cognizancejournal.com
Jessie N. Galindo, Cognizance Journal of Multidisciplinary Studies, Vol.3, Issue.6, June 2023, pg. 368-378
(An Open Accessible, Multidisciplinary, Fully Refereed and Peer Reviewed Journal)
ISSN: 0976-7797
Impact Factor: 4.843
Index Copernicus Value (ICV) = 76.35

Technological Pedagogical and Content Knowledge (TPACK) Assessment of Basic Education Teachers in St. Paul University Surigao

Jessie N. Galindo
Basic Education Department-Senior High School Unit & St. Paul University Surigao, Philippines
Faculty Member, Senior High School Unit
Member of Physical Education Association of the Philippines
jessie.galindo@spus.edu.ph

DOI: 10.47760/cognizance.2023.v03i06.023

Abstract— This study determined the level of teachers' readiness in technology, content, pedagogy, and knowledge using the TPACK framework. This study employed the quantitative approach using the standard questionnaire developed by Koehler & Mishra (2008). The participants were the 67 teachers of St. Paul University Surigao Basic Education Department employed during academic year 2018-2019. In analyzing the data, the Chi-Square Statistics (X^2) was used to determine the significant association of TPCK and profile variables. Results showed that there is a significant association between content knowledge and area of specialization. Significant association was also drawn between content knowledge and academic units. The action plan program by the researcher in this study can be utilized in future training on the formulation of content knowledge, pedagogical knowledge, technological knowledge, pedagogical content knowledge, technological content knowledge, technological pedagogical knowledge, and technological pedagogical content knowledge.

Keywords— TPACK, content knowledge, pedagogical knowledge, technological knowledge, pedagogical content knowledge, technological content knowledge, technological pedagogical knowledge, technological pedagogical content knowledge

I. INTRODUCTION

Our educational system is always adapting and changing with new paradigm to adapt to the ever-changing demand of the world. With this constant change, educators are trying to face the challenges, adapting to the trend to match what they give to what the learners actually need. Recognizing the importance of the continuous development among the teachers, even the Professional Regulation Commission (PRC) requires the professional teachers of the Philippines to show proof of professional development before they can renew their teaching licenses.

However, this PRC practice is not an assurance of teachers' mastery of their content as it does not seek to assess teachers' efficacy; more so, their integration of technology in this era of technological advancement. Thus, to add on the existing literature on the assessment of teachers' mastery of content and effectiveness in technology integration, the researcher pursued the problem using the framework called TPACK.

Technology has always been treated as if it is separate from teaching and learning. Most often during workshops, educators are taught about the features of new software or applications but as to how this can be integrated in classroom is shallowly, sometimes, not even discussed. Misha and Koehler (2008) claimed that this lack of awareness or knowledge on how to integrate technology to classroom may lead to four problems.

First, teachers and learners may have extremely difficult time catching up with all the latest technological advancement. Second, learners are learning how to use the software more than they are learning the content of the lesson. Third, teachers can always adjust to the learners, but technology cannot. Fourth, teachers become planners of what technology or app should be introduced to the students to make learning fun, not planners of how the content can be delivered to the students and how can the knowledge be easily acquired by learners.

With the increasing focus on technology, there is a need to learn how to combine technology with the content and pedagogy to create an effective learning environment. This is the concern which is the focus of

ISSN: 0976-7797
Impact Factor: 4.843
Index Copernicus Value (ICV) = 76.35

TPACK framework. TPACK is a framework that introduces the relationships and the complexities between all three basic components of knowledge (technology, pedagogy, and content). At the intersection of these three knowledge types is an intuitive understanding of teaching content with appropriate teaching methods and technologies. A precursor to the TPCK idea was a brief mention of the triad of content theory (as opposed to pedagogy), and technology in Mishra (2016), though only within the context of educational software design. Pierson (2015), Keating and Evans (2016), and Zhao (2017) similarly describe the relationships between technology, content, and pedagogy.

