without pedagogical knowledge, the changes were more moderate. In the discussion section, recommendations are pro-vided on the potential of longitudinal use of the TPACK model to study and improve the development of pre-service teachers' TPACK."

Vasodavan, V., DeWitt, D., & Alias, N. (2019). TPACK in higher education: Analysis of the collaborative tools used by lecturers. *Jurnal Kurikulum & Pengajaran Asia Pacifik, 7*(1), 9–17. Retrieved from https://juku.um.edu.my/article/view/17500

Abstract: "Globalized Online Learning as one of the shifts to transform the higher education system to align with global trends employ technology-enabled innovations such as video-conferencing and live streaming and is expected to dramatically reshape pedagogy in the 21st-century. Technology in higher education should transform the teaching and learning processes beyond the transmission of knowledge through teaching facts and concepts as content knowledge, but in acquiring skills by interacting, applying, evaluating, creating new knowledge and problem-solving. Therefore, integrating appropriate technology in the pedagogy can contribute significantly to the effectiveness of instruction, and learning. Collaborative learning (CL) has been shown to stimulate cognitive processes and enable learners to generate new knowledge through social interactions. Technology can support the CL using tools for effective collaboration. However, lecturers do not seem to have the knowledge and skills to integrate collaborative tools (CT) for teaching. According to the National e-learning Policy, by 2020, 75% of lecturers should have acquired technology pedagogy content knowledge (TPACK) to employ CT in their curricular designs for generating new knowledge. Hence this study employed one group pre-test and post-test experimental group design to measure 37 volunteer lecturers' ability to use TPACK in CL. To analyze the lecturers TPACK, a rubric was developed based on the performance rating scale. The results show that the most commonly used CT among lecturers are instant messaging, YouTube and a discussion forum. Most importantly, lecturers need to

identify a suitable CT to teach a specific given subject because of their ability to use CT for collaboration were below expectation. The findings of this study provide insights for lecturers, the need to develop skills in TPACK so that they can teach in a meaningful way using collaborative tools."

Voithofer, R., Nelson, M. J., Han, G., & Caines, A. (2019). Factors that influence TPACK adoption by teacher educators in the US. *Educational Technology Research and Development*. Advance online publication. https://doi.org/10.1007/s11423-019-09652-9

Abstract: "This study presents the results of a survey of 842 teacher educators at 541 different institutions across the 50 US states that examined the state and direction of technology integration preparation in accredited teacher education programs. Using both descriptive statistics and regression analysis the study provides a general description of the characteristics of these teacher educators, their Technological, Pedagogical, and Content Knowledge (TPACK) adoption, and the relationships between individual and institutional factors and their TPACK adoption. The results of the research show that TPACK adoption is generally low among these teacher educators and that there are multiple personal and institutional factors that influence TPACK adoption. The participants had a significant amount of both K12 and teacher education experience and had high levels of comfort with their technological knowledge. Factors that were shown to influence TPACK adoption included the highest degree offered at their institution, their self-rated TPACK score, and their individual adoption of the International Society for Teaching and Education (ISTE) standards. The results address implications for teacher educator professional development and program accreditation."

Vukicevic-Dordevic, L. (2018). Evolving learning paradigms: Affordances and constraints. *Journal of Teaching English for Specific and Academic Purposes*, *6*(3), 377–387. https://doi.org/10.22190/JTESAP1803377D

Abstract: "A successful teacher is not only a person with specialist knowledge and prominent personal features but the one with skills and capacities emphasizing particularly his/her managerial qualities. In addition, ESP teachers face a specificity dealing with two subject-matter fields – the English language and specific subject-matter knowledge, be it science, humanities, engineering, or anything else. A successful teacher is not only a person with specialist knowledge and prominent personal features, but the one with skills and capacities emphasizing particularly his/her managerial qualities. In addition, English for Specific Purposes (ESP) teachers face a specificity dealing with two subject-matter fields – the English language and specific subject-matter knowledge, be it science, humanities, engineering, or anything else. Are general pedagogical practices overemphasized and often at the expense of content knowledge? In our opinion, teachers' knowledge of student thinking and learning is more related to their emotional intelligence and psychology than pedagogy. Instead of memorizing facts, students are to be taught to search for information, to connect things, and enable the development of integrative knowledge in a multidisciplinary education. In such a learning environment, the responsibility of teachers is not only in their teaching but in facilitating learning by doing. Teachers' ability to use English in a way that encourages learning in their students, where

accuracy, fluency, and intelligibility are implied as necessary, is in our opinion above all theories, especially in times when motivation in students is constantly decreasing and dazzling lights 'are killing softly' our society of gadgets and gizmos."

Wang, Y., Wang, X., Stein, D., Liu, W., & Chen, W. (2019). Examining Chinese beginning online instructors' competencies in teaching online based on the activity theory. *Journal of Computers in Education*. Advance online publication. https://doi.org/10.1007/s40692-019-00140-w

Abstract: "This study constructed an instrument based on the Activity theory to investigate the beginning online instructors' online teaching competencies from the perspective of the online teaching process and applied it to beginning instructors to examine the validity. Eighty-nine beginning online instructors from China participated in this study. Confirmatory factor analysis, descriptive statistics analysis, and regression are used in this study. The results indicated that the Activity theory fit the practice well and the instrument is reliable. Chinese beginning online instructors' online teaching competencies need to be improved, especially in preparing themselves to teach online and conducting meaningful appraisals of student learning. While beginning instructors' gender and age had no significant influence on their online teaching competencies, instructors' educational level, online teaching and learning experience had significant effects on their online teaching competencies. Most instructors perceived that designing and organizing online teaching, as well as evaluating students' performance are the biggest challenges to move traditional courses online. Additionally, implications of this study and recommendations for future research are provided."

Wastberg, B. S., Eriksson, T., Karlsson, G., Sunnerstam, M., Axelsson, M., & Billger, M. (2019). Design considerations for virtual laboratories: A comparative study of two virtual laboratories for learning about gas solubility and colour appearance. *Education and Information Technologies*. Advance online publication. https://doi.org/10.1007/s10639-018-09857-0

Abstract: "Building a virtual laboratory for teaching and learning is a highly complex process, incorporating diverse areas such as interaction design, visualisation, and pedagogy. This article focuses on the production and implementation issues that were found in the comparison of two different virtual laboratory projects, and discuss which design considerations can be drawn from these observations. Two web-based virtual laboratories - the Gas Laboratory and the Virtual Colour Laboratory - were developed independently of each other within two different content areas. The laboratories share considerable overlaps in goals and production circumstances. Through a comparison of production and outcome, similar problems related to design, development and implementation were observed. The research uses a mixed method approach combining quantitative pre- and post-tests for assessments, qualitative surveys, and qualitative, ethnographic observations and interviews. By comparing the background material, five design challenges for developing virtual laboratories are identified: 1) how to balance ambitions with available resources; 2) how to balance intended levels of user interaction with exploratory freedom; 3) how to find appropriate levels of realism depending on target group; 4)

how to choose between mimicking real world appearance and enhanced features; and 5) how to find the best learning situation for the virtual laboratory. To meet these challenges, the following design considerations are proposed: Guide the design work with a clear understanding of purpose and context; select appropriate technology to ensure efficient design and media usage; select level of realism considering purpose and end users; and provide learning guides before and after the virtual lab session."

Woodward, L., & Hutchinson, A. (2018). The STAK model: Exploring individualized professional development for technology integration in literacy. *Journal of Technology and Teacher Education*, *26*(4), 613–644. Retrieved from https://www.learntechlib.org/primary/p/182165/

Abstract: "While teachers in many states are implementing the Common Core State Standards, increased attention is being paid to supporting teachers through professional development, especially for meeting standards involving digital literacy. This study explores the influence of targeted professional development, the Support, Time, Access, and Knowledge Model, on the technology integration practices of elementary literacy teachers. Through an in-depth description of three teachers receiving professional development on integration of an iPad into their instruction, we illuminate areas of consideration for influencing teachers through professional development. These include considering teachers' stances and skills involving digital technology, developing a sense of ownership of content and technology, and providing opportunities for varying degrees of growth as a result of professional development. This study also provides implications for scholars and school leaders in schools that are not oriented towards sustained professional development."

