TPACK Newsletter, Issue #12: September 2012

Welcome to the (long-awaited!) twelfth edition of the TPACK Newsletter! TPACK work is continuing worldwide, appearing in multiple publications, conferences, and professional development efforts. This document contains 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

"You affect the world by what you browse."
Tim Berners-Lee

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1. TPACK Newsletter Update

The TPACK newsletter currently has 1256 subscribers. This represents a 5.5% increase during the last year.

2. Recent TPACK Publications

Below are recent TPACK publications that we know about: 49 articles, 7 chapters, 8 dissertations, and a book. If you know of others that were published within the past several months, please let us know (at: tpack.news.editors@wm.edu).

Articles

Adıgüzel, A., & Yüksel, İ. (2012). Öğretmenlerin öğretim teknolojileri entegrasyon becerilerinin değerlendirilmesi: Yeni pedagojik yaklaşımlar için nitel bir gereksinim analizi. [Evaluation of teachers' instructional technologies integration skills: A qualitative needs analysis for new pedagogical approaches]. *Necatibey Faculty of Education Electronic Journal of Science & Mathematics Education*, *6*(1), 265-286.

Abstract:
"This study aims at identifying the teachers' needs of new pedagogical approaches in technology-assisted courses. Data were collected through semi-structured interview form from 12 voluntary teachers from different branches at a technology-supported private school. Findings showed that teachers perceived smart boards and PowerPoint presentations as the fundamentals in classes. Results also indicated that the participants had troubles of integrating technologies at times despite of participating training on the use of instructional technologies. The study also revealed that in technology supported courses excessive concentration on technology hinders dealing with the students, and that the students' individual characteristics were neglected. Finally, the findings of the study indicated that different teaching strategies and approaches were not applied, the authentic materials and models were not used in classes. In the study it is recommended that teachers should be informed about integration of technology and pedagogy."

Agyei, D. D., & Voogt, J. (2012). Developing technological pedagogical content knowledge in pre-service mathematics teachers through collaborative design. *Australasian Journal of Educational Technology, 28*(4), 547-564. Retrieved from http://www.ascilite.org.au/ajet/ajet28/agyei.html

Abstract:
"Although many studies have shown the need to pay attention to teachers' preparation for the integration of technology in classroom practice, most teachers in Ghana have not had any preparation that develops their technological pedagogical content knowledge (TPCK). This paper presents a case study of four pre-service mathematics teachers from the University of Cape Coast, Ghana, who worked in two design teams to develop lessons, and subsequently taught in a technology-based environment for the first time. It was evident from the findings that more systematic efforts are needed to engage pre-service teachers in technology-rich design activities, to develop their TPCK adequately. The study also showed the potential of TPCK as a new frame for developing pre-service teachers' experiences in technology integration within initial teacher education, particularly in Sub-Saharan African countries."

Al Musawi, A. S. (2011). Redefining technology role in education. *Creative Education*, *2*(2), 130-135. doi: 10.4236/ce.2011.22018

Abstract:
“The paper is a conceptual attempt to explore the new roles of technology in education which has increasingly become more than a sole medium, as was its description in the past. Basically, the key idea is that technology, with the powers of ICT, in education has now three main roles, namely: a medium/resource, a management, and a delivery. These new roles, when combined, could set the stage for restructuring the education institutions in an innovative way that leaves the current education system in history.”

Atkinson, T. S., & Swaggerty, E. A. (2011). Empowering fourth-grade researchers: Reaping the rewards of Web 2.0 student-centered learning. *Language Arts, 89*(2), 99-112.

Abstract:
“NCTE’s Framework for 21st Century Literacies (2008) prompted collaboration between a university professor and classroom teacher resulting in a professional inquiry project utilizing a Web 2.0 tool, Scrapblog, with fourth-grade students. This article describes implementation of this project, including both challenges and positive outcomes. The authors found that the effort paid dividends in terms of student engagement (“Please, can I work on my Scrapblog?”), student empowerment (shift the responsibility for learning to the student), and collaboration (among university professor, classroom teacher, and students). Specific recommendations for moving beyond traditional literacy instruction practices and delving into 21st Century Web 2.0 learning experiences are included.”

Bauer, W. I. (2012). The acquisition of musical technological pedagogical and content knowledge. *Journal of Music Teacher Education.* Advance online publication. doi: 10.1177/1057083712457881

Abstract:
“Technological pedagogical and content knowledge (TPACK) is a conceptual framework for the teacher knowledge necessary to effectively integrate technology into teaching and learning. The purposes of this study were to (a) develop and administer an instrument to measure music educators’ TPACK, (b) examine how music teachers acquire their TPACK, and (c) determine if a relationship existed between those teachers’ TPACK and their reported integration of technology. Participants (*N* = 284) were music teachers who completed two questionnaires, one designed to measure their TPACK (Musical TPACK Questionnaire [MTPACK-Q]) and another to describe the level of technology integration in their classroom (Concerns-Based Adoption Model–Levels of Use [CBAM-LoU] instrument). Scores on the technology-related domains of the TPACK model were lower than content, pedagogical, or pedagogical content domains. A moderate, significant, positive correlation (*r* =

.51, $p \leq .01$) was found between the participants' MTPACK-Q score and the level of technology integration in their classroom as reported by the CBAM-LoU."

Chai, C. S., Koh, J. H. L., & Tsai, C-C. (2011). Exploring the factor structure of the constructs of technological, pedagogical, content knowledge (TPACK). *The Asia-Pacific Education Researcher, 20*(3), 595-603.

Abstract:
"In recent years, several survey instruments have been designed to measure the technological pedagogical content knowledge (TPACK) of teachers. Even though the TPACK framework was conceptualized as having seven constructs, researchers have only successfully validated the constructs of technological knowledge (TK) and content knowledge (CK). Constructs such as pedagogical content knowledge (PCK), technological content knowledge (TCK), technological pedagogical knowledge (TPK), and TPACK have been found to be difficult to differentiate via factor analysis. This study explored how the contextualization of items in a TPACK to the constructivist-oriented use of ICT for self-directed and collaborative learning improved its construct validity. This survey was administered on 214 Singaporean pre-service teachers. Such an approach for designing this TPACK survey led to the successful identification of the seven theorized constructs through factor analysis. The implications on these findings on the design of TPACK surveys are discussed."

Clemmons, K., & Sheehy, C. (2011). Science, technology and YA lit: Three projects to develop environmental consciousness through reading and technology. *The Science Teacher, 78*(7), 42-45.

Abstract:
"Science teachers today need engaging projects to help students build 21st-century skills (NSTA 2011). Contemporary young adult literature (YA lit) can form the basis of one such project. YA lit--a genre of fiction geared toward 2 to 20-year-olds--opens a powerful avenue to connect with students and cover science topics in greater depth. YA lit is especially powerful when combined with technology--which is ubiquitous in the lives of young people today. Interactive web 2.0 resources and new software, combined with the motivational potential and meaningful messages found in YA lit, can truly engage students. This kind of pedagogical approach allows teachers to address what students know about themselves, the science subject matter, and the world around them.

This article provides three engaging projects science teachers can use to help students develop environmental consciousness and global awareness--both important 21st-century skills--using YA lit and technology. Figure 1 (p. 44) provides a list of additional YA lit titles for use in the science classroom. (Note: Before assigning any YA lit projects, teachers should always read the books to ensure the language and content are appropriate.)"

Coleman, H. (Ed.). (2010/2011). Professional development to support TPACK technology integration: The initial learning trajectories of thirteen fifth- and sixth-grade educators. [Special Section]. *Journal of Education, 191*(2), 3-18. Retrieved from http://www.bu.edu/journalofeducation/files/2011/11/BUJOE-191_2_CASESTUDY.pdf

Abstract:
"This study examined the initial learning trajectories of 13 upper elementary teachers as they developed technological, pedagogical, and content knowledge (TPACK) while participating in a 7-month professional development program focused on integrating technology into their classroom practice. The program was collaborative and non-prescriptive: teachers worked on self-chosen summer projects with flexible support from a university-based partner. A descriptive multicase study design was employed to track teachers' learning progressions. Data included interviews, surveys, digital artifacts, and researchers' notes and memos. During the program, teachers developed varying degrees of TPACK. Analyses distilled sic initial TPACK learning trajectories."

Crompton, H. (2011). Mathematics in the age of technology: There is a place for technology in the mathematics classroom. *Journal of the Research Center for Educational Technology*, *7*(1), 54-66. Retrieved from http://www.doaj.org/doaj?func=abstract&id=754722&recNo=6&toc=1&uiLanguage=en

Abstract:
"In today's world of ubiquitous computing there are a number of technologies available to K-12 educators for teaching and learning mathematics. However, Koehler and Mishra (2008) have described how teaching and learning with such technologies presents a "wicked problem," as it can involve a number of variables, independent of each other and contextually bound, that need to be brought together. This article highlights the advantages technology offers for mathematics education and looks at some of the reasons behind the poor uptake, such as teacher beliefs and lack of training. A number of solutions are offered to address these issues, including the TPACK framework, and a case is made for using technology in the mathematics classroom."

Debele, M., & Plevyak, L. (2012). Conditions for successful use of technology in social studies classrooms. *Computers in the Schools*, *29*(3), 285-299. doi:10.1080/07380569.2012.703602

Abstract:
"The purpose of the authors in this review is to examine how teacher-related, context-related, and project-related conditions interact in successful cases of technology integration projects in social studies classrooms. A close examination of different dimensions of these conditions in the implementation of 33 successful

cases of technology-assisted projects showed the importance of strong pedagogy-technology alignment. This is in line with the emphasis given to the centrality of technological pedagogical content knowledge by the practitioner in the technological pedagogical content knowledge framework. Other conditions found to be important for the success of the projects were focus and clarity of targeted learning outcomes and the supportive role of teacher educators when collaborating with teachers in designing and implementing the projects. The implication of these findings for school research and practice and teacher education is discussed."

Demir, S., & Bozkurt, A. (2011). Primary mathematics teachers' views about their competencies concerning the integration of technology. *Ilkogretim Online*, *10*(3), 850.

Abstract:
"There have been many studies on teachers' role and expectations concerning the integration of technology into their instruction. The present study aimed to reveal mathematics teachers' views about their own proficiency and the standards signifying that competency regarding the integration of technology. The focus group study was used as a data gathering method. The study attempted to respond the question, 'What are the qualities that teachers need to posses for an effective integration of technology into their classroom?'. The teachers' responses were elaborated by asking further questions in order to get a deeper understanding of their views. The teachers' utterances were analyzed within the framework of TPCK. The results indicated that a) the in-service teachers require participating in such courses on technology and pedagogy for their professional development and b) teachers' experiences with technology integration and their beliefs about the ways students learn significantly affect their views about their own competency."

Dilworth, P., Donaldson, A., George, M., Knezek, D., Searson, M., Starkweather, K., . . . Robinson, S. (2012). A framework for instructional innovation in the preparation of tomorrow's teachers. *Journal of Digital Learning in Teacher Education, 28*(4), 130-132.