In 2012, SPUS ventured on the use of iPads in the classroom with e-books replacing the printed textbooks. Training and seminars were conducted on how to maximize the use of technology with the tips of students' fingers. With all these innovation and trainings, the researcher would like to measure how far SPUS teachers have gone when it comes to integration of technology to classroom based on TPACK framework.

The research on TPACK over the past decade had seen both examples of these "games." Some scholars have played the "doubting game" by questioning the framework and underlying theory about the nature, organization, independence, and interdependence of the underlying constructs and the important role of context. This has led to the flowering of a strong line of theoretical work. Others have gone the other route, playing the "believing game," taking the framework as it stands and trying to apply the framework. This application can be seen both in research, as scholars seek to better measure TPACK and its effectiveness, and in practical application, as practitioners seek to guide the development of TPACK in pre-and in-service teachers.

TPACK is a useful frame for thinking about what knowledge teachers must have to integrate technology into teaching and how they might develop this knowledge. Using TPACK as a framework for measuring teaching knowledge could potentially have an impact on the type of training and professional development experiences that are designed for both pre-service and in-service teachers. Hence, their edge, as well as deepening the collective sensitivity to the contexts in which these approaches work (or do not work) (Mishra & Koehler, 2016).

Koehler and Mishra (2016) also attempted to measure TPACK, they used a survey to track changes in teachers' perception of their understanding of content, pedagogy, and technology over the course of an instructional sequence emphasizing design of educational technology. Although they were able to establish and document changes in teachers' perception about their understanding, this approach relied on a survey specifically to those unique course experiences and thus is not generalizable to other contexts, content areas, or approaches to professional development. Moreover, Koehler, et.al (2017) used an approach based on discourse analysis to track the development of TPACK.

Furthermore, analyzing the conversations of teachers working in design teams, they (Mishra & Koehler, 2016) have tracked the development of each of the seven components of TPACK over a semester. This approach, however, is especially time-consuming and is methodologically specific to the unique context in which it was used (i.e., semester-long design experiences).

According to Mishra et al. (2017), the TPACK framework offers no directives concerning what pedagogical approaches are useful. This aligns with the views of Brantley-Dias and Ertmer (2016) who described TPACK as suitable for various pedagogical orientations. In other areas of TPACK, this same flexible feature can be seen. Besides, TPACK has been studied in various content areas, including math (Landry, 2016), biology (Kontkanen et al., 2015), sustainable development (Sointu et al., 2016), and special education (Lyublinskaya & Tournaki, 2017). Similarly, TPACK has been studied from the perspectives of different technologies, such as the World Wide Web (Lee & Tsai, 2017), Second Life (Kontkanen et al., 2015), and social software (Valtonen, Kontkanen, Dillon, Kukkonen, & Väisänen, 2015). This feature makes it possible to apply the TPACK framework flexibly in various areas to study topics related to ICT in different educational contexts.

According to Voogt et al. (2016), teachers must realize different academic ways to deal with ICT and support the development of students' twenty-first century skills. This suggests that twenty-first century skills must be included in teacher education. There is a consensus that teachers must provide students with learning content in ways that support the students' development of twenty-first-century skills (Rotherham & Willingham,

ISSN: 0976-7797
Impact Factor: 4.843
Index Copernicus Value (ICV) = 76.35

2017). Although such skills often labeled *soft* or *generic skills*, skills have been widely recognized in curriculum standards, the main emphasis in standards and assessment remain on the *hard* skills in language and mathematics, along with hard factual knowledge (Scardamalia, Bransford, Kozma, & Quellmalz, 2015). The consensus among researchers in the learning sciences is that these two ideas are not in conflict. That is, problem-solving and social skills are not practiced separately from subject knowledge (Murgatroyd, 2016). Thinking skills and working skills are best learned together in their natural context (Rotherham & Willingham, 2017).