Xiang, Y. M., Aas, E., & Medgard, M. (2019). Teachers' use of digital learning tool for teaching in higher education: Exploring teaching practice and sharing culture. *Journal of Applied Research in Higher Education*. Advance online publication. https://doi.org/10.1108/JARHE-10-2018-0202

Abstract: "The purpose of this paper is to explore teachers' use of digital learning tools for teaching in higher education. Moreover, it investigates how the use of digital tools affects educational practices and how teachers experience the culture of sharing among colleagues and within the organisation. A qualitative methodology was chosen, and semi-structured interviews were conducted with teachers at a higher education institution in Norway. The study uses the TPACK-framework, which illustrates the relationship between technology, professional content knowledge and pedagogical approaches as its theoretical foundation. The findings conclude that teachers are concerned with the convergence of how technology and digital learning tools can support educational processes by engaging and involving the students. The findings further indicate that they are committed to using digital tools to motivate, engage and facilitate student-based education, which in turn leads to more reflection on teachers' own teaching practices. Based on the theory of Professional Learning Communities, the respondents agree that sharing is a basic prerequisite for a learning organisation. They experience, however, that sharing between colleagues is easier in formal forums than at informal settings. The rapid

development of technology suggests that many sectors including the education sector must adapt to the new changes in their teaching practices. Nevertheless, many teachers merely use the basic form of digital learning tools to distribute the teaching materials, as such tools are less utilised to support students' learning process (Fossland, 2015). The research indicates that digital learning tools have positive effect on teaching practices and that they can function as tools to improve the teachers' own teaching practices. Positive teaching practices should also be shared in a learning organisation to improve teaching practices on an organisational level. Hence, sharing at a professional level can impact learning and the organisational culture in academic institutions."

Xiao, H. (2019). An ethnic and folk art space course based on TPACK. *International Journal of Emerging Technologies in Learning*, *14*(3), 110–121. https://doi.org/10.3991/ijet.v14i03.10101

Abstract: "In the past, the apprenticeship system was used to inherit folk art. However, the traditional and rigid teaching methods in the classroom led to the poor effect of learning ethnic and folk art and even the loss of many folk arts. Nowadays, related technologies such as the Internet, cloud computing, and big data are constantly being updated. Under this background of rapid technological development, it is of strong practical significance to integrate ethnic and folk art with technical means. Based on the Technological Pedagogical Content Knowledge (TPACK) framework, the ethnic and folk art space course was constructed in this study by combining the "technology + teaching method + subject knowledge" integration model. Scientific technology was integrated with the education of ethnic and folk art to propose the solution idea and system architecture. Meanwhile, the TPACK-based ethnic and folk art space course was put into practical application to verify its learning effect. The final results show that compared with the traditional teaching, the TPACK-based ethnic and folk art space course can improve the teaching efficiency and promote students' mastery of various skills of ethnic and folk art."

Yildiz-Durak, H. (2019). Modeling of relations between K-12 teachers' TPACK levels and their technology integration self-efficacy, technology literacy levels, attitudes toward technology and usage objectives of social networks. *Interactive Learning Environments*. Advance online publication. https://doi.org/10.1080/10494820.2019.1619591

Abstract: "The present study aims to determine the relation between Technological Pedagogical Content Knowledge (TPACK) levels of teachers and their self-efficacy in integrating technology, their technology literacy and their usage objective of social networks. Structural equation modeling was utilized to create a model explaining and predicting the relations. The study group consisted of 401 teachers. The relational screening model was applied in this study. In the model which was reviewed in the light of obtained study results, it was detected that the most significant variable in the prediction of TPACK levels of teachers' was teachers' technology integration self-efficacy. From this, it can be argued that in teacher education for achieving effective technology integration, it may be useful to explicitly encourage teachers' own beliefs and focusing on developing their own beliefs in practices for technology integration."

Yoestara, M., & Putri, Z. (2019). Podcast: An alternative way to improve EFL students' listening and speaking performance. *Englisia*, *6*(1), 15–26. http://dx.doi.org/10.22373/ej.v6i1.3805

Abstract: "This article aims to view the impacts of using podcast in improving listening and speaking performance. As there is a trend of using ICT in language teaching growths, the authors intend to discuss about the media that can be used in enhancing students' ability in listening skill and speaking performance. The authors collected the information related to the topic of this article from several sources such as, books, journal articels, and previous studies. From these sources, it can be concluded that podcast can bring many benefits in teaching listening and speaking for EFL learners."

Zhang, S., Liu, Q., & Cai, Z. (2019). Exploring primary school teachers' technological pedagogical content knowledge (TPACK) in online collaborative discourse: An epistemic network analysis. *British Journal of Educational Technology*. Advance online publication. https://doi.org/10.1111/bjet.12751

Abstract: "The contextual influences on technological pedagogical content knowledge (TPACK) enactment and the method of TPACK assessment remain to be important research topics. Discourse data of 81 teachers in an online professional learning community were collected and analyzed based on the framework of TPACK. Frequency distribution and time series characteristics of teachers' knowledge domains were analyzed. In addition, epistemic network analysis was used to compare the epistemic network characteristics of teachers in the higher-score and the lower-score groups, different age groups, and post and reply groups. Results showed that teachers' knowledge domains enacted in the context of online discourse were mainly pedagogical content knowledge and general pedagogical knowledge. The teachers in the higher-score group had a rich, organized and flexible knowledge structure of TPACK. Younger teachers had more connections between pedagogical knowledge and pedagogical content knowledge, while senior teachers had more connections between technological knowledge and pedagogical knowledge. The teachers in the reply group had more connections among the different categories of knowledge as compared to the post group. Finally, implications, limitations and future research were discussed."

Chapters

Chan, K. K. H., & Hume, A. (2019). Towards a consensus model: Literature review of how science teachers' pedagogical content knowledge is investigated in empirical studies. In A. Hume, R. Cooper, & A. Borowski (Eds.), *Repositioning pedagogical content knowledge in teachers' knowledge for teaching science* (pp. 3–76). https://doi.org/10.1007/978-981-13-5898-2

Abstract: "This chapter presents a systematic review of the science education literature to identify how researchers investigate science teachers' pedagogical content knowledge (PCK). Specifically, we focus on empirical studies of individual science teachers' PCK published in peer-reviewed science education and teacher education journals since 2008. For each of the reviewed studies, we identify (1) the research context of the investigation; (2) the major purpose of the study; (3) the conceptualisation of PCK in the study; (4) the data sources used to investigate teachers' PCK; and (5) the approaches used to determine teachers' PCK. Using this collated information, we provide an overview of how the PCK concept is used, interpreted and investigated within the science education community. The review reveals that researchers conceptualise and operationalise PCK differently. Consequently, they investigate PCK in highly diverse ways and use a wide range of data sources and approaches to capture and determine teachers' PCK, which in turn generates different kinds of qualitative and quantitative data. Collectively, our findings reveal gaps in the PCK literature and highlight several points of divergence in thinking around the PCK concept within the PCK research community in the field of science education. The findings also provide evidence from the literature supporting the need to build upon and further refine the Consensus Model (CM) that emerged from the first (1st) PCK Summit in 2012 to further science education research."

Chua, C. S. K., & Chai, C. S. (2019). Information communication technology. In B. Wong, S. Hairon, & P. T. Ng (Eds.), *School leadership and educational change in Singapore* (pp. 149–168). https://doi.org/10.1007/978-3-319-74746-0_9

Abstract: "This chapter consists of the narratives of two principals in Singapore on how they had interpreted and communicated Information and Communication Technology (ICT) policies to their teachers, and how they had helped their teachers to design and introduce ICT activities and programmes in their classrooms. As the process of globalization and technological advancement has brought tremendous changes in Singapore, the Singapore government launched the first ICT Masterplan in 1997 with the aim to equip Singaporean students with the necessary skills and dispositions pertaining to ICT so that they are able to thrive in this ICT rich global economy. In order to strengthen this ICT initiative, the technological pedagogical content knowledge (TPACK) was adopted and introduced as a framework to Singapore schools to help educators build the necessary knowledge and skills to facilitate ICT integration in school (Koh et al. 2015). The TPACK contains three basic forms of knowledge, namely the technological knowledge, pedagogical knowledge and content knowledge and in order for TPACK to be successfully operationalized in school, school leaders need to ensure that the vision and

philosophy, curriculum, professional learning, infrastructure and resources, communication and partnerships and research and development are provided for in their schools."