Abstract:
"Emergent technologies offer opportunities to understand concepts in deeper, often different, and more meaningful ways. However, this growth in understanding will occur only if teachers learn to use these technologies in effective ways. The federal initiative Preparing Tomorrow's Teachers to Use Technology (PT3) was launched in 1999 to address this challenge. Start-up funding to establish the National Technology Leadership Coalition (NTLC) was included among the 400 grants awarded through this effort. The NTLC includes representation by the teacher educator associations for the core content areas and corresponding educational technology associations. Despite the progress that has been made, there is still a continuing need to explore how emergent

technologies can best be integrated into teaching and teacher preparation. This article provides an overview of the most recent plans across the NTLC teacher education associations to address their stated goal of increasing the use of emergent technologies to teach content across disciplines. It describes a framework for instructional innovation in the preparation of tomorrow's teachers. The framework of technological pedagogical content knowledge (TPACK) builds on Shulman's (1986) notion of pedagogical content knowledge."

Figg, C., & Jamani, K. J. (2011). Exploring teacher knowledge and actions supporting technology-enhanced teaching in elementary schools: Two approaches by pre-service teachers. *Australasian Journal of Educational Technology, 27*(7), 1227-1246. Retrieved from http://www.ascilite.org.au/ajet/ajet27/figg.html

Abstract:
"Two approaches to teaching with technology to highlight practice-based teacher knowledge and actions for teaching technologically enhanced lessons are presented. Participants were two elementary pre-service teachers teaching during practicum. Qualitative data sources included verbatim transcripts of participant interviews, field notes of planning and support sessions, and classroom observations. Teacher lesson plans and student work samples triangulated data. Cross case analysis revealed that content-centric pedagogy - focusing lesson design on a specific content learning outcome, rather than technical skill - promoted student engagement and learning of both content and technical skill. Additionally, some pedagogical knowledge characteristics, reflected in specific teacher actions related to planning and implementation of technology-enhanced lessons, were fundamental across the two subject areas investigated. For novice elementary teachers, explicit communication of generic technology pedagogical knowledge characteristics, supported by concrete examples of teacher actions, may contribute to teachers experiencing a degree of success during their initial attempts at teaching with technology."

Fransson, G., & Holmberg, J. (2012). Understanding the theoretical framework of technological pedagogical content knowledge: A collaborative self-study to understand teaching practice and aspects of knowledge. *Studying Teacher Education*, *8*(2), 193-204.

Abstract:
"This paper describes a self-study research project that focused on our experiences when planning, teaching, and evaluating a course in initial teacher education. The theoretical framework of technological pedagogical content knowledge (TPACK) was used as a conceptual structure for the self-study. Our understanding of the framework in relation to our teaching practice was in focus. The principal educational goal of the course was to develop the pedagogical use of web 2.0 resources to support learning in the preschool/school context. As a result, the focus, content, form of distribution, teaching, and assessment of the

course went beyond what is common in initial teacher training in Sweden. The potential of the different digital tools was explored by situated use in the design and teaching of the course. Analysis highlights the challenges and opportunities that teacher educators and student teachers may encounter while working with, and learning about, information and communication technologies to support learning. Some of the findings discussed are related to the identified challenges and opportunities for both teachers and students to integrate content knowledge, pedagogical knowledge, and technological knowledge into a TPACK. Taken-for-granted organizational and institutional assumptions about teaching, learning, and assessment in teacher education were identified in the study. (Contains 1 figure.)"

Graham, C. R., Borup, J., Smith, N. B. (2012). Using TPACK as a framework to understand teacher candidates' technology integration decisions. *Journal of Computer Assisted Learning.* Advance online publication. doi: 10.1111/j.1365-2729.2011.00472.x

Abstract:
"This research uses the technological pedagogical and content knowledge (TPACK) framework as a lens for understanding how teacher candidates make decisions about the use of information and communication technology in their teaching. Pre- and post-treatment assessments required elementary teacher candidates at Brigham Young University to articulate how and why they would integrate technology in three content teaching design tasks. Researchers identified themes from student rationales that mapped to the TPACK constructs. Rationales simultaneously supported subcategories of knowledge that could be helpful to other researchers trying to understand and measure TPACK. The research showed significant student growth in the use of rationales grounded in content-specific knowledge and general pedagogical knowledge, while rationales related to general technological knowledge remained constant."

Handal, B., Campbell, C., Cavanagh, M., Petocz, P. & Kelly, N. (2012). Integrating technology, pedagogy and content in mathematics education. *Journal of Computers in Mathematics and Science Teaching, 31*(4), 387-413. Retrieved from http://www.editlib.org/p/40450

Abstract:
"The need for appraising the effective integration of technologies into teaching and learning within a disciplinary context is crucial for upholding quality teaching standards in schools and formulating professional development programs. This paper describes the development and validation of an instrument aimed at characterising the integration of technological knowledge in secondary school mathematics teachers. The Technological Pedagogical Content Knowledge (TPACK) framework is used to underpin the development and validation of the questionnaire. The questionnaire consisting of three 10-item scales was administered to a sample of 280 teachers across the state of New South Wales,

Australia. The factor analysis undertaken confirms the structurally soundness of the instrument in terms of validity and reliability."

He, W., Zhang, S., Strudler, N., & Means, T. (2012). Integrating a case library with blogs for lesson planning activities. *International Journal of Learning Technology*, *7*(2), 133-153.

Abstract:
"This study explored how combining a case library with blogs can help pre-service teachers plan a lesson with technological pedagogical content knowledge (TPACK). This study was conducted in a secondary general methods course in autumn 2008. The participants included 34 secondary teacher candidates in an urban teacher education programme at a Southwestern State University. Findings of the study indicated that: a) teacher candidates developed TPACK; b) teacher candidates valued the KITE library as a source for TPACK application; c) blogging created a positive social collaboration community, but was not so evidently effective in the integration of technology in lesson planning. Meanwhile, the results showed that there was a gap between teacher understandings of the importance of technology integration and their use of technology in lesson planning. Findings generated discussion about the conceptualisation of TPACK and technology integration in teacher education."

Hechter, R. P. (2012). Pre-service teachers' maturing perceptions of a TPACK-framed signature pedagogy in science education. *Computers in the Schools, 29*(1), 17. Retrieved from www.tandfonline.com/doi/abs/10.1080/07380569.2012.657999

Abstract:
"Teacher education programs across North America are transforming. What were once piecemeal programs consisting of often unrelated courses are now becoming coherent and intertwined trajectories toward teacher certification. Part of this transformation can be attributed to the weaving of "signature pedagogies" throughout overarching program frameworks. A modern signature pedagogy within science teacher education is the integration of technology with science area content and effective pedagogy. In this article the author reports an action research study aimed toward promoting the "scholarship of teaching" of pre-service teachers through articulating changes in their maturing perceptions of the integrated relationship between technological, pedagogical, and science content knowledge."

Hodges, T. E., & Conner, E. (2011). Reflections on a technology-rich mathematics classroom. *Mathematics Teacher*, *104*(6), 432-438. Retrieved from http://www.nctm.org/publications/article.aspx?id=28058

Abstract:
"Integrating technology into the mathematics classroom means more than just

new teaching tools--it is an opportunity to redefine what it means to teach and learn mathematics. Yet deciding when a particular form of technology may be appropriate for a specific mathematics topic can be difficult. Such decisions center on what is commonly being referred to as TPACK (Technological Pedagogical and Content Knowledge), the intersection of technology, pedagogy, and content. Making decisions about technology use influences not only students' conceptual and procedural understandings of mathematics content but also the ways in which students think about and identify with the subject. In this article, the authors examine students' identification with mathematics by focusing on the role of a mathematics teacher in a technology-rich introductory calculus classroom and the role of a student in that class. One important consideration in understanding students' identification with mathematics is the extent to which activities are learner centered. As the mathematics teacher in this classroom, author Thomas E. Hodges describes the available technologies in the classroom and how he used them to craft learning opportunities for students. As a student in this classroom, co-author Elizabeth Conner gives her reflections as Hodges discusses particular examples. The authors then offer some guiding questions for teachers to consider as they attempt to integrate technology into the mathematics classroom. By highlighting the perspectives of teacher and student, the authors begin to make sense of the shifting roles of teachers and students in technology-rich mathematics classrooms through attention to a student's interaction with other students, the teacher, and various technologies. The authors' purpose in this article is to share how technology integration can provide different conceptions of what it means to be a mathematics teacher and a mathematics student. (Contains 3 figures and 1 table.)"

Hofer, M., & Grandgenett, N. (2012). TPACK development in teacher education: A longitudinal study of preservice teachers in a secondary M.A.Ed. program. *Journal of Research on Technology in Education, 45*(1), 83-106.

Abstract:
"How does preservice teachers' knowledge for technology integration develop during their teacher preparation program? Which areas of their knowledge develop most naturally, and which areas require more scaffolding? In this mixed-methods, descriptive study of preservice teachers enrolled in an 11-month M.A.Ed. program, we sought to trace the development of participants' technological pedagogical content knowledge (TPACK) over time. Comparisons of self-report surveys, structured reflections, and instructional plans at multiple data points spanning the three-semester program revealed significant development of the participants' technological pedagogical knowledge (TPK) and technological pedagogical content knowledge (TPACK), but only limited growth in technological content knowledge (TCK)."

Hsu, P. (2012). Examining the impact of educational technology courses on pre-service teachers' development of technological pedagogical content knowledge. *Teaching Education*, *23*(2), 195-213.

Abstract:
“The purpose of this qualitative study was to examine the impact of educational technology courses on pre-service teachers' development of knowledge of technology integration in a teacher preparation program in the USA. The present study was conducted with eight pre-service teachers enrolled in the elementary teacher education program at a large university in the mid-western USA. Data sources included interviews, documents, and observations. The findings identified knowledge of technology integration the pre-service teachers developed and identified knowledge of technology integration needed in the technology integration courses. The present study provided a number of suggestions on different activities that could be built into educational technology courses to better prepare pre-service teachers to teach with technology. (Contains 5 tables.)”

Jang, S., & Tsai, M. (2012). Exploring the TPACK of Taiwanese elementary mathematics and science teachers with respect to use of interactive whiteboards. *Computers & Education*, *59*(2), 327-338.

Abstract:
“There has been an increasing tendency to enhance teachers' ability to apply educational technology. Few researchers have investigated with the relationships between the use of interactive whiteboards (IWBs) and the impact on the technological pedagogical and content knowledge (TPACK) of teachers. The purposes of the study were to examine Taiwanese elementary mathematics and science teachers' TPACK with respect to current use of IWBs. Associations between in-service teachers' TPACK and other factors were also examined. The IWB-based TPACK questionnaire was developed and validated in an elementary school context. The results indicated that there were significant differences in the TPACK of elementary teachers who used IWBs compared to teachers who did not use IWBs. Furthermore, elementary science teachers demonstrated significantly higher TPACK than elementary mathematics teachers. No significant difference was found in teachers' TPACK according to gender. The results also showed that teachers' TPACK differed significantly on the basis of teachers' varying amounts of teaching experience. Teachers who had more years of teaching experience demonstrated significantly higher TPACK than did teachers who had fewer years of teaching experience. The research implications of this study are provided along with suggestions. (Contains 8 tables and 1 figure.)”