Analytically, the integrative view is reflected in the TPACK framework proposed by Koehler and Mishra (2008) and it conceptualizes TPCK as an integrative body of knowledge, defined by its subcomponents as these are formed in consequence of the intersections between pedagogy and content (PCK), technology and content (TCK), and technology and pedagogy (TPK). According to the integrative view, these subcomponents are integrated "on the spot" during teaching, allowing teachers to make decisions about the educational uses of technology in their respective classrooms. The transformative view of TPCK is projected in the ICT-related PCK framework.

Other researchers have addressed similar ideas, though often under different labeling schemes, including integration literacy (Gunter & Bumbach, 2015); information and communication (ICT)-related PCK (Angeli & Valanides, 2017); Technological Content Knowledge (Slough & Connell, 2015); and electronic PCK or e-PCK (Franklin, 2004; Irving, 2017). Others who have demonstrated sensitivity to the relationships between content, pedagogy, and technology include Hughes (2016); McCrory (2018); Margerum-Leys and Marx (2016); Niess (2015); and Slough & Connell (2015).

Lastly, TPCK is conceptualized as a unique and distinct body of knowledge that goes beyond simple integration, or accumulation, of the constituent knowledge bases, toward the transformation of these contributing knowledge bases into something new and unique (Angeli & Valanides, 2019). Substantial empirical evidence, originating from interactive investigations about the educational uses of computer technology, revealed that growth in the related constructs of TPCK without particular instruction, targeting exclusively the development of TPCK, does not automatically result in TPCK growth (Angeli & Valanides, 2019).

II. FRAMEWORK

This study was based on the TPACK framework of Koehler & Mishra (2008). Technological Pedagogical Content Knowledge (TPCK) was introduced to the educational research field as a theoretical framework for understanding teacher knowledge required for effective technology integration. The TPACK framework acronym was renamed TPACK (pronounced "tee-pack") to remember it easily and to form a more integrated whole for the three kinds of knowledge addressed: technology, pedagogy, and content (Thompson & Mishra, 2017).

As shown in Figure 1, the schematic diagram of the study, the first box shows the profile of the participants, as regards to their highest educational attainment, length of service, area of specialization, and the academic unit. While the second box shows the dependent variables of TPACK components namely: Technological Knowledge (TK)

Content Knowledge (CK), Pedagogical Knowledge (PK), Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK), Technological Pedagogical Content Knowledge (TPACK). After the assessment of the two connected independent and dependent variables, a comprehensive action plan will be proposed as shown in the third box.

cognizancejournal.com
Jessie N. Galindo, Cognizance Journal of Multidisciplinary Studies, Vol.3, Issue.6, June 2023, pg. 368-378
(An Open Accessible, Multidisciplinary, Fully Refereed and Peer Reviewed Journal)
ISSN: 0976-7797
Impact Factor: 4.843
Index Copernicus Value (ICV) = 76.35