Nicolete, P. C., Bento da Silva, J., Cristiano, M. A., Bilessimo, S. M., Ferreira de Farias, G., & Filho, S. S. (2019). A remote mobile experiment in Brazilian public basic education. In Information Resources Management Association (Ed.), *Virtual reality in education: Breakthroughs in research and practice* (pp. 573-594). https://doi.org/10.4018/978-1-5225-8179-6.ch028

Abstract: "The STEM subjects (Science, Technology, Engineering, and Mathematics) are very important for education, but the lack of experimental laboratories for these subjects in a school might decrease the interest of its students in STEM fields. This chapter explores these issues in the Brazilian context where, in order to address this issue, remote experiments are used to share real experiments manipulated through the Internet. Teachers and students can use remote laboratories, equipped with real experiments, to put in practice theoretical concepts learned in class. This chapter presents a report on a pilot project that aims to explore the use of Mobile Remote Experimentation (MRE) by teachers and students of public high schools in Brazil. It involves the use of mobile devices to access remote experiments in STEM subjects through the Internet. The report demonstrates the effectiveness of using such educational resources to improve pedagogical results by applying the TPACK (Technological Pedagogical Content Knowledge) model to measure the impact of MRE by STEM teachers."

Tan, L. & Ali, J. (2019). Investigating TPACK as professional knowledge for Australian literacy teachers. In R. Hobbs & P. Mihailidis (Eds.), *The international encyclopedia of media literacy.* Advance online publication. https://doi.org/10.1002/9781118978238.ieml0235

Abstract: "The evolving nature of literacy necessitates new bodies of professional knowledge that equip literacy teachers for effective teaching in the digital age. Identifying *technological pedagogical content knowledge* (TPACK) for literacy teaching is defensibly crucial to teacher education programs. While recommendations for new literacies have been put forward by literacy researchers, less is reported about the knowledge that literacy teachers need to develop students' metalanguage for responding to and composing multimedia and multimodal texts. Critical investigations of what constitutes literacy teachers' TPACK for negotiating a range of texts across modes, mediums, and contexts with their students warrant further research to inform reforms in literacy education."

3. Recent TPACK-Related Dissertations and Theses

Amick, M. (2019). *The impact of 1:1 technology initiatives on lesson planning* (Doctoral dissertation). Retrieved from https://dsc.duq.edu/etd/1757/

Abstract: "Districts across the country are quickly moving toward a 1:1 student to laptop ratio. Where computer labs or carts were once the norm, many districts are now purchasing all

students a laptop to start the year. This movement is occurring at a rapid pace, despite a growing body of research that shows that increased technology does not automatically lead to achievement gains. The teacher plays a vital role in student outcomes, with or without technology. In particular, the manner in which teachers plan lessons is significant to classroom outcomes. This is evident in that the Charlotte Danielson Framework for Teaching (2011), adopted by the majority of states as the rubric for teacher evaluations, recognizes planning as one of the four broad categories essential to effective teaching. Given the explosion of interest in educational technology, as well as the recognition that planning is important to good teaching, the primary goal of this research study was to determine the impact that 1:1 technology has on teacher planning. A secondary purpose of the research was to determine the barriers to improving the quantity and quality of technology lessons planned in a 1:1 environment. The theoretical frameworks used in this study are the Substitution Augmentation Modification Replacement (SAMR) model and the Technological Pedagogical and Content Knowledge (TPACK) framework. The SAMR model was used as a guide to determine whether technology was used in a way that increased the rigor of a planned lesson (Puentedura, 2014). TPACK was used as a framework to understand barriers to planning technology lessons (Koehler & Mishra, 2005)."

Antonelli, S. (2019). *Teacher perceptions of technological knowledge and pedagogy in mathematics instruction in a Northeast state* (Doctoral dissertation). Available from ProQuest Dissertations and Theses Global database. (UMI No. 13865988)

Abstract: "Educators are now charged with instructing students who are growing up in a digital environment (Hsin, Li & Tsai, 2014). Students need access to 21st century learning environments that incorporates technology use, especially in mathematics (Darling-Hammond, Wilhoit & Pittenger, 2014). Unfortunately studies show that technology integration is happening least in mathematics compared to other subject areas (Howard, Chan, & Caputi, 2015a; Howard, Chan, Mozejko & Caputi, 2015b; Howard, Chan, and Caputi, 2014). Moeller and Reitzes (2011) found that according to a National Center for Education Statistics study, only 23% of K-12 teachers feel prepared to integrate technology into instruction. The purpose of this sequential explanatory mixed methods study was to investigate and explore teacher perceptions regarding technology knowledge, content knowledge, pedagogy, and preparedness to implement technology integration in mathematics instruction in elementary teachers in an urban ring district in a northeast state. This study addressed the following research questions: 1. How do elementary teachers rate their perceived knowledge of teaching and technology in mathematics on the following components of the Technological Pedagogical and Content Knowledge (TPACK) framework: technological knowledge (TK), content knowledge (CK), pedagogical knowledge (PK), pedagogical content knowledge (PCK), technological content knowledge (TCK), technological pedagogical knowledge (TPK), technological pedagogical content knowledge (TPACK), and models of TPACK related to preparedness? 2. Is there a significant difference in how elementary teachers rate their perceived knowledge of teaching and technology in mathematics on the components of the Technological Pedagogical and Content Knowledge (TPACK) framework by the following demographics: gender, age and years of teaching experience? 3. How do elementary teachers describe their perceived technology

knowledge, content knowledge, pedagogical knowledge, and preparedness to implement technology integration as they relate to mathematics instruction? The major themes that emerged from this study included limited teacher mathematics knowledge because mathematics instruction and expectations for understanding are different today than in the past; and teachers did not feel like they were supported or prepared well to integrate technology into mathematics instruction. Administration and teacher educators may benefit from knowing teachers feel a need to be supported in mathematics conceptual knowledge, problem solving and technology integration."

Basquill, J. (2018). *"A tool not a substitute": A multiple case study investigation of technology use in the early years foundation stage* (Doctoral dissertation). Retrieved from http://eprints.lancs.ac.uk/132776/1/2018basquillphd.pdf

Abstract: ""The increasing availability of digital resources accessible to young children and their engagement with technology is often portrayed in a negative manner. Early years teachers are in an ideal position to address this by introducing technology to young children as a tool for learning. This study investigates the use of digital resources in a cross-case analysis of four early years settings. This multiple case study utilized the Technological Pedagogical And Content Framework (TPACK) (Mishra and Koehler, 2009) to shape the metrics for the study. Qualitative datain the form of interviews, observations and documentary evidence was collected to gain an overview of current practice. Consequently, the TPACK domains and intersections were deconstructed and associated to early years practice. Criteria for each domain and intersection were derived from this and provided the themes for Direct Content Analysis. The findings of the study revealed that personal experience and views of technology use, impact on the equity of children's experience of technology across the settings. The availability of support and training was noted to impact the use of technology as well as the influence of external pressures such as fabrication and social desirability. Thus, it was revealed that teacher confidence and understanding of the capabilities of digital resources available is an important factor in the pedagogical use of technology with young children. The data highlights the need for staff development through bespoke training programmes that consider the pedagogy of early years technology. The need to adapt the TPACK framework to ensure it supports early years practice was also raised. The TPACK-EY offers a framework that promotes self-assessment and highlights areas for development. TPACK-EY enabled identification and analysis of activities in which participants combined their knowledge of technology, content and pedagogy to provide effective, play-based activities which enhanced the children's learning experiences."