Jordan, K. (2011). Beginning teacher knowledge: Results from a self-assessed TPACK survey. *Australian Educational Computing, 26*(1), 16-26. Retrieved from http://acce.edu.au/journal/26/1/beginning-teacher-knowledge-results-self-assessed-tpack-survey

Abstract:

“For over twenty years teachers in Australia and internationally have been encouraged to use ICT in their practice. Various government policies have been implemented to provide the technical means for teachers to do so as well as numerous teacher professional learning programs, often skills based, short term and off site. Yet teacher uptake of technologies in their routine classroom practice continues to be slow and uneven, with pre-service teacher education sometimes bearing the brunt of blame. The TPACK framework developed by Mishra and Koehler (2006) has emerged as an influential tool for describing the knowledge teachers need to integrate technology into their practice. This paper reports on a survey which measured the TPACK knowledge of sixty-four beginning teachers in Victoria, Australia. This data was analysed to reveal how beginning teachers self-assessed their knowledge in each of the seven domains, as well as to explore patterns by gender. As a result of these findings several suggestions for pre-service teacher education are made.”

Juniu, S. (2011). Pedagogical use of technology in physical education. *Journal of Physical Education, Recreation and Dance, 82*(9), 41-60.

Abstract:
“Teachers' subject and pedagogical knowledge requires an understanding of the relationship between various elements, rather than thinking of them in isolation. In order to teach in a given discipline, the teacher must have knowledge of the subject, an understanding of the best teaching strategies for presenting the content, and knowledge of the learners' characteristics and of the educational context (e.g., the gymnasium). This article examines the technological pedagogical content knowledge framework as a way of preparing physical educators to integrate technology in the teaching and learning process and to represent subject matter with technology in pedagogically appropriate ways. With this approach, preservice teachers learn to design successful, technology-integrated projects in physical education.”

Juniu, S., Harris, J., & Hofer, M. (2012). Grounded tech integration: Physical education. *Learning & Leading with Technology, 39*(2), 34-36. Retrieved from http://www.iste.org/learn/publications/learning-leading/digitaledition/digital-edition-september-2012

Kabakci Yurdakul, I., Odabasi, H., Kilicer, K., Coklar, A., Birinci, G., & Kurt, A. (2012). The development, validity and reliability of TPACK-deep: A technological pedagogical content knowledge scale. *Computers & Education*, *58*(3), 964-977. doi:10.1016/j.compedu.2011.10.012

Abstract:
“The purpose of this study is to develop a TPACK (technological pedagogical content knowledge) scale based on the centered component of TPACK framework in order to measure preservice teachers’ TPACK. A systematic and step-by-step approach was followed for the development of the scale. The

validity and reliability studies of the scale were carried out with 995 Turkish preservice teachers. The sample was split into two subsamples on random basis (n1 = 498, n2 = 497). The first sample was used for Exploratory Factor Analysis (EFA) and the second sample for Confirmatory Factor Analysis (CFA). After the EFA, the TPACK-deep scale included 33 items and had four factors. These factors were design, exertion, ethics and proficiency. The Cronbach's alpha coefficient for the whole scale was found to be .95, whereas the values of Cronbach's alpha coefficient for individual factors of the scale ranged between .85 and .92. The CFA was conducted within the scope of the validity study of the scale. In this way, this structure of the 4-factor scale was confirmed. In addition, the test-retest reliability coefficient of the scale was calculated as .80. The findings revealed that the TPACK-deep scale was a valid and reliable instrument for measuring TPACK. Consequently, various suggestions were put forward regarding the use the TPACK-deep scale for applied research and for future studies."

Kadijevich, D. M. (2012). TPCK framework: assessing teachers' knowledge and designing courses for their professional development. *British Journal of Educational Technology*, *43*(1), E28-E30. doi:10.1111/j.1467-8535.2011.01246.x

Abstract:
"The article presents a study which aims to assess teacher's knowledge and designing courses for professional development using Technological Pedagogical Content Knowledge (TPCK) framework. Studies on TPCK can help researchers comprehend better the complex interactions among content, technology, and pedagogy. These also can be used for evaluating teachers' knowledge of technology integration and designing courses for professional development. It concludes the three challenging areas of teachers' professional development including teaching methods for the work with different programming contents, educational technology for implementing teaching methods, and for the work with different programming contents."

Kennedy-Clark, S. (2011). Pre-service teachers' perspectives on using scenario-based virtual worlds in science education. *Computers & Education*, *57*(4), 2224-2235. doi: 10.1016/j.compedu.2011.05.015

Abstract:
"This paper presents the findings of a study on the current knowledge and attitudes of pre-service teachers on the use of scenario-based multi-user virtual environments in science education. The 28 participants involved in the study were introduced to "Virtual Singapura," a multi-user virtual environment, and completed an open-ended questionnaire. Data from the questionnaire indicated that gender and current computer game use were likely to affect the perceived benefits of using virtual worlds in a classroom setting. Behavior management was seen as being a constraining factor on a pre-service teacher's willingness to

use a virtual world in the future. Overall, the results of the study indicate that pre-service teachers as a result of their use of "Virtual Singapura" are both aware of virtual worlds and have a reasonable understanding of both their potential advantages and disadvantages within a classroom setting. (Contains 3 figures and 5 tables.)"

Kinchin, I. (2012). Avoiding technology-enhanced non-learning. *British Journal of Educational Technology*, *43*(2), E43-E48. doi:10.1111/j.1467-8535.2011.01264.x

Abstract:
"The author cautions against discusses [*sic*] technology-enhanced non-learning. According to the article, the digital revolution has introduced educational technology for electronic learning that is often incorporated into curriculum delivery without balanced educational planning. The author argues that non-learning, or the linear acquisition of information without understanding, can result from education methods that do not balance content, technology, and pedagogy. Topics include the technology, pedagogy, and content knowledge (TPACK) framework, knowledge structures, and technopositivism."

Kohen, Z., & Kramarski, B. (2012). Developing a TPCK-SRL assessment scheme for conceptually advancing technology in education. *Studies in Educational Evaluation*, *38*(1), 1-8.

Abstract:
"The present study aimed to: (a) develop a conceptual TPCK-SRL scheme for assessing teachers' integration of self-regulated learning (SRL) considerations while infusing technology into a TPCK classroom context (blending K = knowledge about T = technology, P = pedagogy, and C = content), which reflects all three knowledge components' dynamic interactions with SRL and (b) test this scheme's validity and reliability as a practical tool for measuring effects of teacher education. The scheme was used to assess 9 preservice teachers' lesson designs, collected before and after a course on TPCK Teaching and Learning Methods. At posttest, lesson designs revealed specific, qualitative TPCK-SRL descriptions that referenced TPCK components and SRL considerations ("what", "how", "when", and "why" to infuse technology), thus providing content validity for the scheme. Theoretical, methodological, and practical implications and future research are discussed for using the TPCK-SRL scheme to empower teachers' technological professionalism. (Contains 4 tables and 1 figure.)"

Krauskopf, K., Zahn, C., & Hesse, F. W. (2012). Leveraging the affordances of Youtube: The role of pedagogical knowledge and mental models of technology functions for lesson planning with technology. *Computers & Education, 58*(4), 1194-1206. doi: 10.1016/j.compedu.2011.12.010. ISSN: 0360-1315

Abstract:
“Web-based digital video tools enable learners to access video sources in constructive ways. To leverage these affordances teachers need to integrate their knowledge of a technology with their professional knowledge about teaching. We suggest that this is a cognitive process, which is strongly connected to a teacher’s mental model of the tool’s affordances. First we elaborate the theoretical integration of the notion of mental models and the Technological Pedagogical Content Knowledge (TPCK) framework. Then we report on a study where we investigated pedagogical knowledge in a sample of German pre-service teachers as a predictor for their mental models of YouTube and how these affect lesson plans for instructional use of this technology. We describe the active mental models of YouTube and present quantitative analyses suggesting mental models as mediators for the influence of pedagogical knowledge on participants’ lesson planning. Results are discussed with regard to theoretical and research implications.”

Larkin, K., Jamieson-Proctor, R., & Finger, G. (2012). TPACK and pre-service teacher mathematics education: Defining a signature pedagogy for mathematics education using ICT and based on the metaphor “Mathematics Is a Language.” *Computers in the Schools*, *29*(1-2). doi: 10.1080/07380569.2012.651424

Abstract:
“National professional standards for teachers in Australia (AITSL, 2011) expect teacher education graduates to demonstrate technological, pedagogical and content knowledge (TPACK). Those standards have emerged concurrently with the development of a new Australian mathematics curriculum. Thus, the expectation is that graduates can demonstrate the use of information and communication technologies in mathematics teaching and learning. The authors argue that “signature pedagogy” (Shulman, 2005) is the use of a key metaphor which views mathematics as a language and suggests that mathematics should be taught and learned as any other language. This article provides a summary of the findings of an action research project involving two cohorts of undergraduate mathematics education students in an Australian university. Data collected was used to inform targeted changes to improve the technological pedagogical approach employed by the course team across two offers of the course to enhance student learning and align the course with the expectations for graduate teachers. The implications of this action research are provided to inform the design and implementation of pre-service teacher education courses with respect to the development of TPACK capabilities specifically in mathematics education.”

Lux, N. J., Bangert, A. W., & Whittier, D. B. (2011). The development of an instrument to assess preservice teacher's technological pedagogical content knowledge. *Journal of Educational Computing Research, 45*(4), 415-431.

Abstract:
“The purpose of this study was to develop and validate the Pre-service Teacher-Technological Pedagogical Content Knowledge Survey (PT-TPACK) instrument. The PT-TPACK survey items were written to assess preservice teachers' perceptions and understanding of the Technological Pedagogical Content Knowledge construct originally proposed by Mishra and Koehler (2006). The participants for this study were preservice teachers (n = 120) enrolled in a foundations of educational technology course at a mid-sized western university. Data analysis yielded six interpretable factors: pedagogical knowledge (PK), technological knowledge (TK), content knowledge (CK), pedagogical content knowledge (PCK), technological pedagogical knowledge (TPK), and technological pedagogical content knowledge (TPACK). Technological content knowledge (TCK) was the only dimension in the TPACK construct specified a priori that did not emerge. Results from this study suggest that the PT-TPACK survey holds promise as a useful evaluation tool for assessing preservice teachers' knowledge and use of technology to increase the effectiveness of their instructional efforts.”

Maddin, E. (2011). Using TPCK with digital storytelling to investigate contemporary issues in educational technology. *Journal of Instructional Pedagogies*, 1-11. Retrieved from http://www.aabri.com/manuscripts/11970.pdf

Abstract:
“Digital storytelling is recognized as a motivating instructional approach that engages students in critical thinking and reflective learning. Technology tools that support digital storytelling are readily available and much easier to use today than they were in years past. The convergence of these factors has facilitated the inclusion of digital storytelling in pre-service educational technology courses. Some researchers have expressed concern over the tendency to approach technology instruction with an emphasis on learning to use the technology tool itself over careful consideration of the educational value of the tool, speculating that such approaches are unlikely to result in powerful uses of technology in schools. Mishra and Koehler (2006) proposed a conceptual framework that examines the complex relationships between content, technology and pedagogy. With emphasis on the development of Technological Pedagogical Content Knowledge (TPCK), the model reframes the approach to educational technology courses for pre-service teachers. This case study illustrates the application of the TPCK conceptual framework to a digital storytelling project in an undergraduate teacher education course.”