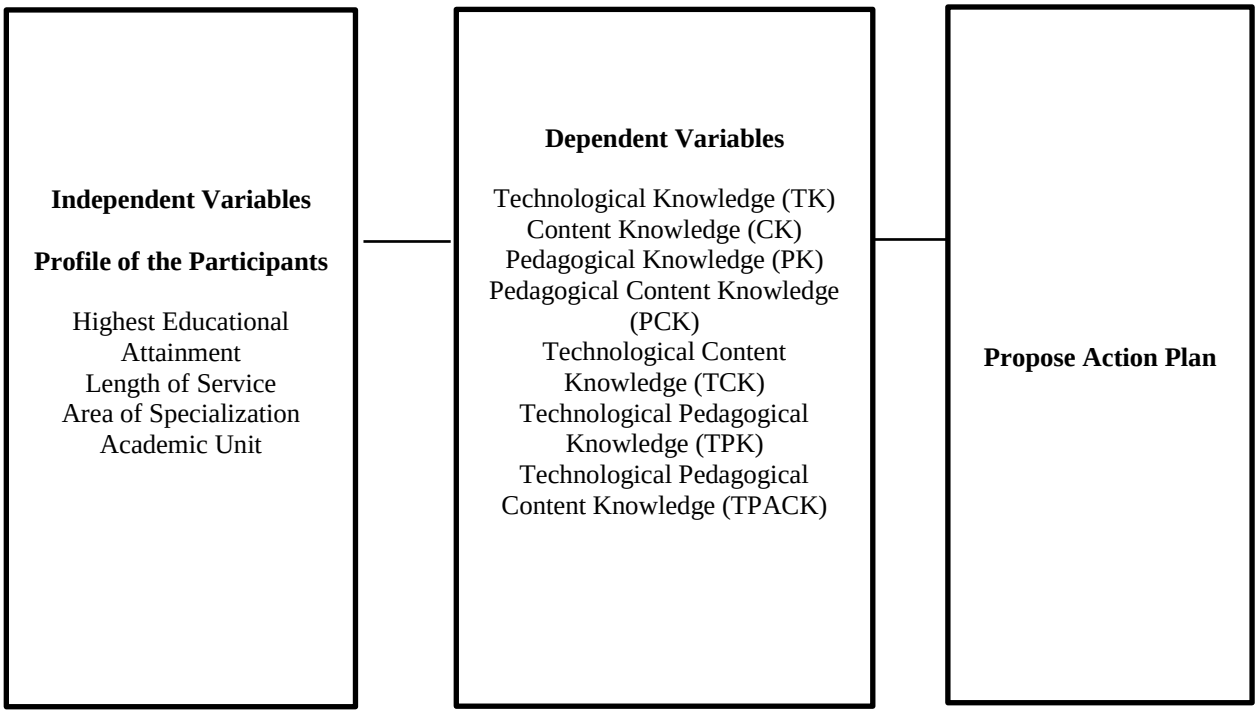

Figure 1. *Schematic Diagram of the Study*

III.STATEMENT OF THE PURPOSE

This study aimed to determine the level of Technological Knowledge, Content Knowledge, Pedagogical Knowledge, Technological Knowledge, Technological Content Knowledge, Pedagogical Content Knowledge, Technological Pedagogical Knowledge, and Technological Pedagogical Content Knowledge (TPACK) of the basic education teachers of St. Paul University Surigao.

Specifically, it sought answers to the following questions:

1. What is the profile of the teachers in terms of:
   1.1 Highest Educational Attainment;
   1.2 Length of Service;
   1.3 Area of Specialization; and
   1.4 Academic Unit?
2. What is the integration level of St. Paul University Surigao Basic Education Department teachers in terms of;
   2.1. Technological Knowledge (TK);
   2.2. Content Knowledge (CK);
   2.3. Pedagogical Knowledge (PK);
   2.4. Pedagogical Content Knowledge (PCK);
   2.5. Technological Content Knowledge (TCK);
   2.6. Technological Pedagogical Knowledge (TPK); and
   2.7. Technological Pedagogical Content Knowledge (TPACK)
3. Is there a significant association between TPACK level and the selected profile variables?
4. Based on the results, what area needs to improve on and what plan may be suggested?

IV.METHODOLOGY

This study utilized quantitative approach using survey method to determine the teachers' level on TPACK. The participants were the 67 teachers of St. Paul University Surigao Basic Education Department employed during the academic year 2018-2019.

cognizancejournal.com
Jessie N. Galindo, Cognizance Journal of Multidisciplinary Studies, Vol.3, Issue.6, June 2023, pg. 368-378
(An Open Accessible, Multidisciplinary, Fully Refereed and Peer Reviewed Journal)
ISSN: 0976-7797
Impact Factor: 4.843
Index Copernicus Value (ICV) = 76.35