Bernard, C. J. (2019). *How ideology and pedagogy impact technology adoption in the classroom, a causal-comparative study* (Doctoral dissertation). Retrieved from https://dune.une.edu/theses/200/

Abstract: "As the world changes from an industrial driven society to one more focused on services and knowledge, the drive for change within higher education is mounting from both students and employers. With the availability of the vast majority of the world's knowledge available to an ever-increasing populace via the Internet, students and employers alike are no

longer satisfied with the three r's – reading, writing, and arithmetic. Instead, employers are expecting graduates to be knowledgeable of the three C's – collaboration, communication, and creative problem solving to negotiate a progressively complex global market. Through advances in cognitive science, we now have a better understanding of how individual learners construct and retain new knowledge. At odds with this understanding of how individuals learn is the continued use of the lecture class format where an instructor is the center of the classroom. The lecture class format or Socratic Method has not only demonstrated a lack of effectiveness compared to other methods such as active-learning which places the student at the center of the classroom but may even disenfranchise students leading to lower test scores and retention issues. Yet, when higher education institutions attempt more productive methods of learning based on the ideas of constructivism such as active-learning or student-centered learning the efforts fail as instructors naturally revert back to the lecture method for a variety of reasons. Where technology has enabled change in other areas of our lives such as social media, entertainment, and retail it has yet to make as profound of an effect in higher education. Understanding to what extent certain curricular ideologies may predict the adoption of technology in the classroom may be beneficial in emboldening change from the Socratic Method to a more student-centered learning experience. Other benefits may include improvements in the return on investments made by higher education institutions as well as shortened technology deployment timelines improving opportunities to keep up with rapidly changing technology trends. Using a combination of two survey instruments, the Schiro Curriculum Ideology Instrument (2013) and the iTEaCH Instrument (Choy, 2013), this causal-comparative research study analyzed data collected from both full-time and part-time faculty at a private liberal arts institution. Through the application of a one-way ANOVA and Tukey-Kramer post hoc test, the results identified statistically significant differences among several of the curriculum ideology types and the adoption of technology in the classroom. Insight into the relationship between curriculum ideology and technology adoption can be used both by technologists and pedagogical specialists as part of technology deployments to improve not only the use of technology in the classroom but also enabling faculty seeking opportunities to change the classroom dynamic focusing more on students and opportunities for individual learning."

Besar, S. N. P. H. (2015). *Engaging higher education students with social media: MIB module case study* (Doctoral thesis, University of Manchester, Manchester, UK). Retrieved from https://www.research.manchester.ac.uk/portal/files/84019928/FULL_TEXT.PDF

Abstract: "This thesis reports on a study which investigated the application of social media in teaching Malay Islamic Monarchy (MIB) in a University of Brunei. The aim was to complement the on-campus delivery of this module, encourage student engagement and produce more active than passive learners. However, tensions existed between social media and the content of the course because of the potential of social media to drown and influence Bruneian Malay cultures and Islamic beliefs in a way that is not consistent with MIB. A questionnaire to 362 undergraduate students at the University of Brunei Darussalam taking the PB1501 MIB module In the semester 1 2012/2013 provided an initial sense of social media use and expectations. Six MIB teachers were also selected to represent different perspective of using social media in

MIB module. Furthermore, the observation of ten MIB Facebook groups spaces and content analysis of ten MIB Facebook groups' transcripts produced information on teaching and learning activities as well as findings as to how teachers facilitate student engagement. The findings of the study indicate that whilst social media is a tool that should be able to solve the pedagogical problems in the MIB course, at the same time cultural obstacles are perceived by some teachers in this particular setting, impacting on its acceptance. Findings suggest that the Implementation of social media such as Facebook in order to so lve a pedagogical problem have raised tensions in this specific cultural environment. The research also shows the MIB teachers have mixed feelings about the fact that social media could complement MIB education.
A way of conceiving the tensions between the issues is provided by the Technological Pedagogical Content Knowledge (TPACK) framework developed by Koehler and Mishra (2009), which is used to understand teacher decisions with respect to MIB, MIB pedagogy and social media (TPACK). This shows the connections and interactions between the content of MIB, the MIB pedagogy and social media."

Bridge, C. (2019). *Examining the effectiveness of middle school students using iPad devices for improving 21st-century skills with and without four Cs specific instruction* (Doctoral dissertation). Available from ProQuest Dissertations and Theses Global database. (UMI No. 13808058)

Abstract: "The 21st Century Skills Movement advocates the need for teaching and learning to emphasize 21st-century themes and trends, such as the skills related to information, media, innovation, technology, and career, plus science, global awareness, and financial and civic literacy. However, a decade after the movement's inception, educators still have questions about skill integration to keep 21st-century education moving forward. The problem addressed in this study was the challenge of effectively teaching the 21st-century Four C skills of critical thinking, communication, collaboration, and creativity in K-12 education is a challenge that remains unsolved. The purpose of this quantitative, quasi-experimental study was to investigate if students learning with iPad devices show a statistically significant improvement in the 21st-century skills of communication and collaboration, two of the Four C's skills, after receiving twice weekly, Four C mini-lessons for five weeks, compared to students learning with iPad devices who do not receive the mini-lessons. The sample was 407 8th grade students at an urban public school in the Midwest, non-randomly selected into four groups. Teams A and B were assigned as the treatment group and Teams C and D were assigned as the control group. Both the control and treatment groups used iPad devices, but the treatment group received an instructional intervention, consisting of a five-week, twice weekly 10-minute mini-lesson on communication and collaboration. A 20-item pre-and posttest survey was employed to measure the effectiveness of Four C mini-lessons on communication and collaboration to improve middle school students' communication and collaboration skills. Findings were that the mini-lesson intervention had a statistically significant effect on the development of communication skills ($p < .05$) but no significant effect on collaboration skills ($p > .05$). One recommendation for future research is to conduct a longer study to see how additional mini-lessons impact Four C skills."

Doherty, B. (2019). *The role of content, pedagogical, and technological knowledge in explaining music teacher self-efficacy* (Doctoral dissertation). Available from ProQuest Dissertations and Theses Global database. (UMI No. 13813724)

Abstract: "This quantitative study examined the self-efficacy of music teachers in each of the technological, pedagogical, and technological knowledge (M-TPACK) domains with a particular focus on their technological self-efficacy. Bauer's (2013) M-TPACK questionnaire was used as its measurement tool and was sent to members of the National Association for Music Education. Overall, respondents reported high levels of self-efficacy when implementing technology in their instruction. In addition, this study revealed that music educators were discovering technology, as well as learning to use it, mostly during their own time and outside of school hours. This study further validated the factor structure of Bauer's M-TPACK survey as it pertains to music teachers for the questions measuring each of the individual TPACK domains. Some additional findings include that male music educators may have greater self-efficacy in using technology in their instruction, and also that technology knowledge might potentially be even more important to the overall self-efficacy of music teachers than either content or pedagogical knowledge. A possible explanation for this could be that effective and appropriate use of technology may also increase student engagement, thus perpetuating a positive cycle of successful teaching and learning. The implications of this study also suggest that previous models of teacher self-efficacy, which did not include technological self-efficacy, may not be reflective of current-day music teachers. Further research is needed regarding technology as it used in the various areas of music education."

Falkenberg Getman, J. (2017). *Digital portfolios for learning and professional development: A faculty development curriculum* (Doctoral dissertation). Available from ProQuest Dissertations and Theses Global database. (UMI No. 10801944)

Abstract: "When constructed with deep reflection, curated artifacts of learning, and structured narratives, a digital portfolio can surface the development of knowledge and skills, demonstrate competency and offer a dynamic portrait of the author's professional identity. The curriculum, Digital Portfolios for Learning and Professional Development is designed to motivate and teach adjunct instructors in Rossier's School Business Management Certificate Program (SBMCP) how to use, and teach their students to use, digital portfolios so that they and their students realize the digital portfolio's educational and professional advantages. The TPACK (Technology Pedagogy and Content Knowledge) framework, expectancy-value theory, constructivist, and adult learning theories influenced the instructional design and delivery of this curriculum. Overall, the curriculum engages learners in portfolio practices that increase metacognition, communication, critical thinking, and digital literacy skills while encouraging self-regulated learning. Evaluation of this curriculum is guided by the New World Kirkpatrick's model of evaluation to assess changes in motivation by measuring task value, self-efficacy and goal orientation before and after instructors participate in training. Formative and summative assessments measure the achievement of learning outcomes, while surveys, observations and interviews are planned to evaluate the transfer of learning and achievement of program level outcomes in the long term. Although the hybrid curriculum references a specific portfolio

application, a modular arrangement of content allows for flexibility in delivery and choice of technology for creating digital portfolios. Recommendations are included for adapting the curriculum to teach portfolio practices in the context of other disciplines and professional fields."