Manso, M., Garzón, M., Rodriguez, C., & Pérez, P. (2011). Contenidos educativos digitales que promueven la integración efectiva de las tecnologías de la información y comunicación. [Digital educational contents that promote the effective integration of information and

communication technologies]. *Digital Education Review*, *19*, 56-67. Retrieved from http://greav.ub.edu/der/index.php/der/article/view/181/315

Abstract:
"This qualitative research study explores the relationship between the quality of curriculum designs that integrate ICTs and the quality of teachers' actual implementation of these designs. To analyze them, we selected 10 qualities that build on TPACK (Technological Pedagogical Content Knowledge) and the Teaching for Understanding framework (TfU). We selected three curriculum designs that integrate ICTs and conducted in-depth interviews to 6 secondary teachers, 34 students and 3 curriculum designers in Argentina, Mexico and Colombia. When the majority of the qualities were present in the curriculum designs, the majority of the qualities were also present in the teachers' implementations. High quality curriculum designs that integrate ICTs tended to promote high quality teacher practices."

Martinovic, D., & Karadag, Z. (2012). Dynamic and interactive mathematics learning environments: The case of teaching the limit concept. *Teaching Mathematics and its Applications: An International Journal of the IMA*, *31*(1), 41-48.

Abstract:
"This theoretical study is an attempt to explore the potential of the dynamic and interactive mathematics learning environments (DIMLE) in relation to the technological pedagogical content knowledge (TPACK) framework. DIMLE are developed with intent to support learning mathematics through free exploration in a less constrained environment. A typical DIMLE software package has interactivity and dynamism as key affordances; these are especially suitable for enhancing learning and teaching with technology of the essentially dynamic mathematics concepts. Moreover, we propose that DIMLE and their affordances should be studied under the TPACK framework because this framework is explicit in considering technology-supported mathematics learning as a qualitative add-on as contrasted to what would be a simple totaling of technological, pedagogical and mathematical knowledge. As an example, we focus in our discussion on using a DIMLE in order to support learner in development of the limit concept."

Meagher, M., Özgün-Koca, S. A., & Edwards, M. T. (2011). Preservice teachers' experiences with advanced digital technologies: The interplay between technology in a preservice classroom and in field placements. *Contemporary Issues in Technology & Teacher Education*, *11*(3), 243-270.

Abstract:
"This paper reports on a study of 22 preservice teachers enrolled in a first-semester mathematics teaching methods course. Course activities included

participation in two separate field experiences in neighboring school districts. The methods class placed considerable emphasis on the use of advanced digital technologies in the teaching and learning of mathematics, with particularly extensive use of the TI-Nspire. The purpose of the study was to examine preservice teachers' evolving relationships with advanced digital technologies in their teaching, examined through the lens of their technological pedagogical content knowledge (Koehler & Mishra, 2005; Niess 2005, 2006, 2007), and to examine the interplay between their field placements and the quality of their use of advanced digital technologies in inquiry-based lessons. The principal conclusion of the study is that there seems to be a crucial, perhaps decisive effect that modeling of exemplary practice in the field placement has on candidate attitudes regarding the use of advanced digital technologies in their teaching. There is evidence that the pre-service teachers' experiences in the classroom primed them for the possibilities of technology use but it takes the experiencing of exemplary practice to convince them of the benefits of working to incorporate technology in their own teaching."

Nicholas, H., & Ng, W. (2012). Factors influencing the uptake of a mechatronics curriculum initiative in five Australian secondary schools. *International Journal of Technology and Design Education*, *22*(1), 65-90.

Abstract:
"While the ready-made Lego[TM] Robotics kits are popular in schools and are used by students at both primary and secondary year levels, using the Picaxe microcontroller (chip) to create simple electronic devices, including robotic devices is less popular. The latter imposes an additional challenge as a result of the need to construct the universal board with the chip in it--a challenge embraced in the cross-disciplinary mechatronics program in this study. This paper reports on how teachers from five Australian secondary schools put into practice technological pedagogical content knowledge (TPCK) developed from expert-led workshops and explores factors (intrinsic and extrinsic) that influenced the implementation. The results show that different strategies were adopted by the schools in implementing the programs. While teacher attitude played an important role in influencing the program's success, being able to identify where the program sits within the curriculum and planning around timetable and facility constraints were also important factors to consider. The research indicated that teachers' TPCK was most challenged in non-obvious areas such as diagnosing where faulty soldering joints were."

Ping, G., Tan Seng, C., Longlong, W., Wong, A., & Choy, D. (2011). Self reflection and preservice teachers' technological pedagogical knowledge: Promoting earlier adoption of student-centred pedagogies. *Australasian Journal Of Educational Technology*, *27*(6), 997-1013.

Abstract:

“The purpose of this paper is to present the qualitative findings relating to fourteen preservice teachers' development and translation of their technological pedagogical knowledge (TPK) into their classroom practices throughout the first year of their teacher preparation program. It was found that all fourteen participants demonstrated a gain in both technological and pedagogical knowledge, and registered positive changes both in their pedagogical beliefs and their beliefs in using information and communication technology (ICT) to engage their students in active meaning making after an ICT course and an intervention workshop on reflection. There was, however, great variation in the ways that they used ICT in their first field placements: from using ICT as a presentation tool to complement or support their teaching, to engaging their students in using ICT as a cognitive tool to extend their students' learning and knowledge construction. This variation was largely related to whether the participants could synergise their constructivist-oriented beliefs, technological knowledge and pedagogical knowledge. It seems that only the preservice teachers who demonstrated student-centric pedagogies and reflected on student learning showed more advanced development of TPK. Recommendations for engaging preservice teachers in reflection with a focus on student learning are discussed.”

Polly, D. (2011). Teachers’ learning while constructing technology-based instructional resources. *British Journal of Educational Technology*, *42*(6), 950-961. doi: 10.1111/j.1467-8535.2010.01161.x

Abstract:
“Grounded in a constructionist paradigm, this study examined elementary school teachers' learning while creating technology-rich instructional materials. Sixteen teachers at an elementary school were interviewed about their experience. Using the components of Technological Pedagogical and Content Knowledge as an analytical framework, inductive qualitative analysis indicated that these professional learning activities led to teachers' growth primarily in technological knowledge, technological pedagogical knowledge and content knowledge. These findings as well as implications for designing professional learning activities for teachers are also shared.”

Polly, D., & Orrill, C. (2012). Developing technological pedagogical and content knowledge (TPACK) through professional development focused on technology-rich mathematics tasks. *Meridian, 15*. Retrieved from http://ced.ncsu.edu/meridian/index.php/meridian/article/view/44

Abstract:
“This study provides findings from a professional development program for middle grades (Grades 4-8) teachers, which focused on developing teachers’ knowledge of mathematics, pedagogy, and technology skills through the exploration of technology-rich mathematical tasks. Using the Technological Pedagogical and Content Knowledge (TPACK) framework (Mishra & Koehler, 2005), data from interviews and open-ended surveys were analyzed to examine

teachers' perspectives of their learning because of participating in the program. Inductive data analyses indicated that participants reported gaining knowledge about technology, and about how technology could support their teaching of mathematics. However, very few participants reported a clear sense about how to use technology while teaching mathematics. Implications for designing and examining the influence of technology-rich professional development focused on content are discussed."

Rohaan, E. J., Taconis, R., & Jochems, W. M. (2012). Analysing teacher knowledge for technology education in primary schools. *International Journal of Technology and Design Education*, *22*(3), 271-280.

Abstract:
"Teacher knowledge guides a teacher's behaviour in the classroom. Teacher knowledge for technology education is generally assumed to play an important role in affecting pupils' learning in technology. There are an abundant number of teacher knowledge models that visualise different domains of teacher knowledge, but clear empirical evidence on how these domains interact is lacking. Insights into the interaction of teacher knowledge domains could be useful for teacher training. In this study, the hypothesised relations between different domains of teacher knowledge for technology education in primary schools were empirically investigated. Subject matter knowledge, pedagogical content knowledge, attitude, and self-efficacy were measured with tests and questionnaires. Results from a path analysis showed that subject matter knowledge is an important prerequisite for both pedagogical content knowledge and self-efficacy. Subsequently, teachers' self-efficacy was found to have a strong influence on teachers' attitude towards technology. Based on the findings in this study, it is recommended that teacher training should first of all focus on the development of teachers' subject matter knowledge and pedagogical content knowledge. This knowledge will positively affect teachers' confidence in teaching and, in turn, their attitude towards the subject. More confidence in technology teaching and a more positive attitude are expected to increase the frequency of technology education, which consequently increases teaching experience and thereby stimulates the development of teachers' pedagogical content knowledge. This circle of positive reinforcement will eventually contribute to the quality of technology education in primary schools. (Contains 3 tables and 2 figures.)"

Tabach, M. (2011). A mathematics teacher's practice in a technological environment: A case study analysis using two complementary theories. *Technology, Knowledge and Learning, 16*(3), 247-265.

Abstract:
"Integrating technology in school mathematics has become more and more common. The teacher is a key person in integrating technology into everyday practice. To understand teacher practice in a technological environment, this study proposes using two theoretical perspectives: the theory of technological

pedagogical content knowledge to analyze teachers' knowledge, and instrumental orchestration to analyze teachers' actions. Applying this dual perspective to one teacher's practice can shed light on the complexities faced by a teacher who integrates technology in her practice."

Tondeur, J., van Braak, J., Sang, G., Voogt, J., Fisser, P., & Ottenbreit-Leftwich, A. (2012). Preparing pre-service teachers to integrate technology in education: A synthesis of qualitative evidence. *Computers & Education*, *59*(1), 134-144. doi: 10.1016/j.compedu.2011.10.009

Abstract:
"This study reviewed qualitative studies that focused on strategies to prepare pre-service teachers to integrate technology into their lessons. A meta-ethnography approach was utilized to locate, critically appraise, and synthesize the results of these studies. Based on an extensive search in the Web of Science, 19 articles were included in this synthesis. The results were divided into two parts: (1) key themes explicitly related to the preparation of pre-service teachers (e.g., using teacher educators as role models, learning technology by design, scaffolding authentic technology experiences), and (2) conditions necessary at the institutional level (e.g., technology planning and leadership, co-operation within and between institutions, training staff). To present how these key themes related to each other, an overarching model was developed. By interpreting the results of the review, recommendations were discussed for pre-service teacher technology training and future research."

Tondeur, J., Roblin, N. P., van Braak, J., Fisser, P., & Voogt, J. (2012). Technological pedagogical content knowledge in teacher education: in search of a new curriculum. *Educational Studies.* Advance online publication. doi: 10.1080/03055698.2012.713548

Abstract:
"The aim of this study was to explore the ways in which teacher education institutions (TEI) prepare pre-service teachers for integrating information and communication technology (ICT) in their classroom practise. Specifically, a multiple case study was conducted to examine the ways in which the development of technological pedagogical content knowledge (TPACK) was promoted in the existing curriculum of three TEI in Flanders. In the three cases, data were drawn from semi-structured interviews with the heads of the department and the ICT coordinators. Focus group discussions collected the perspectives of pre-service teachers and teacher educators. The results indicate that (1) the three institutions are moving from ICT as a 'stand-alone' course towards embedding ICT across the curriculum and (2) three approaches were adopted for developing pre-service teachers' TPACK, each representing different ways of understanding the place of ICT in the curriculum. The discussion will focus on the challenges and opportunities inherent in understanding how to develop pre-service teachers' TPACK in the curriculum of TEI."