The study utilized an adopted questionnaire developed by Koehler & Mishra (2008) which comprised of two parts. The first part gathered the information of the participants' profile in terms of highest educational achievement, length of service, area of specialization, and academic unit. The second part assessed the level of TPACK of the participants in terms of technology knowledge, content knowledge, pedagogical knowledge, pedagogical content knowledge, technological content knowledge, and technological pedagogical content knowledge. It utilized Likert scale with the following classifications: 5-Strongly Agree, 4-Agree, 3-Neither Agree nor Disagree, 2-Disagree, 1-Strongly Disagree

V. RESULTS AND DISCUSSIONS

Based on the analyses and interpretation of the data, the following findings and results were disclosed:

1. Out of 67 participants, 50 of them were bachelor's degree holders; 48 of the participants were probationary teachers; 13 of which were specializing mathematics subject; and 25 were from senior high school unit;
2. The level of technology knowledge of SPUS basic education teachers has the mean average of 3.99 qualitatively described as *moderately high*; content knowledge has a mean average of 2.30 qualitatively described as *moderately low*; level of pedagogical knowledge has a mean average 4.18 qualitatively described as *very high*; level of pedagogical content knowledge has a mean average of 3.78 qualitatively described as *moderately high*; level of technological content knowledge has a mean average of 3.76 qualitatively described as *moderately high*; level of technological pedagogical knowledge has a mean average of 4.19 qualitatively described as *very high*; and level of technology pedagogy and content knowledge has a mean average of 3.73 qualitatively described as *moderately high*.
3. Furthermore, there is a significant association of content knowledge particularly the subjects math, social sciences, literacy, and MAPEH to the area of specialization. Similarly, Pedagogical content knowledge and technological content knowledge are significantly associated to the area of specialization. Content knowledge in mathematics, science, literacy, and language is also significantly associated to academic units

Action Plan

Main Objective: Promote an integral professional development and academic formation of St. Paul University Surigao Basic Education Department teachers.

Plan Item	Objectives/Targets	Strategies/Activities	Time Frame	Person Involved	Expected Result/Output	Remarks
Subject Area Development	To offer teachers for professional improvement, i.e. further education and knowledge in the subject area to develop different competencies (e.g. learning new theories or learning how to teach subject-area content and concepts effectively)	Send teachers to different programs and trainings to improve their specialized field (service training, benchmarking, seminar & workshops) Allow teachers to conduct re-echo in their subject area department after the activity	3-5 days 1-2 days	Principal, Academic Supervisor, Subject Team Leader & Subject teacher	Re-echo in Subject/Field Area Department Team collaboration	Each subject teacher chosen by the Academic chair
Differentiation with the aid of Technology	To train in specialized teaching techniques that can be used in many different subject	Set a quarterly training schedule for all subject areas to discover new techniques	Once per quarter	Principal, Academic Supervisor, Subject Team	Employment of strategies in class per subject	Improved content delivery

ISSN: 0976-7797
Impact Factor: 4.843
Index Copernicus Value (ICV) = 76.35

	areas, such as differentiation (varying teaching techniques based on student learning needs and interests)	Create working committees to organize this activity Invite guests/speakers from different institutions Give tokens/certificates for the speakers and participants		Leader & Subject teacher		
Educational ICT Development	To learn new technological skills, such as how to use course-management systems in ways that can improve teaching effectiveness and student performance	Set schedule for ICT development seminar/workshop Ask the ICT staffs to give input and hands-on on different educational ICT partner with chosen techy-teachers Create working committees for this activity Let teachers demo educational ICT Give tokens/certificates for the speakers and participants	Days before semester (2x a year) 1-2 days 1 day	Principal, Academic Supervisor, Homeroom team leader, ICT staffs and teachers	Teachers' Demonstration	100% attendance of teachers
Specialized Skills Development	To develop specialized skills to better teach and support certain populations of students, such as students with learning disabilities or students who are not proficient in English.	Send teachers who are regular in status for skills training, e.g. English proficiency, TLE/TVL domains and etc. Craft an action plan, narrative report and documentation after training	1 year	Specialized Teachers	Action/Strategic Plan	Not included all level of Probationary teachers
Quantitative and Analytical Skills Development	To develop technical, quantitative and analytical skills that can be used to analyze student-performance data, and then use the findings to make	Coordinate with the Research Development Office of university Provide a talk regarding quantitative and analytical skills development Create a working	1-2 days	Research Development Office Head, Academic Supervisor, STL & Subject teachers	Inputs in different quantitative and analytical skills development	100% attendance of teachers