Ferreira, D. I. (2019). *A qualitative action research study of barriers to information and communication technology integration at an Eastern Japan liberal arts college* (Doctoral dissertation). Available from ProQuest Dissertations and Theses Global database. (UMI No 13811846)

Abstract: "The purpose of this qualitative action research study was to explore the perceptions and experiences of English as a foreign language (EFL) university teachers in Eastern Japan to overcome barriers to integrate information and communication technology (ICT) in their daily teaching practice. The problem addressed in this study was universities in Japan are under pressure to align their curriculums with government initiatives that demand ICT integration, but governmental guidelines for faculty development across educational institutions have not been developed. The research setting was a liberal arts college in Eastern Japan and purposeful sampling was used to attain a sample of 12 EFL university teachers. Cultural-historical activity theory (CHAT) served as the theoretical framework. The MAXQDA 12 software was used to identify codes, patterns, and themes across the collected data. The three major themes were: (a) no computer, no projector, and no Internet were faculty barriers to ICT integration, (b) software too difficult to use for teaching purposes was a barrier to ICT integration, and (c) faculty contemplation of learning objectives and learning outcomes informed decisions to integrate ICT successfully. Recommendations for educational leadership included (a) to equip every non- computer classroom with an Internet connected computer and a projector and to ensure these devices were operational at the start of class, (b) to provide reliable Wi-Fi connectivity to improve adoption of ICT, (c) to create a theoretically-driven ICT training program tied to curriculum learning objectives, and (d) to hire educational technologists to provide "just-in-time" techno-pedagogical support. Recommendations for future research: (a) to conduct a mixed method study to compare the operationalized variables of the technological pedagogical and content knowledge (TPACK) framework with a qualitative understanding of the CHAT framework to improve faculty training, (b) a longitudinal qualitative narrative study of contract lecturers to investigate sociocultural teaching/learning contexts of different English departments ICT integration in Japan, and (c) a multiple case study of the perceptions and experiences of teachers in disciplines other than EFL in universities across Japan to compare the findings of this study to contribute to a holistic pedagogical training in ICT integration and learning objectives."

Gettman, S. L. (2019). *A quantitative study of the impact of professional development on teacher technology integration* (Doctoral dissertation). Available from ProQuest Dissertations and Theses Global database. (UMI No. 13806034)

Abstract: "School districts have spent millions on technology tools and trainings. Yet, half of teachers still feel unprepared to utilize technology in the classroom. The primary barrier to

technology has shifted to teacher belief—composed of teaching philosophy, technology skills, and experience with technology. Technology-based professional development must integrate a theoretical framework which directly addresses the role of technology in order to fully support teacher technology integration. Moreover, technology-based professional development requires new models to counteract the focus on skills acquisition. The researcher used the TPACK (Technological, Pedagogical, and Content Knowledge) framework— conceptualizing instruction as a blending of technology, pedagogy, and content- to support participants in evaluating their own practice. Additionally, the researcher investigated supplemental supports for professional development, modeling and mentoring, on technology integration. The researcher used the Technology Integration Assessment Rubric (TIAR), based on the TPACK framework, to measure changes in technology integration. Comparison of pretest and posttest TIAR scores found TPACK-based professional development raised TIAR scores by 0.37 (SE = 0.051, p < 0.001). Analysis of the mean posttest TIAR scores for the supplemental supports showed mentoring (M = 2.47), modeling (M = 2.29), and modeling and mentoring (M = 2.27) scored higher than the control group (M = 2.17), but were not statistically significant. Based on the results, the researcher asserts the need for theory-based support for technology integration and school districts to incorporate TPACK into the core principles guiding instructional technology departments. Further research is needed regarding the evolution of diverse models for professional development."

Greenelsh, H. (2019). *Technology in education* (Master's thesis). Retrieved from
https://digitalcommons.csumb.edu/caps_thes_all/442/

Abstract: "This paper will examine how technology is useful in education and should be integrated into curriculum. The participants for the Capstone Project included 23 fifth-grade students in a public middle school on the Central Coast of California. This project focused on using a web-based art program called Canva to create infographics based on students' knowledge and study of Ancient Egypt. The students also commented on their peers' work on a blog page the researcher created. The researcher found that students had difficulty using a new application. They were also less creative than the researcher expected, which could be due to a limited attention span or being distracted all of the time. As an aspiring teacher, the researcher knows that using technology in the classroom will be a sought-after job skill because administrators want technologically-savvy teachers. Technology can help students be more successful in their future careers."

Jensen, D. C. (2019). *A quasi-experimental examination of digital literacy and achievement of learning objectives in online versus traditional labs* (Doctoral dissertation). Available from ProQuest Dissertations and Theses Global database. (UMI No. 13857617)

Abstract: "Laboratory work is considered a fundamental component of the learning process in a science course, enabling students to interact with natural phenomena and analyze collected data. Recent technological advances have prompted the implementation of online classrooms and virtual laboratories in science education. This movement has been further supported by the digital native theory, which assumes all students born after 1980 prefer and excel in

technology-based pedagogical methods. The problem is science teachers are working under the presumption that students achieve at least the same as, if not better, given their digital native characteristics, when using virtual labs versus hands-on labs in classrooms when little evidence exists to support the assumption. The current study adds to the research on the digital literacy levels of high school science students and how this measure correlates with achievement measures and perception of learning subsequent to completing a virtual simulation or hands-on laboratory experiment. Participants exhibited a range of digital native levels and a significant negative correlation was observed between the level of digital literacy and certain measures of learning achievement. Students who performed the traditional lab had significantly greater improvement on post-test scores and their preference and perception of learning was greater. The results from this study support the principles of embodiment theory; hands-on labs are necessary for the scientific learning process. The implications of these findings are that students may achieve greater learning objectives, have a preference and perceive hands on laboratories as more applicable to their education. Caution should be used in replacing traditional labs with virtual labs. The speculation that online activities are not equally beneficial in acquiring scientific content knowledge and cannot give students experience in planning an experiment, in addition to being perceived as less relevant to learning, were supported by the results of this study. Future research should be conducted on the effect of combining both modalities of learning, the impact on practical skills, and further exploration of preference and perception of learning of virtual and hands on laboratory experiments."

Kaschuluk, E. (2019). *The impact of learning organization on teacher TPACK* (Doctoral dissertation). Available from ProQuest Dissertations and Theses Global database. (UMI No. 13811940)

Abstract: "Technology, even at its most primitive, has been influential in education. Especially over the past decade, the evolution of technology in the classroom has forced educators to rethink the way they approach teaching and learning. With that change has come resistance and often a reliance on traditional teaching approaches. Even with increased access, infrastructure, supportive leadership, and professional development, research finds that teachers continue to struggle integrating technological tools into content and pedagogy. This research utilizes the technological pedagogical content knowledge (TPACK) framework put forth by Mishra and Koehler (2006) as the measurable specialized knowledge necessary to effectively teach with technology. Learning organization culture factors, as measured by the Dimensions of Learning Organization Questionnaire (DLOQ) developed by Watkins and Marsick (2006), have been shown to influence financial performance, knowledge performance, and innovation. Utilizing multiple linear regression analysis, this research explored relationships between LOC factors, generated by exploratory factor analysis, and TPACK. While no relationships were established between LOC factors and TPACK, results identified a statistically significant negative relationship between "team communication and support for learning" and technology knowledge (TK). The paper concludes with an explanation of findings, emphasizing communication and dialogue during professional development, and then offers suggestions for further research."

Kinnari-Korpela, H. (2019). *Enhancing learning in engineering mathematics education: Utilising educational technology and promoting active learning* (Doctoral dissertation, Tampere University of Technology, Tampere, Finland). Retrieved from https://tutcris.tut.fi/portal/files/18101298/kinnari_korpela.pdf

Abstract: "This study contributes to the discussion of development of engineering mathematics education from two different perspectives: to explore the possibilities to enhance engineering mathematics teaching and learning with the help of educational technology, and to promote active learning of students. From these two perspectives, it has been explored, for example, how engineering students experience the usage of selected educational technology and does utilisation of educational technology affect students' activity or learning. The investigations have concentrated on developing a feasible framework for mathematics teaching and learning in Bachelor's level engineering education. From the theoretical perspective, this dissertation discusses instruments to promote students' active learning as a part of the framework.