Turcsányi-Szabó, M. (2012). Aiming at sustainable innovation in teacher education — from theory to practice. *Informatics in Education*, *11*(1), 115-130.

Abstract:
"The paper composes a framework for learning design, using Web 2.0 technologies in teacher training, transferring the advancement in technology to become an affordance in the teaching/ learning process, based on Bloom's Extended Digital Taxonomy in order to enhance the Technological Pedagogical and Content Knowledge of teachers. As a case study, it shows how ELTE University tries to develop sustainable innovation of competencies in digital literacy and modern teaching/learning methodologies directly among the teaching staff in teacher training and student/ future teachers as well as indirectly within public education in order to transfer innovation there. The complex aims of a specific course Educational Technology are described with detailed explanation of the methodology used in attaining the prescribed aims, giving links to the concrete tools and resources used. The description of course requirements are tagged with features of the nature of the learning design as being transmissive, dialogic, constructionist and co-constructive, illustrating how each element contributes to the adaptation of theory into practice. The role of a newly established T@T Mentoring Network is explained, which presumes sustainability for innovation within teacher training and the network of in-service and practicing teachers."

Voogt, J., Fisser, P., Roblin, N. P., Tondeur, J., & van Braak, J. (2012). Technological pedagogical content knowledge – A review of the literature. *Journal of Computer Assisted Learning*. Advance online publication. doi: 10.1111/j.1365-2729.2012.00487.x

Abstract:
"Technological Pedagogical Content Knowledge (TPACK) has been introduced as a conceptual framework for the knowledge base teachers need to effectively teach with technology. The framework stems from the notion that technology integration in a specific educational context benefits from a careful alignment of content, pedagogy and the potential of technology, and that teachers who want to integrate technology in their teaching practice therefore need to be competent in all three domains. This study is a systematic literature review about TPACK of 55 peer-reviewed journal articles (and one book chapter), published between 2005 and 2011. The purpose of the review was to investigate the theoretical basis and the practical use of TPACK. Findings showed different understandings of TPACK and of technological knowledge. Implications of these different views impacted the way TPACK was measured. Notions about TPACK in subject domains were hardly found in the studies selected for this review. Teacher knowledge (TPACK) and beliefs about pedagogy and technology are intertwined. Both determine whether a teacher decides to teach with technology. Active

involvement in (re)design and enactment of technology-enhanced lessons was found as a promising strategy for the development of TPACK in student teachers. Future directions for research are discussed."

Wachira, P., & Keengwe, J. (2011). Technology integration barriers: Urban school mathematics teachers perspectives. *Journal of Science Education and Technology, 20*, 17-25. doi: 10.1007/s10956-010-9230-y

Abstract:
"Despite the promise of technology in education, many practicing teachers face several challenges when trying to effectively integrate technology into their classroom instruction. Additionally, while national statistics cite a remarkable improvement in access to computer technology tools in schools, teacher surveys show consistent declines in the use and integration of computer technology to enhance student learning. This article reports on primary technology integration barriers that mathematics teachers identified when using technology in their classrooms. Suggestions to overcome some of these barriers are also provided."

Webb, M. (2011). Changing models for researching pedagogy with information and communications technologies. *Journal of Computer Assisted Learning.* Advance online publication. doi: 10.1111/j.1365-2729.2011.00465.x

Abstract:
"This paper examines changing models of pedagogy by drawing on recent research with teachers and their students as well as theoretical developments. In relation to a participatory view of learning, the paper reviews existing pedagogical models that take little account of the use of information and communications technologies as well as those that are focused more specifically on technology-rich learning environments. A possible framework for understanding pedagogy is beginning to emerge, which can be applied to both face-to-face and online learning. This framework combines individual and group regulation of learning where pedagogical reasoning is transparent and shared between students, teachers, and others involved in students' learning. The framework needs to integrate the purposeful elements and sharing of roles characteristic of formative assessment in pedagogy as well as a learning culture that could enable supportive interaction."

Wetzel, K., & Marshall, S. (2012). TPACK goes to sixth grade: Lessons from a middle school teacher in a high-technology-access classroom. *Journal of Digital Learning in Teacher Education*, *28*(2), 73-81.

Abstract:
"This is a qualitative study addressing the question: In what ways does a sixth grade middle school teacher show evidence of behaviors that fit the Technological Pedagogical Content Knowledge (TPACK) framework in the

classroom? The researcher observed in this class, interviewed the teacher, and looked for evidence of the interplay between components of the framework. This teacher's class was particularly appropriate for this study because she was an experienced teacher her school district selected to pilot a classroom with many technologies, including one laptop for each student. Applying the TPACK theoretical framework to her classroom helps us better understand how the framework is translated into practice. Findings indicate that the teacher provided a foundation for the use of technology in content (language arts) and pedagogy (project-based learning). The teacher demonstrated technological pedagogical knowledge through well-planned classroom management practices as well as the interplay between components of the framework. Recommendations include the use of the TPACK framework as a lens for classroom observation and the need for additional cases to be used in professional development. (Contains 2 figures and 1 table.)"

Yurdakul, I. K., Odabasi, H. F., Kilicer, K., Coklar, A. N., Birinci, G., & Kurt, A.A. (2012). The development, validity and reliability of TPACK-deep: A technological pedagogical content knowledge scale. *Computers & Education, 58*(3), 964-977. doi: 10.1016/j.compedu.2011.10.012

Abstract:
"The purpose of this study is to develop a TPACK (technological pedagogical content knowledge) scale based on the centered component of TPACK framework in order to measure preservice teachers' TPACK. A systematic and step-by-step approach was followed for the development of the scale. The validity and reliability studies of the scale were carried out with 995 Turkish preservice teachers. The sample was split into two subsamples on random basis (n1 = 498, n2 = 497). The first sample was used for Exploratory Factor Analysis (EFA) and the second sample for Confirmatory Factor Analysis (CFA). After the EFA, the TPACK-deep scale included 33 items and had four factors. These factors were design, exertion, ethics and proficiency. The Cronbach's alpha coefficient for the whole scale was found to be .95, whereas the values of Cronbach's alpha coefficient for individual factors of the scale ranged between .85 and .92. The CFA was conducted within the scope of the validity study of the scale. In this way, this structure of the 4-factor scale was confirmed. In addition, the test-retest reliability coefficient of the scale was calculated as .80. The findings revealed that the TPACK-deep scale was a valid and reliable instrument for measuring TPACK. Consequently, various suggestions were put forward regarding the use the TPACK-deep scale for applied research and for future studies."

Chapters

Anderson, S. (2012). TPACK: Technology, pedagogy and content knowledge. In *Classroom 2.0 the book*. Retrieved from

http://www.scribd.com/doc/98582379/Steven-Anderson-TPACK-Technology-Pedagogy-and-Content-Knowledge *
*Requires a free Scribd account to download.

Klieger, A., & Oster-Levinz, A. (2010). How online tasks promote teachers' expertise within the technological pedagogical content knowledge (TPACK). In T. Yuzer, & G. Kurubacak (Eds.), *Transformative learning and online education: Aesthetics, dimensions and concepts* (pp. 219-235). Hershey, PA: Information Science Reference. doi:10.4018/978-1-61520-985-9.ch015

Abstract:
"In the Information Communication Technology (ICT) era, teachers will have to wisely use the online environment in order to realize a new pedagogy. We developed a digital indicator for examining the extent to which technological knowledge is integrated with pedagogical content knowledge (TPACK). This indicator is used to examine online tasks developed by teachers in different subjects over time. The factors found to contribute and promote such integration are the instruction given to the teachers and time. These two factors enable the teachers to implement the appropriate pedagogy in a diverse technological environment. The authors recommend that correct integration of TPACK should be emphasized when planning professional development for teachers in the field of online tasks."

Mishra, P., Koehler, M. J., Zellner, A., & Kereluik, K. (2012). Thematic considerations in integrating TPACK in a graduate program. In D. Polly, C. Mims, & K. Persichitte (Eds.), *Developing Technology-Rich Teacher Education Programs: Key Issues* (pp. 1-12). Hershey, PA: Information Science Reference. doi:10.4018/978-1-4666-0014-0.ch001

Abstract:
"The integration of technology into classrooms is an increasingly important issue in America's schools, and at the core of this integration is the training of teachers. Teacher educators seeking to impact teachers' use of technology should recognize the needs of these learners as well as their knowledge as practitioners, in order to expand their knowledge and help them think about technology in creative ways. In this chapter, the authors describe the design and implementation of the Master's program in Educational Technology at Michigan State University (MSU) as an example of an institution's attempts to improve their facility to incorporate technology into the classroom practice. The authors briefly define the concept of the TPACK and how that theoretical model is important in thinking about technology with teacher practitioners, and how it helped to focus the design of the Educational Technology program at MSU. The authors then outline central TPACK themes that run through each of the stages of this program, and how each level, in turn, informs the others. Finally, the chapter

offers concrete examples of TPACK in practice at each stage of the Master's program in educational technology."

Niess, M. L. (2012). Re-thinking pre-service mathematics teachers preparation: Developing technological, pedagogical, and content knowledge (TPACK). In D. Polly, C. Mims, & K. Persichitte (Eds.), *Developing technology-rich teacher education programs: Key issues* (pp. 316-336). Hershey, PA: Information Science Reference. doi:10.4018/978-1-4666-0014-0.ch021

Abstract:
"Powerful and modern digital technologies have significantly impacted mathematics teaching – both what is to be learned and how it should be learned. Technology, pedagogy, and content knowledge (TPACK) is the knowledge that teachers rely on for teaching content with appropriate digital technologies. What preparation do mathematics teachers need in order to develop this knowledge needed for integrating appropriate digital technologies as teaching and learning tools? The challenges of understanding TPACK and identifying appropriate educational programs for pre-service mathematics teachers call for thoughtful attention toward the development of the knowledge, skills, and dispositions that support the dynamic nature embedded within the TPACK construct. The design of appropriate pre-service teacher learning trajectories for developing a rigorous TPACK emphasizes that both how and where they learn to teach mathematics are fundamental to what is learned about teaching and learning mathematics. Redesign ideas and models support re-thinking and re-designing pre-service mathematics teacher preparation programs."

Ottenbreit-Leftwich, A. T. (2012). The importance of using subject-specific technology uses to teach TPACK: A case study. In D. Polly, C. Mims, & K. Persichitte (Eds.), *Developing technology-rich teacher education programs: Key issues* (pp. 152-169). Hershey, PA: Information Science Reference. doi:10.4018/978-1-4666-0014-0.ch011

Abstract:
"The objective of this chapter is to describe a case study of an educational technology course that uses subject-specific contexts to address preservice teachers' development of TPACK. Many have indicated that in order for technology knowledge to be transferred to the classroom, teachers need to find the knowledge being taught relevant to their future classrooms. This course uses various workouts and cases to develop preservice teachers' technology abilities within the context of their future classrooms. Through these activities, preservice teachers showed improvement in technology knowledge (TK), technological pedagogical knowledge (TPK), and technological pedagogical and content knowledge (TPACK). Recommendations are made to other teacher educators on how to apply such principles within their own educational technology courses."