	modifications to academic programs and teaching techniques	committee to organize the activity. Prepare the venue, logistics, snacks and materials.				
Classroom Management	To improve fundamental teaching techniques, such as how to manage a classroom effectively or frame questions in ways that elicit deeper thinking and more substantive answers from students.	Invite speaker/s from other school to conduct this seminar Create a working committee to organize the activity Prepare the venue, logistics, snacks and materials.	1 day	Homeroom Team Leader and Classroom Adviser	Simulation Reflection sharing	GS/JHS/SHS advisers must attend the seminar
Teachers Collaboration	To work with colleagues, such as in professional learning communities, to develop teaching skills collaboratively or create new interdisciplinary courses that are taught by teams of two or more teachers.	Establish a monthly meeting with the same subject area or grade level. Plan for synergize activities and propose techniques on how to achieve it. Craft a consolidated output Secure minutes of the meeting	Once a month	Grade level teachers and subject teachers	Minutes of the meeting, Sharing	If the teacher is absent, inform him/her ahead to leave notes/info
Leadership Training	To acquire leadership skills, such as advanced skills that can be used to develop and coordinate a school-improvement initiative or a community-volunteer program.	Inquire to different organizations and/or associations (such as Phoenix, Vibal, CEAP, etc.) who offer leadership training seminar inside or outside the province Select capable teachers, esp. those managers, to send them in training. Coordinate with the principal about this matter Request budget from the school finance and approved by school head.	1-7 days	Principal, different heads/leaders/ managers	Liquidation Report and documentation	Not applicable to probationary and rank in file teachers

cognizancejournal.com
Jessie N. Galindo, Cognizance Journal of Multidisciplinary Studies, Vol.3, Issue.6, June 2023, pg. 368-378
(An Open Accessible, Multidisciplinary, Fully Refereed and Peer Reviewed Journal)
ISSN: 0976-7797
Impact Factor: 4.843
Index Copernicus Value (ICV) = 76.35

Evaluation on Academic Programs	To conduct evaluation to gain a better understanding of what's working or not working in a school's academic program, and then using the findings to improve educational quality and results.	Conduct evaluation on academic programs to be given by academic supervisor Craft a consolidated evaluation regarding the pros and cons of academic formation within 5 years Meet the principal and other office head to discuss the evaluation Present the result of evaluation to the teachers	1-3 days	Principal, Different heads/leaders/ managers	Proposal for new academic program/s, Presentation of the result of evaluation	Must be given ample time to process evaluation
Licensure Examinations/ ;ations	To earn additional formal certifications and/or professional license, such as the National Board for Professional Teaching Standards, which requires educators to be credible teachers and spend a considerable amount of time for evaluation and reflection.	Encourage non-licensed teachers to take the board examinations Inquire for the opportunities given by the Professional Regulation Commission, TESDA and others. Fully support teachers for this academic endeavor.	1 to 12 months ____ *Inclusion: review, training, & formal study	School Principal, all teachers	License Professional Teacher, National Certificate holder, Trainer's Methodology, Assessor	Support all teachers as privilege working in SPUS however not totally in financial aspect
Further Studies Program	To attend graduate school to earn advance degree, such as master's degree or doctorate in education, educational leadership, or a specialized field of education such as literacy or technology	Discuss further studies program for those teachers in Probation 3, a status before regular employee. Make arrangement between both party through a contract. Conduct screening and interview to those willing and credible applicants (teachers) Grant further studies program approved by BOT.	2-3 years	BOT, university administrators and regular teachers only	Diploma in Masteral/ Doctoral Program, Return service program	Application is not automatically granted unless approved by the Board of Trustees

ISSN: 0976-7797
Impact Factor: 4.843
Index Copernicus Value (ICV) = 76.35

VI. CONCLUSION

Based on the result of the study, there is no significant association of the TPACK components when paired to highest educational attainment and length of service except when content knowledge, pedagogical content knowledge, and technological content knowledge are paired to area of specialization and academic unit.