The research has been conducted between 2011-2017 with four empirical studies at Tampere University of Applied Sciences. The adopted research approach is design-based research that has included several iterative cycles for developing the framework for mathematics teaching and learning. This process has included twenty-five university of applied sciences level engineering mathematics course implementations. Short educational video lectures and computer-aided assessment were the main educational technologies that were implemented during the research process.

As an outcome of the research, the guidelines for utilising selected educational technology and activating students in similar educational setting are given. These guidelines provide knowledge for developing instructional design and learning resources especially at UAS-level engineering mathematics context. The findings indicated that engineering students experience short educational video lectures and computer-aided assessment as meaningful and feasible for mathematics learning. Students used short educational videos for different learning purposes and pointed out such benefits as repeatability and having more time in peace to learn and understand the current task at hand. When non-compulsory automatically assessed online exercises were provided, high completion rate were detected among study groups.
Utilising short educational videos and computer-aided assessment provides instant feedback to students about their learning process. The findings indicated that such resources have a potential to motivate, activate and promote self-regulated learning. However, the most of the students were studying nearby the deadlines. Hence, proper and distinct assignment deadlines guide students' learning activity and are more likely to activate them. Overall, the focus of this dissertation has been on the utilisation of potential of digitalisation and the promotion of active learning. At the center of the prevailing digitalisation hype, these both goals play a central role in higher education. Thus, the dissertation discusses topics covered in many higher education institutions nationally and internationally."

Kong, M. C. (2019). *Pedagogical innovation through mobile learning implementation: An exploratory study on teachers' extended and emergent use of mobile learning systems* (Doctoral dissertation). Available from ProQuest Dissertations and Theses Global database. (UMI No. 13808296)

Abstract: "Past studies have shown that mobile learning can enhance learning performance and that the extended and emergent use of technology was a critical factor towards the realization of the potential benefits of the technology. However, studies have also shown that most teachers were still at the initial adoption stage of mobile learning technologies and did not use mobile learning technologies on a routine basis. If mobile learning has been proven to contribute to learning performance, then more must be known about the opportunities and potential barriers that would motivate or hinder teachers to go beyond the perfunctory adoption of mobile learning. Therefore, this basic qualitative study sought to explore teachers' experiences with using mobile learning systems, as their experiences might provide cues on their level of involvements in the usage of mobile learning systems. The study also explored why and how teachers incorporate different levels of mobile learning adoption, i.e., symbolic adoption, extended adoption, and emergent adoption of mobile learning. Using the Technological pedagogical content knowledge (TPACK) theoretical framework, this study sought to answer the following central research question: How do teachers at universities in Hong Kong incorporate mobile learning technologies into their classroom? Findings of this study have identified five themes, including a) Teachers' Perception of Mobile Learning, b) Motivators of Mobile Learning Adoption, Mobile Learning Usage Behavior, Challenges of Adopting Mobile Learning, and Advantage of Adopting Mobile Learning. In addition, this study also identified the factors which will affect teachers' emergent use of mobile learning. Implications for practice and areas for future research are discussed."

Luo, M. (2018). *Exploring Chinese English-as-a-foreign-language teachers' beliefs about effective teaching of English reading in primary schools in Zhejiang Province of China and the impact of these beliefs on the teachers' instructional practices* (Doctoral thesis, Edith Cowan University, Perth, Australia). Retrieved from https://ro.ecu.edu.au/theses/2160

Abstract: "The English curriculum standards in China have shifted towards cultivating core competencies in students' English language to incorporate a more constructivist approach than was used previously. This has posed challenges for Chinese English-as-a-foreign-language (EFL) teachers because it is necessary for them to hold the requisite knowledge and skills themselves before they can cultivate students' core competencies. English reading plays an important role in facilitating students' acquisition of these core competencies. Thus, there is a need to ensure that Chinese EFL teachers have the knowledge and skills to align with the curriculum changes and evidence-based teaching practices that support reading development. A wealth of literature has documented that teachers' knowledge and beliefs influence their instructional practices. Therefore, the purpose of this study was to explore Chinese primary school EFL teachers' knowledge and beliefs concerning effective teaching of English reading in the Chinese context, and how these relate to their instructional practices.

The methodology of this research focused on a constructivist epistemology with interpretivism as the theoretical perspective. A case study design was selected, using a mixed methods approach, with case study teachers drawn from 262 survey participants who were teaching English in public primary schools in Zhejiang Province, China. Three teachers from two schools located in the suburban areas of Zhejiang volunteered to participate in the qualitative

phase of the research. The survey results provided broad contextual information for the case studies; the interviews, classroom observations and document analysis revealed the case study teachers' knowledge, beliefs and instructional practices.

The findings from this research indicated a preference for a skills perspective in English reading instruction by the majority of the survey participants, including the case study teachers. The case study teachers identified pedagogy, teaching materials, a supportive environment, motivation and the status of English as a school subject as key components in effective English reading instruction, but did not perceive their own knowledge and beliefs as influential on their practices. This research identified a number of effective instructional practices highlighting teacher led-activities, including the use of explicit instruction with frequent modelling and scaffolding, first language with multiple purposes, strategies to motivate students to learn, and integration of contemporary technology in reading instruction. In particular, teacher-led explicit instruction was among the repertoire of pedagogical content knowledge held by the case study teachers. However, the findings from this research also indicated that knowledge of the basic language constructs related to literacy acquisition was generally insufficient among all participating teachers, thereby hindering the case study teachers' use of metalanguage as a tool for instruction. Overall, the case study teachers' reading instruction tended to converge with their beliefs, but there were also a considerable number of inconsistencies in their knowledge, beliefs, instruction and evidence-based teaching practices. It was found that the dynamic interplay and mutual influence between teachers' knowledge, beliefs and teaching practices was mediated by the EFL context, including curriculum mandates, school context and teacher education.

This research calls for teachers to examine and reflect on their knowledge and beliefs in daily teaching practices, continue to value what succeeds from the traditional Confucian teaching approach, and simultaneously incorporate current evidence-based teaching practices—for example, highlighting teachers' essential role in using explicit instruction of key components of English reading and improving teacher knowledge. It is recommended that policy development, practices of EFL reading instruction, and preservice and in-service EFL teacher development programs in China consider incorporating teachers' knowledge and beliefs to improve the effectiveness of English language pedagogy."

Madoda, P. (2018). *The adoption and use of information and communication technologies in private high schools in the Western Cape* (Master's Thesis, Cape Peninsula University of Technology, Cape Town, South Africa). Retrieved from http://etd.cput.ac.za/handle/20.500.11838/2759

Abstract: "This study investigates some of the factors affecting the adoption and use of Information and Communication Technologies (ICTs) for curriculum delivery in selected private high schools in the Western Cape. In this 21st century, ICT has penetrated the society to the point that it is most likely to assume that the private high school in general, are effectively incorporating them (ICTs) in delivery of the curriculum. Regrettably, this assumption is not always true as revealed in most of the cases examined in this study. Instead, a lot of private high school teachers who were selected as participants or respondents in this study revealed that they are still facing critical challenges when they want to effectively adopt and use ICTs for

curriculum delivery. While the previous studies have focused more on the ICT integration in pubic schools in disadvantaged communities, this study employed a mixed methods research design (that is both quantitative and qualitative research methods) to explore the factors affecting the adoption and use of ICTs in private high schools in the Western Cape Province. The two frameworks adopted in this study, the Teacher Development framework (DoE, 2007) and the Technological Pedagogical Content Knowledge (TPACK) framework guided the researcher in the analysis of the research findings. The study also used both deductive and inductive reasoning in the interpretation of the results. The results of the study show that despite the high level of appreciating the importance of ICT adoption and use in teaching and learning by private high school teachers in the Western Cape Province, there are still critical factors that continue to militate against the effective integration of technology in the classroom. The study revealed the following factors as critical regarding the effective adoption and use of ICTs in curriculum delivery: lack of skills, limited access to ICT resources, lack of technical support, shortage of class time, and lack of teacher motivation."