Saglam, Y., & Demir, S. (2012). A framework for the integration of technology into science instruction. In F. Ornek, & I. M. Saleh (Eds.), *Contemporary Science Teaching Approaches: Promoting Conceptual Understanding in Science* (pp. 165-177). Charlotte, NC: Information Age Publishing.

Abstract:
"Contemporary science teaching approaches focus on fostering students to construct new scientific knowledge as a process of inquiry rather than having them act as passive learners memorizing stated scientific facts. Although this perspective of teaching science is clearly emphasized in the National Research Council's National Science Education Standards (NRC, 1996), it is however challenging to achieve in the classroom. Science teaching approaches should enhance students' conceptual understanding of scientific concepts which can be later utilized by students in deeper recognition of real world (Marsak & Janouskova, 2007). This book identifies and describes several different contemporary science teaching approaches and presents recent applications of these approaches in promoting interest among students. It promotes conceptual understanding of science concepts among them as well. This book identifies pertinent issues related to strategies of teaching science and describes best practice. The chapters in this book are culmination of years of extensive research and development efforts to understand more about how to teach science by the distinguished scholars and practicing teachers."

Sheehy, C., & Clemmons, K. R. (2012). Beyond the language arts classroom: The dynamic intersection of young adult literature and technological, pedagogical, and content knowledge. In Hayn, J. A., & Kaplan, J. S. (Eds.), *Teaching young adult literature today: Insights, considerations, and perspectives for the classroom teacher* (pp. 225-240). Blue Ridge Summit, PA: Rowman & Littlefield Publishers.

Abstract:
"*Teaching Young Adult Literature Today* introduces the reader to what is current and relevant in the plethora of good books available for adolescents. More importantly, literary experts illustrate how teachers everywhere can help their students become lifelong readers by simply introducing them to great reads--smart, insightful, and engaging books that are specifically written for adolescents. Hayn, Kaplan, and their contributors address a wide range of topics: how to avoid common obstacles to using YAL; selecting quality YAL for classrooms while balancing these with curriculum requirements; engaging disenfranchised readers; pairing YAL with technology as an innovative way to teach curriculum standards across all content areas. Contributors also discuss more theoretical subjects, such as the absence of lesbian, gay, bisexual, transgender and questioning (LGBTQ) young adult literature in secondary classrooms; and contemporary YAL that responds to the changing expectations of digital generation readers who want to blur the boundaries between page and screen."

Book

Abera, B. (2011). *Technological pedagogical content knowledge: A framework for Ethiopian teacher education.* Saarbruecken, Germany: Lambert Academic Publishing.

Summary:
"Technological Pedagogical Content Knowledge (TPACK) is a framework to understand and describe the kinds of knowledge needed by a teacher for effective pedagogical practice in a technology enhanced learning environment. The idea was originated from pedagogical content knowledge (PCK). The introduction of instructional technology in the teaching learning environment breeds the notion. It connotes the integration of instructional technologies in the education world. The proponents of TPACK argue that effective technology integration for teaching specific content or subject matter requires understanding and negotiating the relationships between three components: technology, pedagogy, and content. Therefore, teacher educators nowadays are beginning to stress the need for TPACK development in teacher preparation programs. The book is aimed at recommending the possible application of the framework in Ethiopian teacher preparation in general and English language teacher education in particular."

3. Recent TPACK Presentations

Abera, B. (2012, July). *Applying a technological pedagogical content knowledge framework in Ethiopian English language teacher education.* Paper presented at the IADIS International Conference on e-Learning, Lisbon, Portugal. Available from http://www.pedagogy.ir/index.php/e-learning/172-applying-a-technological-pedagogical-content-knowledge-framework-in-ethiopian-english-language-teacher-education

Abstract:
"Technological Pedagogical Content Knowledge (TPACK) has emerged as a useful frame for instructional technology based education. This paper addresses the existing literature on technological pedagogical content knowledge framework and overview of teacher education in Ethiopia in general and English language teacher education in particular. Data were collected through a structured questionnaire from 30 experienced English language teachers who have taught English via the plasma-channeled instruction for four to five years. Moreover, an interview was conducted with 6 of the sample classroom English teachers, and 10 plasma-channeled lessons were observed in order to look into the technological pedagogical content knowledge of the samples. The results revealed that the existing literature failed to demonstrate the application of TPACK in English language teacher education in the country. The technological pedagogical content knowledge of classroom English language teachers was

also found to be low. The classroom observations, similarly, confirmed that teachers have applied their pedagogical content knowledge while teaching English language through the televised instruction like the conventional instruction. They seldom observed applying their technological pedagogical content knowledge. Finally, based on the results and the conceptual framework of TPACK, implications for the Ethiopian secondary school teacher preparation programs were outlined and further studies were suggested."

Anderson, S. (Producer). (2012, August 21). *TPACK at Nearpod session #1* [Webinar]. Retrieved from http://www.nearpod.com/steven-anderson-presenting-tpack-at-nearpod-session-1/

Abstract:
"Are you using technology as effectively as you could in your classroom? Or perhaps you know you need to try it, but don't want to include tech just for the sake of it? This Session will introduce you to TPACK (Technological Pedagogical Content Knowledge) and how it can be used to effectively integrate new technology in a classroom setting. We will examine how three important components (Technology, Pedagogy, and Content) intersect to form a new way of learning. We'll also explore how teachers can create content-rich lessons in a few simple steps and, when appropriate, use technology effectively."

Bos, B., & Lee, K. (2012, October). *In-service teachers' ICT-TPCK development in an elementary mathematics master teacher program.* Information session presented at the International Conference on Online Learning, Lake Buena Vista, Florida. Retrieved from http://sloanconsortium.org/conference/2012/aln/service-teachers-ict-tpck-development-elementary-mathematics-master-teacher-prog

Classroom 2.0 Live. (Producer). (2012, February 11). *TPACK and common core* [Webinar]. Retrieved from http://live.classroom20.com/1/post/2012/02/tpack-and-common-core.html

Courville, K. (2011, November). *Educational technology: Effective leadership and current initiatives.* Paper presented at the Louisiana Computer Using Educators Conference, New Orleans, LA.

Abstract:
"This article describes the basis for effective educational technology leadership and a few of the current initiatives and impacts that are a result of the aforementioned effective leadership. (Findings) Topics addressed in this paper include: (1) the role of the educational technology leader in an educational setting; (2) an examination of the required skills of an educational technology leader; (3) theoretical frameworks and models such as organizational change and TPCK [technological pedagogical content knowledge]; (4) social and emotional aspects of technology integration; (5) impacts of effective leadership;

(6) distributed and distance learning technology; (7) technology initiatives focused on learning enrichment. (Conclusions) Although educational technology leaders have had a significant impact on the field of education, effective leaders require an extensive knowledge of the leadership process and related theory to effectively integrate technology with the goal of increasing student achievement and overall school performance."

Grotti, M. G., & Sobel, K. (2012, June). *Thinking critically about classroom technologies using the TPCK framework.* Poster session presented at the annual conference of the American Library Association, Anaheim, CA. Retrieved from http://www.slideshare.net/kslovesbooks/thinking-critically-about-classroom-technologies-using-the-tpck-framework

Horzum, M. B., Demirbas, M., & Bayrakci, M. (2012, March). *Analysing technological pedagogic content knowledge of science teacher candidates according to various variables.* Paper presented at the New Perspectives in Science Education Conference, Florence, Italy. Retrieved from http://www.pixel-online.net/science/common/download/Paper_pdf/

Abstract:
"The aim of this study was to analyze science teacher candidates' technological pedagogic content knowledge level according to various variables. Technological pedagogic content knowledge of teacher candidates was measured by qualitative semi-structured interviews by the researchers. Teacher candidates' content knowledge was analyzed according to sex, class, age and having technology education or not. In this study, qualitative data analysis techniques was [*sic*] used to analyze data. This study was carried out with 12 teacher candidates from Sakarya University, Faculty of Education, Science Teacher Teaching Department. According to the results of the study, it is found that they were provided with the sufficient education on technology and pedagogy at university."

Koh, J. H. L., & Sing, C. C. (2011, December). *Modeling pre-service teachers' technological pedagogical content knowledge (TPACK) perceptions: The influence of demographic factors and TPACK constructs.* Paper presented at the Ascilite 2011 Conference, Hobart, Tasmania. Retrieved from http://www.leishman-associates.com.au/ascilite2011/downloads/papers/HweeLingKoh-full.pdf

Abstract:
"The TPACK framework comprises seven constructs that describe teachers' technology integration expertise. These TPACK constructs address a theoretical void in the area of educational technology and have been widely adopted by colleges of education for the planning of teacher technology integration courses. This study first describes Singapore pre-service teachers' TPACK perceptions with respect to these seven constructs. Using a stepwise regression model, this study then analyzes the relative impact of age, gender, and TPACK constructs

on the TPACK perceptions of pre-service teachers. It was found that TPACK constructs had significant impact on pre-service teachers' TPACK perceptions whereas the demographic variables of age and gender were not significant. Among the TPACK constructs, only technological pedagogical knowledge and technological content knowledge were found to be significant predictors of TPACK. The implications of these findings on the design of pre-service teacher ICT courses are discussed."

Özevgec, T. (2012, September). *Turkish senior pre-service science teachers' technological pedagogical content knowledge of 'environmental chemistry'.* Lecture and discussion at the University of Copenhagen, Copenhagen, Denmark. Retrieved from http://www.ind.ku.dk/begivenheder/2012/erasmus-seminar/

Abstract:
"Since an effective technology integration requires interdependent content, technological, and pedagogical knowledge, Harris and Hofer (2006) suggested a logical approach that helps teachers integrate technologies in their classrooms well. In this approach, students' content-related learning needs are directly linked with particular content-based learning activities and related educational technologies that will support successful implementation of the activities'.

The aim of this presentation is to introduce technological pedagogical content knowledge (TPACK) and to provide some information about recently finished project called 'Technological Embedded Scientific Inquiry (TESI): Modeling and Measuring Pre-Service Science Teachers' Knowledge and Practice'. The presentation also includes the results of another study called "Turkish senior pre-service science teachers' Technological Pedagogical Content Knowledge (TPACK) of 'Environmental Chemistry' which is part of the TESI project."

Peffer, T., Bodzin, A., & Kulo, V. (2012, January). *Effectiveness of a geospatial science technological pedagogical content knowledge professional development model.* Paper presented at the meeting of the Association for Science Teacher Education (ASTE), Clearwater, FL. Retrieved from http://www.ei.lehigh.edu/eli/research/ASTE2012a.pdf

Tan, C. B. (2012, June). *Technological interdisciplinary content knowledge: A learners'* [sic] *framework.* Paper presented at the meeting of the Centre for Information Technology in Education, Hong Kong, PRC. Slides available from http://www.slideshare.net/citehku/technological-interdisciplinary-content-knowledge-a-learners-framework

Abstract:
"The study seeks answers to the question: "What makes students' TICK in the digital age?" The paper proposes the concept of Technological Interdisciplinary Content Knowledge (TICK). Building on Shulman's Pedagogical Content

Knowledge (PCK), and Mishra and Koehler's Technological Pedagogical Content Knowledge (TPACK); this study examines the types of knowledge learners need to thrive in the Conceptual Age. The study addresses the three domain areas needed to ensure deep and strategic learning approaches to achieve positive learning outcomes. Using case studies exemplars, the presentation will show how the proposed model represents an innovative nexus for learners' knowledge."