VII. RECOMMENDATION

For the study to become more effective and valuable, the following are recommended based on the results and findings:

Teachers may join and participate in various seminars and trainings, physical or especially virtual ones in the new normal, aligned to their area of specialization to improve their content knowledge;

Institution/administration may give pre-and in-service seminars, trainings, and workshops for teachers' faculty development in terms of content, technology, and strategies every year for effective content delivery in blended learning or online learning;

Further studies are recommended using the same variables and same questionnaire but should use more participants to validate the significant association between the other variables; and

For future researches, the following topic may be dealt with: Technological, Pedagogical, and Content Knowledge (TPACK) Assessment of Basic Education Teachers in New Normal; and Level of Technological and Content Integration of Basic Education Teachers in Online Learning

REFERENCES

1. Angeli, C., & Valanides, N. (2017). Epistemological and methodological issues for the conceptualization, development, and assessment of ICT–TPCK: Advances in technological pedagogical content knowledge (TPCK). *Computers & Education, 52*(1), 154–168. DOI10.1016/j.compedu.2017.07.006
2. Angeli, C., & Valanides, N. (2019). Preservice elementary teachers as information and communication technology designers: An instructional systems design model based on an expanded view of pedagogical content knowledge. Journal of Computer Assisted Learning, 21(4), 292–302. DOI10.1016/j.compedu.2019.07.006
3. Brantley-Dias, & Ertmer, D. (2016). Goldilocks and TPACK. Journal of Research on Technology in Education. 46. 103-128. 10.1080/15391523.2013.10782615. https://doi.org/10.1080/1359866X.2014.932332CrossRefGoogle Scholar
4. Chai, C.S., Koh, J.H.L., Tsai, C.-C., Tan, L.L.W. (2015). Modeling primary school pre-service teachers' Technological Pedagogical Content Knowledge (TPACK) for meaningful learning with information and communication technology (ICT). Comput. Educ. **57**, 1184–1193. https://doi.org/10.1080/1359866X.2014.932332CrossRefGoogle Scholar
5. Chai, C. S., Koh, J.H.L, & Tsai, C. C. (2015). A review of technological pedagogical content knowledge. Educational Technology and Society. http://doi.org/10.1111/j.1365-2729.2010.00372.x
6. Cox, S., Amp, J., & Graham, C. R. (2015). Using an elaborated model of the TPACK framework to analyze and depict teacher knowledge. TechTrends, 53(5), 60–69. DOI:10.1007/s11528-009-0327-1
7. Cox, M.& Amp, K. (2015). What factors support or prevent teachers from using ICT in their classrooms? British Educational Research Association Annual Conference. Brighton, UK: University of Sussex**. DOI:** 10.12691/jmsa-8-1-2
8. Cox, S., & Graham, C. R (2016). Teacher professional engagement and constructive-compatible computer usage (Report no. 7). Irvine, CA: Teaching, Learning, and Computing. Retrieved May 1, 2019, from http://www.crito.uci. edu/tlc/findings/report_7
9. Ervin, L. (2015). Assessing student learning with technology: A descriptive study of technology-using teacher practiced and technological pedagogical content knowledge (TPACK). ProQuest Dissertations and Theses. University of San Francisco, Ann http://search.proquest.com/dociew/1658234466?accountid=15272
10. Evans, A. (2016). The spillover effect of Brexit on other parts of the world; looking at West Africa.DOI: 10.13140/RG.2.2.17781.19688
11. Franklin, C. (2017). Teacher preparation as a critical factor in elementary teachers: Use of computers. In R. Carlsen, N. Davis, J. Price, R. Weber, & D.Willis (Eds.), *Society for Information Technology and Teacher Education Annual, 2004* (pp. 4994–4999). Norfolk, VA: Association for the Advancement of Computing in Education. DOI 10.1007/978-1-4614-3185-5_9
12. Franklin, C. & Irving, K. E. (2017). Teacher preparation as a critical factor in elementary teachers: Use of computers. In R. Carlsen, N. Davis, J. Price, R. Weber, & D. Willis (Eds.), Society for Information Technology and Teacher Education Annual. https://citejournal.org/volume-19/issue-4-19/general/preparing-elementary-school-teachers-to-teach-computing-coding-and-computational-thinking/