Rickles, P. R. (2019). *Can learning geographic information systems be improved for interdisciplinary researchers?* (Doctoral thesis, University College London, London, UK). Retrieved from http://discovery.ucl.ac.uk/10069057/1/PhD_Report_PRickles_final.pdf

Abstract: "In an increasingly complex world, interdisciplinary approaches in research are becoming necessary to address challenges faced by modern society. Universities are progressively acknowledging this and new collaborative opportunities are being recognised between disciplines. When undertaking Interdisciplinary Research (IDR), words may not have the same meaning in other disciplines and, if a commonly understood methodology of work is not established, there may be confusion or serious misunderstandings. IDR comes with a unique set of challenges and suggested solutions; however, that does not mean they may be implemented so easily. The field of Geography lends itself well to IDR, as it has been described as an integrator for other disciplines. Therefore, a Geographic Information System (GIS) as a spatial analysis tool from Geography may be aligned for IDR. However, GIS in IDR adds another dimension of complexity, as those who need to learn it may have difficulties doing so. GIS educators and educational materials try to help quickly skill people up in new areas; however, how are these efforts perceived by interdisciplinary researchers and can they be improved upon? This research begins by highlighting that challenges in IDR, which relate to issues including conflicts or gaps of knowledge between disciplines, time constraints, differing agendas or personality conflicts. These may be addressed through training and building relationships with other learners. To understand the concepts of learning, various educational theories and learning approaches were reviewed to ascertain ways of framing and presenting educational resources. From older theories, such as behaviourism, to more contemporary ones, such as context-based learning, educators can improve their practices and materials to hopefully better suit the learner by understanding who the learner is, what they wish to learn and how they would go about learning it (in this case, GIS). Determining which GIS concepts are of interest to interdisciplinary learners required the use of a standard structure to investigate them. International GIS curricula were evaluated, which included the NCGIA Core Curriculum and its successor the Geographic Information Science and Technology Body of Knowledge. The

Knowledge Areas and descriptions of topics from the latter were selected to frame concepts in a flexible way for activity contexts for this research. With challenges in IDR and suggested solutions highlighted as well as categories of GIS concepts to explore, an analysis of existing IDR studies that used GIS is carried out to determine current approaches to using GIS and where they succeed and fail. This involved gathering information from relevant research articles by mining Google Scholar and a year-long survey, administered online, that asked interdisciplinary researchers that learned GIS how they went about doing so. A more in-depth exploration was then carried out through a series of interviews with interdisciplinary researchers to understand why they learned GIS in the way they did and the contexts they applied it in. Additionally, a review of learning diaries kept by GIS learners to provide insight into their own learning process was carried out. Overview findings from Google Scholar and the survey show difficulties come from gaps in knowledge around GIS and that training opportunities are looked upon favourably. The interviews and learning diaries highlighted that people believed face-to-face training was a time efficient manner of learning, in comparison to informal methods (e.g. internet searches, watching videos, etc.). Altogether, the results showed interest in web GIS platforms and using a GIS to create, analyse and visualize contextually relevant data, which related back to core concepts from the Geographic Information Science & Technology Body of Knowledge. Based on these findings, an online resource was developed to teach GIS concepts identified as important to interdisciplinary researchers, through contextually relevant lessons, minimising on extra-disciplinary information and simplifying GIS terms. This was used to explore contextual relevance of lessons and formal and informal learning approaches with interdisciplinary researchers. It was found that while context may play a role, motivation for learning GIS may be a more important factor. Additionally, training resources must be mindful about language used to improve understanding. This work provides guidance on what to change for GIS learning materials and teaching approaches to better accommodate IDR and learners outside the discipline."

Stewart, N. (2018). *The design and development of e-textbooks to support problem-based learning in secondary school science classrooms.* (Doctoral thesis, University of Notre Dame Australia, Freemantle, Australia). Retrieved from https://researchonline.nd.edu.au/theses/205/

Abstract: "Problem-based Learning (PBL) is widely used in education and extensive research has been conducted into the use of PBL to improve student learning. E-textbooks are a relatively recent development and represent the next stage of evolution of print media with improvements in the presentation of information. They also offer the possibility of being used as a learning tool rather than just as a store of knowledge. This thesis attempts to develop a set of design principles that allow the development of e-textbooks to promote PBL in secondary school science students.

This research presents the results of a four-year study, between 2013 and 2016 with different classes, that aimed to investigate the development and use of e-textbooks to facilitate PBL in secondary school science classrooms. It involved identification of constraints that limit the implementation of PBL and measurement of their effect on learning through PBL. These included learning, pedagogical and technical constraints. An investigation was conducted into

the use of e-textbooks to augment PBL and ameliorate these constraints. Through a process of Design-based Research, a set of principles was established that might promote the successful use of PBL and e-textbooks in secondary science contexts.

A review of the research literature revealed that PBL can have a powerful impact as an educational tool if the learning environment is well managed. However, certain constraints to using PBL, especially in secondary schools, require investigation. E-textbooks may also be able to improve student learning using PBL while ameliorating some of these constraints. The three research questions developed for this research aimed to identify such constraints and identify factors that could increase the impact of PBL on student learning using e-textbooks.
This study used a qualitative approach to investigate the use of e-textbooks to support PBL in secondary school science classrooms with some quantitative data used to support one aspect of the study (student knowledge). Data collected from a PBL Evaluation Tool before and after each intervention were used to measure student knowledge, planning, monitoring and evaluation and student engagement. In addition, data were collected through focus group interviews and observations of students in class. The four-year time span of the study allowed the collection of a large amount of data that provided opportunities for triangulation.

The three research questions guided the development of a set of design principles that will be useful in the future development of e-textbooks that support PBL. The results of the study were several design principles that could be used by teachers and schools to develop e-textbooks to support a PBL program. These principles are presented using a road map analogy that illustrates the journey undertaken in this research. The design principles involve the pedagogy of the teacher, the design of the e-textbook and the facilitation of the students in the PBL environment."

Whiteman, S. B. (2019). *Increasing student engagement with iPads* (Doctoral dissertation). Retrieved from http://d-scholarship.pitt.edu/35923/1/1.22%20Whiteman_final_etd.pdf

Abstract: "This is a study of one teacher's technology integration journey. This case study will characterize the state of one teacher's understanding and practice before and after receiving coaching that was designed to help the participant learn to use technology integration to increase student engagement. The results of this research led to three findings. The three findings from this research are: 1. The teacher demonstrated an improved understanding of engagement and technology integration. 2. The teacher demonstrated an improved practice of engagement and technology integration. 3.The findings help to determine the impact that coaching had on the understanding of student engagement and how to use iPads for instruction in the classroom. This study has shown, through professional development and coaching with incorporating technology, we can increase a teacher's skill set for engaging students in the classrooms. By increasing student engagement, we increase the opportunity for students to learn and succeed. Our responsibility as leaders is to find ways to support our teachers and to get educational technologies into the hands of our students."

4. Recent TPACK Presentations

Abu-Elwan, R. (2018, March). The development of TPSM: Technology, pedagogy, and school mathematics for candidates future teachers. *Proceedings of the 30th International Conference on Technology in Collegiate Mathematics (ICTCM)*. Retrieved from https://www.pearson.com/content/dam/one-dot-com/one-dot-com/us/en/files/RedaRedaAbuElwan-ABUELWANICTCM30WASHINGTON2018.pdf

Abstract: "Mathematics Teacher Preparation Programs increasingly include a focus on the use of technology for teaching school mathematics. A key feature in this approach to prepare teachers to teach mathematics with technology is to integrally develop teachers' TPSM. Teachers need to understand that critical instructional decisions they make are grounded in their understandings of each domain (technology, pedagogy, and School Mathematics) and influenced by their beliefs and conceptions. The main professional course in (SQU: Sultan Qaboos University) mathematics teachers program focus on the potential integration of three domains TPSM to prepare new teachers."