4. Recent TPACK-Related Dissertations

Abate, L. M. (2006). *Technology integration and novice teachers: looking at technology use of novice teachers in the context of their first year of teaching.* (Doctoral dissertation, University of Texas). Retrieved from http://repositories.lib.utexas.edu/handle/2152/14315

Abstract:
"The aim of this study was to examine first year teachers' experiences incorporating instructional technology into their teaching through the lens of Technology-Pedagogical Content Knowledge. Technology-Pedagogical Content Knowledge is a fairly new concept drawn from the concept of Pedagogical Content Knowledge, originating with Shulman. Participating teachers were graduates of a Southwestern University's College of Education laptop initiative that required all College of Education students to purchase a laptop. The laptop was used throughout their pre-service teaching course work. The first graduating cohort of this initiative was surveyed during their first full year of teaching. Ten of those surveyed then participated in interviews and journal writing related to their technology integration experiences. Results indicated that for the most part these new teachers are not facing access and support related barriers to technology use, though time constraints are still an issue. Results also indicated that the teachers are using technology in their instructional activities, and are continuing to grow in their technology integration skills. The basis in technology use from their College of Education combined with the technology-supportive school atmosphere in which they teach appears to be an environment that is fostering teachers who are willing to experiment with technology integration and are planning how to integrate it more in the coming school year. Their understanding of the connections between technology, content and pedagogy, their t-PCK, are developing and transforming. Impact on the field includes a greater understanding of how teachers come to design lessons for technology integration as well as a greater understanding of how graduates from teacher preparation programs with an emphasis on technology integration are able to apply their skills upon entering the teaching field."

Dalgarno, N. J. (2011). Compulsory laptop programs: Teachers' responses to the adoption and implementation process*. Dissertation Abstracts International: Section A. Humanities and Social Sciences, 71*(12-A), 4363.

Abstract:
“This thesis presents a multiple-method investigation of teachers‘ responses to the adoption and implementation of a compulsory laptop program (CLP). It reports on the beliefs, opinions, and behaviours of teachers responsible for translating a CLP into classroom-based reality. The study is based on data collected from 18 interviews, 2 focus groups, and classroom observations of 5 teachers obtained from teachers and administrators at one Canadian independent school, as well as an online survey data from educators at nine independent schools across Canada. The purpose of the research was to investigate the impact of adopting and implementing a planned change initiative by examining teachers‘ responses to a school-wide mandated curriculum initiative by focusing on their perceptions of (a) requisite participation, (b) essential components, and (c) changing roles when implementing a CLP. The findings of the study include four supports for teachers trying to implement a CLP into teaching practices. First, clearly communicate and revise shared, benchmark-driven policies on an ongoing basis to assist in unifying an understanding of the program. Second, address teachers‘ self-imposed pressures within a CLP by ensuring individual teachers‘ intrinsic motivation and affective needs are respected and addressed. Third, provide teachers with job-embedded learning opportunities to work individually and in small groups, and with access to knowledgeable resources in order to connect technological, pedagogical, and content knowledge, to meet just-in-time needs. Fourth, adopt an implementation model that is fluid and addresses elements affecting a teacher to provide a more inclusive and realistic method for explaining and supporting what may occur when teachers engage in implementing a CLP.”

Doukakis, S. (2012). *Exploring undergraduate students' transformation of technological pedagogical knowledge in mathematics as prospective teachers and as teachers in their school action.* (Unpublished doctoral dissertation). University of the Aegean, Rhodes, Greece.

Abstract (excerpt):
“The present study examines undergraduate students’ transformation of Technological Pedagogical Content Knowledge (TPACK) in Mathematics during a six-month cooperative action research programme. Furthermore, it examines whether the above-mentioned transformation is transferred to their subsequent activity as schoolteachers. Twenty-five undergraduate primary students (nine men and sixteen women) took part in this educational intervention while the researcher, as well as the supervisor of this research, were teachers of the participant students group.

Mishra and Koehler’s (2006) Technological Pedagogical Content Knowledge (TPACK) framework was used in this study. Furthermore, the dialectical nature of Mathematics (Lakatos, 1976; Davis & Hersh, 1981), the tenets of constructionism (Papert, 1980) and of situated learning (Lave, 1988) were also adopted so as to

investigate students' TPACK transformation in regard to Curriculum implementation, pupil Assessment, Learning, Teaching and Access to digital technologies at Niess et al. (2009) developmental stages (Recognizing, Accepting, Adapting, Exploring, and Advancing). Moreover, this study examines students' cognitive analysis of geometrical thinking according to four apprehensions of geometrical figures: Perceptual, Sequential, Discursive and Operative (Duval, 1995) and also researches students' perceptions about the nature of mathematics according to Ernest's (1989) categories: Instrumentalist, Platonist and Problem-Solving." *

Haley-Mize, S. (2012). The effect of instructional methodology on pre-service educators' level of technological pedagogical content knowledge. *Dissertation Abstracts International: Section A. Humanities and Social Sciences,* 72(12-A), 4515.

Abstract:
"Technological Pedagogical Content Knowledge (TPACK) is presented by Mishra and Koehler (2006) as a form of complex, situated knowledge that is a prerequisite to seamless and successful technology integration into educational spaces. This form of knowledge is believed necessary for technology use to transform classrooms into vibrant, collaborative spaces that build 21st century skills – a transformation that has been elusive in K-16 spaces. Preservice education programs are poised to develop this type of knowledge in future teachers to contribute to the development of educators that can act as change agents. This study used a quasi-experimental, pre/post-test design to evaluate three different course experiences on preservice educators' level of TPACK. Results indicated that candidates who participated in course design that explicitly modeled technology integration, created a digital space to extend the community of practice, challenged participants to create collaborative solutions using Web 2.0 platforms, and integrated content on Universal Design for Learning showed significant increases in Pedagogical Knowledge, Pedagogical Content Knowledge, Technological Content Knowledge, Pedagogical Technological Knowledge, and Technological Pedagogical Content Knowledge when post scores were compared with pre-test scores. Multivariate analysis of variance between groups on each of the six TPACK subscales reviewed in this study indicated that this group also showed significantly higher gains in TPACK when compared to a fully online group and a face-to-face without technology-enhanced learning on Pedagogical Content Knowledge, Technological Content Knowledge, and Technological Pedagogical Knowledge."

Hiltz, J. R. (2012). A case study of school technology support networks. *Dissertation Abstracts International: Section A. Humanities and Social Sciences, 73*(2-A), 432.

Abstract:

“Since the last decade of the 20th Century, there has been an effort to integrate technology into classroom instruction. The success of this effort has been uneven, as teachers have resisted this change. There has been a great deal of recent research on the importance of teacher-to-teacher interactions and successful organizational change. This descriptive and exploratory case study was conducted to: (1) learn about the social networks teachers form in order to support technology integration in the classroom, (2) learn about how the instructional technology resource teacher (ITRT) is positioned in these social networks and to see if the instructional background of the ITRT affects that position, and (3) learn how technology leadership on the part of the school principal and the ITRT affects the structure of these networks. The study was conducted at two middle schools located near a large city along the East Coast of the United States. Qualitative and quantitative methodologies were used to conduct this study. The qualitative portion of the study consisted of interviews with the principal and the instructional technology resource teacher (ITRT) at each school. The quantitative portion of the study consisted of social network analyses (SNA) of the curricular support and technology support networks. The SNA software package of UCINET and NetDraw was used to analyze the data. Correlations were also examined between degree centrality and the teachers’ technological, pedagogical and content knowledge (TPACK). Both principals were strong supporters of classroom technology integration, but they used different methods to put into place their respective visions. These differences seem to have affected the structures of the technology support networks that formed in the schools, with a highly centralized network efficient for exchanging routine information in one school, while in the second school, the technology support network was less centralized and took on a structure more closely identified with innovation and organizational change. As a result of this study, a number of leadership traits were identified, which include developing a vision that is subject-specific and pedagogically-focused as well as empowering the ITRT and others as technology leaders.”

Lee, Y-L. (2012). The development of technological pedagogical content knowledge for science learning with a three-dimensional interactive computer simulation. *Dissertation Abstracts International: Section A. Humanities and Social Sciences, 72*(11-A), 4120.

Abstract:
“Much research in educational technology has focused mainly on how the technology supports student learning. Research on what teachers need to know in order to appropriately incorporate technology into their teaching has been limited because of the lack of theoretical grounding for understanding teachers' cognitive process of technology integration into teaching and learning. With the technological pedagogical content knowledge (TPCK) framework, components that influence teachers' decisions about using technology to support student learning can be explicitly examined. The purpose of this study is to investigate how to prepare teachers to take into account the pedagogical uses of technology

as well as the knowledge of students to inform the designing of tasks for science learning. Both the learning-by-design (LBD) and the experiencing-model-based-inquiry (EMBI) approaches support the cognitive processing necessary for planning to use technology to teach conceptual content in science. The study examined whether the LBD approach, which challenges teachers to discover and construct their own instructional practices with minimal guidance on the principles of supporting student learning in a particular principle, is less effective than the EMBI approach for developing TPCK. The EMBI approach, in contrast, challenges teachers to reflect on the model-based-inquiry that they experience to advance their understandings of the pedagogical uses of technology and ways to support students to learn the subject matter. This study used a multi-method case study design to investigate the effectiveness of these two approaches. Data were collected from eight experienced secondary science teachers developing their TPCK either in the LBD or the EMBI approach for science learning with a three-dimensional (3D) interactive computer simulation. The results captured the complexities and interactions of how these two approaches influence teachers' ways of leveraging the knowledge components embodied in TPCK to inform their technology integration. Findings indicated that the EMBI approach was more effective than the LBD approach in preparing teachers to develop the components of TPCK. Teachers who experienced how students learn science with the technology and reflected on this experience designed tasks that were more specific for supporting students' learning procedures and for achieving the goals of understanding science."

Lundstrem, K. A. (2012). Exploring the effectiveness of online professional development in developing skills in computer-mediated communication technologies. *Dissertation Abstracts International: Section A. Humanities and Social Sciences, 73*(2-A), 585.