Bahri, A., Nurhayati, B., & Sigarra, D. F. (2019). Blended learning method integrated with Bloom-Rederker-Guerra (B-R-G): Model to enhance self-regulated learner. In W. Strielkowski, & J. Cheng (Eds.), *ICAMR 2018: Proceedings of 1st International Conference on Advanced Multidisciplinary Research* (pp. 79–84). https://doi.org/10.2991/icamr-18.2019.20

Abstract: "The development of science and technology can be utilized to improve the quality of the learning process. Therefore, the teachers need to have a good understanding and ability to improve Technology, Pedagogy, Content, Knowledge (TPCK) to develop their professional skills. The effort to enhance the quality of learning can be conducted by combining conventional learning (face to face) with online learning (e-learning) which is currently known as Blended Learning (BL). Many types of research showed that BL is an effective learning innovation to improve the quality of learning. This study aimed to develop blended learning which is integrated with Bloom-Rederker-Guerra (B-R-G) mapping model on a valid and practical biology learning. The Bloom-Rederker-Guerra (B-R-G) mapping is used to represent learning objectives, classify learning activities, and propose alternative technologies that can be used in the implementation of blended learning. This development research was carried out by adopting the ADDIE model. The resulting product is a learning tool consisting of learning syllabus, lesson plans, student activity sheets, and a learning management system (LMS) which use Moodle as a tool. The result showed that the developed blended learning is valid. The teachers and learners also show a positive response to blended learning, as they believe that developed blended learning is practical. Thus, it is feasible to be implemented in the learning system as it can help to enhance self-regulated learner."

Craciun, D. (2019, April). Educational trends in medicine: Collaborative technologies and pedagogical models. *Proceedings of the 15th International Scientific Conference "eLearning and Software for Education," 3*, 199–208. http://dx.doi.org/10.12753/2066-026X-19-164

Abstract: "At present, most medical students belong to a generation raised with unlimited access to modern information and communication technologies, also named by researchers the Net-generation, Millennials, Y-generation or YouTube Generation. Collaborative internet-based applications are part of their day-to-day lives, dramatically changing how they communicate, interact or access information. This has led to a great change in how these future doctors interact with their educators, or with the learning resources and the entire medical knowledge available, resulting in a globalization of medical education and a transformation of the medical curriculum mainly due to the available e-learning solutions. In this context, medical education means not only teaching content knowledge and training specialised medical competencies, but also the diversification of teaching-learning methods and improving their efficiency through ICT, the understanding of new types of medic-patient relationships wherein the patient is empowered and informed, ensuring the active participation of students in clinical situations and case based reasoning. From a pedagogical point of view, the massive infusion of technology in education led to the shaping of new pedagogical models with the role of highlighting and explaining how technology supports, modifies and refines learning in the medical field. Examples of such pedagogical models include the Technology Pedagogy and Content Knowledge (TPACK) model and the Substitution Augmentation Modification Redefinition (SMAR) model. In this paper, we present educational trends and ICT based pedagogical models, highlighting the opportunities and the difficulties identified in this direction by the doctors who go through the teacher training program offered by the Teacher Training Department at the West University of Timisoara."

Malik, S., Rohendi, D., & Widiaty, I. (2018). Technological pedagogical content knowledge (TPACK) with information and communication technology (ICT) integration: A literature review. In A. G. Abdullah, I. Kustiawan, I. Widiaty, & T. Aryanti (Eds.), *ICTVET 2018: Proceedings of the 5th UPI International Conference on Technical and Vocational Education and Training* (pp. 498–503). https://doi.org/10.2991/ictvet-18.2019.114

Abstract: "This research aims to get an overview of knowledge of learning technology and to identify factors that influence the use of technology in learning. Seeing this condition, it is necessary to do critical analysis in depth from the papers reviewed by the use of Information and Communication Technology (ICT) carried out by the teacher, especially the ability in learning. The data from the paper were analyzed to find out how much the teacher's capability to use ICT in learning. The intended ability is including mastery of teacher related to technology, pedagogy and subject content as explained in the TPACK framework. From the results of the analysis and synthesis, it can then be used as input for the development of the teacher's capability to use technology."

Mohamed Yusof, Y. M., Abdullah, N. K., & Jantan, H. (2019). Benchmarking the potential educational technology competency standard based on TPCK in Malaysia for local higher education institutions. In A. N. Mat Noor, Z. Z. M. Zakuan, & S. Mohamed Noor (Eds.), *Proceedings of the Second International Conference on the Future of ASEAN (ICoFA) 2017* (pp. 343–356). https://doi.org/10.1007/978-981-10-8730-1_35

Abstract: "Various researchers have found that the value of educational technology is directly linked to the educators' capability; the more knowledgeable the educators are on technology, the more the students are able to understand them. Technology in education is purposely designed to help both educators and students in knowledge transfer and knowledge gain simultaneously. In many aspects, technology in education is supposed to prove that education can be delivered effectively and efficiently. However, there are cases in which technology in education can be frustrating and annoying for both parties. Government and university management have invested a lot of money to ensure that educators and students can really benefit from technology. In spite of huge investment on educational technology tools (hardware and software) over the past decade in various education initiatives, the potential of technology usage in university level has not reached the desired level among educators and students. What is the missing link for the realization of the expected return-of-investment? The outcome of this study proposes an educational technology standard to be applied in university setting using TPCK (technological pedagogical content knowledge) as the basic framework. The research hopes for university management to review and regulate the educational technology efforts prepared to uplift the standards of teaching and learning to be in compliance with the Malaysia Education Blueprint 2015–2025 (Higher Education). However, this chapter will only discuss a part of our standard development while highlighting the various ETC/ICT prominent standards that are used as the benchmarking standard for our future proposed standard."

Theunissen, K., & Sieborger, I. (2019). The potential use of tablet computers to support teaching and learning activities in South African schools. In Institute of Electrical and Electronics Engineers (Ed.), *ICTAS 2019: Proceedings of the Conference on Information Communications Technology and Society* (pp. 1–5). https://doi.org/10.1109/ictas.2019.8703614

Abstract: **"**In South Africa, currently, "education is in crisis" and there is much speculation that Information Communication Technologies (ICTs) could be used to improve education in developing countries, such as South Africa. One ICT often cited for its benefits to education is that of the Tablet computer (PC). In this paper we explore the affordances of tablet PCs, as well as the factors which positively contribute to the uptake of tablet PCs within educational settings. Furthermore, we discuss the importance of educator knowledge through the lens of Technological Pedagogical Content Knowledge (TPACK) in successfully integrating the use of technology into teaching and learning; research tells us that there can only be meaningful and skilled teaching with technology if pedagogical knowledge, content knowledge and technological knowledge are well defined. As Toyama said, "there are no technology shortcuts to good education".

5. Selected TPACK Blog Posts

Farmer, L. (2019, May 9). The role of librarians in supporting ICT literacy [Blog post]. Retrieved from https://er.educause.edu/blogs/2019/5/the-role-of-librarians-in-supporting-ict-literacy

Excerpt: "Librarians should seriously consider TPACK as a way to embed themselves into the classroom to incorporate information and ICT literacy. Because TPACK is a recent model, many instructors might not know about it, so librarians can facilitate professional development in this area as well. At the same time, librarians can point out their own knowledge—linking it to ICT literacy. In the process, not only will students become more ICT literate, which is the ultimate goal, but librarians can build a stronger partnership that contributes to student learning as a whole."

Rodgers, D. (2018, January 19). The TPACK framework explained (with classroom examples) [Blog post]. Retrieved from https://www.schoology.com/blog/tpack-framework-explained

Excerpt: "TPACK is a technology integration framework that identifies three types of knowledge instructors need to combine for successful edtech integration—technological, pedagogical, and content knowledge (a.k.a. TPACK). While TPACK is often compared with the SAMR Model, they are very different in scope. Later, we'll take a look at the differences of these frameworks in more depth. But to quickly give you a little context, the SAMR Model is really designed to provide a high-level gauge of the degree of technology use, but some consider it to be overly simple and somewhat confusing. The TPACK framework, on the other hand, provides more of a map for understanding how to integrate technology into the classroom effectively."

6. TPACK Newsletter Suggested Citation

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

Harris, J., & Wildman, A. (Eds.). (2019, May 27). TPACK newsletter issue #41: May 2019 [Electronic mailing list message]. Retrieved from http://bit.ly/TPACKNewslettersArchive

7. Learning and Doing More with TPACK

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

- Visit the TPACK wiki at: http://tpack.org/
- Join the TPACK SIG at: http://site.aace.org/sigs/tpack-sig/
- Read past issues of the newsletter at: http://bit.ly/TPACKNewslettersArchive
- 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/

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

Standard End-Matter

If you have questions, suggestions, or comments about the newsletter, please send those to tpack.newsletter.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 & Amelia

…for the SITE TPACK SIG leadership:

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