Abstract:
"While online professional development is an increasingly valuable means of providing busy educators with flexible, convenient learning opportunities, a lack of empirical research exists that determines its effectiveness. Part of this gap is due to the complex nature of assessing educational technology. The purpose of this mixed methods case study was to explore the effectiveness of online professional development in terms of both helping faculty members acquire the knowledge to integrate computer-mediated communication (CMC) technologies into teaching and then apply this knowledge to their own teaching practice. The study was conducted at a large, public college located in New York City. The quantitative portion of this research involved a survey of 24 faculty members, who have participated in an online professional development seminar, with a modified version of the Technological Pedagogical Content Knowledge (TPACK) survey that measures educators' self-assessment of their combined knowledge of various educational domains. Descriptive statistics indicated the percentages of faculty members who agreed with statements concerning the usage of CMC tools. The data indicated that 22 (91.7%) of the surveyed professors agreed or

strongly agreed that they could appropriately select and use CMC technologies as a result of the online professional development seminar. The surveyed participants used all of the CMC tools, but they primarily used the discussion board. The qualitative portion of this research involved an expert sampling of six additional faculty members, who were asked to participate in a concurrent focus group. The focus group transcript was analyzed according to themes. "Confidence and experience" emerged as one of the themes, which supported the quantitative survey data that showed the online professional development was effective at giving the professors the confidence and experience to teach with CMC tools. However, focus group members indicated a need for more subject-specific training, which they believed could be resolved through online mentorship. The data collected only applies to this small case study, so the findings are only relevant within this specific instance. Future studies are suggested to be conducted on a larger scale and should explore the role of mentorship to fulfill the need for subject-specific online professional development."

Wilson, M. T. (2012). *Using the technological pedagogical content knowledge (TPCK) framework to explore teachers' perceptions of the role of technology in the implementation of mCLASS®: Reading 3D.* (Doctoral dissertation, North Carolina State University). Retrieved from http://repository.lib.ncsu.edu/ir/bitstream/1840.16/7514/1/etd.pdf

Abstract:
"This qualitative study considers the perceptions of teachers from one rural county in North Carolina who implemented the program implementation of mCLASS ®: Reading 3D. Reading 3D is an electronic early literacy assessment that is designed to assist teachers in planning appropriate literacy instruction based on student needs by offering immediate access to individual student data. This study sought to provide perspectives about which aspects of technology are occurring in schools and the degree to which actual practices resemble North Carolina's intended delivery of the Reading 3D program. The primary framework that was used to understand the teachers' perceptions was the Technological Pedagogical Content Knowledge (TPCK) Framework. The purpose of TPCK is to recognize the information that is needed for teachers to be able to properly integrate technology into their teaching. The findings were acquired by surveying 26 teachers, reviewing online documents, and interviewing eight participants through stratified random sampling.

Although the findings of this study were guided primarily through the TPCK framework, there was a secondary interest in perceptual theory. The results showed that although teachers appreciated the capabilities of the technology, they were not using it to its full potential. These findings suggest that schools seeking to implement technology based early literacy assessment programs such as mCLASS ®: Reading 3D should offer specific professional development

plans, solicit teacher input on county-wide standards, and acquire updated technology for a positive implementation climate.

The theoretical implications included closer monitoring of all programs, connection of program to improved student achievement as well as offering appropriate training that supports new technology. There are also implications for future research including investigating the reliability of the assessments before using this assessment as its main support to guiding instruction, adding to the participant pull - including the principals and other staff members, and examining the impact that this program is having on student achievement.
Although the findings from this study would not be considered generalizable, the findings would be deemed useful to other rural counties who are implementing mCLASS ®: Reading 3D."

5. Recent TPACK-Related Professional Development

Since the previous issue of the TPACK Newsletter, Mark Fijor, a professional development provider in the Arlington Heights, Illinois school district, has continued to share his "TPACK Professional Development Framework" that schools in his district are continuing to use.

In "TPACK in Action," Mark shares a presentation that he uses "to outline the goals for the framework." (http://www.newschooltechnology.org/2011/10/tpack-in-action/) The complete series of rich, thoughtful blog posts to date comprise:

a. TPACK and Systemic Technology Integration
http://www.newschooltechnology.org/2011/07/tpack-and-systemic-technology-integration/

b. TPACK and Systemic Technology Integration – The Analogy
http://www.newschooltechnology.org/2011/07/tpack-and-systemic-technology-integration-part-two/

c. TPACK and Systemic Technology Integration – Focus Tools
http://www.newschooltechnology.org/2011/08/tpack-and-systemic-integration-focus-tools/

d. TPACK and Systemic Technology Integration – Affordances and Constraints
http://www.newschooltechnology.org/2011/08/tpack-and-systemic-integration-affordances-and-constraints/

e. TPACK and Systemic Technology Integration – The Four C's of Tech Integration
http://www.newschooltechnology.org/2011/08/tpack-and-systemic-integration-the-four-cs-of-tech-integration/

f. TPACK and System Integration – Learning Activity Types

http://www.newschooltechnology.org/2011/08/tpack-and-system-integration-learning-activities-types/

g. TPACK – Systemic Integration: 2011-2012
http://www.slideshare.net/mfijor/tpack-9859057

6. Selected TPACK-Related Videos

nancyrubin (Producer). (2012). TPACK (or technological pedagogical content knowledge) [Video]. Available from http://www.youtube.com/watch?feature=player_embedded&v=0wGpSaTzW58

postingforschool (Producer). (2012). Digital short week 3: The sweet spot (TPACK anthem) [Video]. Available from https://www.youtube.com/watch?feature=player_embedded&v=phDKNuwJ5b0

Punya Mishra (Producer). (2012). *Don't mess with TPACK* [Video]. Available from http://www.youtube.com/watch?feature=player_detailpage&v=y97tsEJPtjM

ravsirius. (Producer). (2012). TPACK con Creatividad [Video]. Available from http://www.youtube.com/watch?feature=player_detailpage&list=UUYPB8Wh4qnpFUIuJrf7utFw&v=wDnpcE9ILY4 (Spanish language video)

recitpi. (Producer). (2011). Tpack : un modèle pour mieux saisir l'intégration des TIC en classe [Video]. Available from http://www.youtube.com/watch?feature=player_detailpage&v=6cfah3Xt1Y4 (French language video)

7. Selected TPACK-Related Blog Entries

Anderson, S. (2011, December 9). The technology integration answer (well…almost). [Web log post]. Retrieved from http://blog.web20classroom.org/2011/12/technology-integration-answer-well.html

Hagerman, M. S. (2012, July 20). TILE-SIG feature: Got TPACK? [Web log post]. Retrieved from

http://www.reading.org/general/publications/blog/BlogSinglePost/12-07-20/TILE-SIG_Feature_Got_TPACK.aspx

Lane, J. (2012). *TPACK iPad project in schools (TIPS).* [Web log]. Retrieved from http://tips2012.edublogs.org/

Luca, J. (2011, December 15). Moving to a networked school community using ISTE standards, Australian curriculum and an Edublogs platform. [Web log post]. Retrieved from http://jennyluca.com/tag/technological-pedagogical-content-knowledge/

Mishra, P. (2012, January 24). Is TPACK fundamentally flawed? A quick response. [Web log post]. Retrieved from http://punya.educ.msu.edu/2012/01/24/is-tpack-fundamentally-flawed-a-quick-response/

Olsen, R. (2012, January 21). The TPACK framework is fundamentally flawed. [Web log post]. Retrieved from http://www.richardolsen.me/b/2012/01/the-tpack-framework-is-fundamentally-flawed/?utm_source=rss&utm_medium=rss&utm_campaign=the-tpack-framework-is-fundamentally-flawed

Olsen, R. (2012, February 2). TPACK and the fallacy of integration, wicked problems and protean technology. [Web log post]. Retrieved from http://www.richardolsen.me/b/2012/02/tpack-and-the-fallacy-of-integration-wicked-problems-and-protean-technology/

teedee. (2012, July 4). TPACK and my professional practice working with students with disabilities. [Web log post]. Retrieved from http://teedee.wordpress.com/2012/07/04/tpack-and-my-professional-practice-working-with-students-with-disabilities/

Woodward, S. (2012, July 18). Getting to know TPACK. [Web log post]. Retrieved from http://www.teachertechnologies.com/2012/07/getting-to-know-tpack/

8. Regional/National TPACK Activity

The Instructional Technology Standards for the State of Georgia, USA, published in December 2010, are based upon TPACK. This is the first time, to our knowledge, that a U.S. state identified TPACK as the basis for its educational technology standards. The document can be accessed online here:

Georgia Professional Standards Commission, Instructional Technology Task Force. (2010, December). Instructional technology standards. Atlanta, Georgia. Retrieved from

http://www.gapsc.com/policies_guidelines/documents/Instructional_Technology_Standards.pdf

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TPACK takes hold in Australia. (2012, August). *Michigan State University, College of Education News.* Retrieved from http://edwp.educ.msu.edu/news/2012/tpack-takes-hold-in-australia/

9. Other TPACK Updates

Vickel Naravan in New Zealand has proposed "TPACK 2.0," a framework for learning and teaching with Web 2.0 tools. On his wiki (http://tpack2.wikispaces.com/), Vickel presents the framework, saying,

> The TPACK 2.0 framework proposed emerged from literature reviewed on learning and teaching in the Web 2.0 world as a part of a my master thesis. The literature reviewed considered the learner, the types of pedagogy and how the affordances of Web 2.0 tools enable a learning environment that allows learners to take 'charge' of their own learning.
>
> Learning is described as not just about gaining knowledge and skill but also about learning that allows learner autonomy and ownership. Learning is also considered to be where the learner is actively engaged in the process unlike the learning that occurs in most classrooms and higher education institutes where learning occurs by the 'stand and deliver' and 'sit and listen' model.
>
> This theoretical framework (TPACK 2.0) is based on: (i) the learner and learning domain (Bloom et al., 1956), (ii) the pedagogies that drive the learning process and (iii) how technology (Web 2.0 tools) have impacted both, the learner and pedagogies.

The Ed Tech Primer wiki has added an entry for "Pedagogical Content Knowledge" that is actually TPACK:
http://third-bit.com/educate/index.php?title=Pedagogical_Content_Knowledge

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Annie Blaauw created a TPACK Wordle based Mishra & Koehler's 2006 article:
http://aeblaauw.wordpress.com/2012/07/17/tpack-wordle/

Leigh Zeitz's Spring 2012 graduate class, "Coordinating Technology in an Educational Environment," developed a TPACK Wikibook:
http://en.wikibooks.org/wiki/TPACKing_for_a_Wonderful_Educational_Trip

10. 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., & Theisinger, D. (Eds.). (2012, September 27). TPACK newsletter issue #12: September 2012 [Electronic mailing list message]. Retrieved from http://punya.educ.msu.edu/research/tpck/newsletter-archive/

11. 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 and contribute to the TPACK wiki at: http://tpack.org/
- Join the TPACK SIG at: http://site.aace.org/sigs/tpack-sig.htm
- Subscribe to the tpack.research, tpack.teaching, tpack.grants and/or tpack.future discussion lists at: http://site.aace.org/sigs/tpack-sig.htm
- Access the TPACK Learning Activity Types taxonomies at: http://activitytypes.wmwikis.net/
- Access two tested TPACK assessment instruments (that use three types of data) at: http://activitytypes.wmwikis.net/Assessments

Please feel free to forward this newsletter to anyone who might be interested in its contents.

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

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

Standard End-Matter

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

email message to sympa@lists.wm.edu, with the following text in the subject line: unsubscribe tpack.news

- Judi, Mark & Diana (our wonderfully helpful graduate assistant)

…for the SITE TPACK SIG leadership:

Candace Figg,	Co-Chair, Brock University
Mark Hofer,	Co-Chair, College of William & Mary
Judi Harris,	Wing Chair, College of William & Mary
Mario Kelly,	Futon, Hunter College
Matt Koehler,	Chaise Lounge, Michigan State University
Punya Mishra,	Recliner, Michigan State University