13. Fransson, G. & Holmberg, J. (2017). 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.. Studying Teacher Education. 8. 193-204. https://doi.org/10.17220/mojet.2020.03.005
14. Gunters, F., & Bumbach, C. 2015. Self-Efficacy of Helath Assessment Skills for Nursing Students after a Comprehensive Health Assessment Video Assignment. https://sigma.nursingrepository.org/bitstream/handle/10755/624110/Bumbach_Info_88137.pdf;jsessionid=B115F437E44559FDC196E51D7581BF3F?sequence=2
15. Hughes, L. (2015). Changing Technological Pedagogical Content Knowledge (TPACK) through Course Experiences. Proceedings of Society for Information Technology & Teacher Education International Conference 2015. https://lib.dr.iastate.edu/etd/15833
16. Hughes, J. (2016). Technology learning principles for preservice and in-service teacher education. Contemporary Issues in Technology and Teacher Education, 4(3), 345–362. https://citejournal.org/wp-content/uploads/2016/04/v4i3general2.pdf
17. Jaipal, K. & Figg, C. (2010). Unpacking the "Total PACKage": Emergent TPACK Characteristics From a Study of Preservice Teachers Teaching With Technology. Journal of Technology and Teacher Education, 18(3), 415-441. https://www.researchgate.net/publication/277728896
18. Kereluik, Y. (2011). On Learning to Subvert Signs: Literacy, Technology and the TPACK Framework.California Reader, 44(2), 12-1. https://www.punyamishra.com/wp-content/uploads/2011/12/californiareader2010.pdf
19. Koehler, M.J., Mishra, P., & Shin, T. (2008, March). TPACK Questionnaires. DOI: 541.302.3777
20. Koehler, M. J., Mishra, P., & Kereluik, Y. (2009). Tracing the development of teacher knowledge in a design seminar: Integrating content, pedagogy, and technology. Computers and Education, 49(3), 740–762. doi:10.1016/j.compedu.2005.11.012
21. Koehler, M. J., & Mishra, P. (2017). Introducing TPCK. In AACTE Committee on Innovation and Technology (Eds.), Handbook of technological pedagogical content knowledge (TPCK) for educators. Routledge. https://www.punyamishra.com/wp-content/uploads/2017/05/koehler_mishra_.pdf
22. Koehler, M. J., & Mishra, P. (2017). What is technological pedagogical content knowledge? Contemporary Issues in Technology and Teacher Education (CITE), 9(1), 60–70. https://www.researchgate.net/publication/241616400
23. Koehler, M. J. (2017). Levels of technology implementation (LoTi): A framework for measuring classroom technology use. Learning and Leading with Technology, 23(3), 40–42. https://eric.ed.gov/?id=EJ515029
24. Kontkanen, S. (2015). The impact of authentic learning experiences with ICT on pre-service teachers' intentions to use ICT for teaching and learning. *Computers & Education, 81*(1), 49-58. Elsevier Ltd. Retrieved May 10, 2020 from https://www.learntechlib.org/p/201598/.
25. Landry, F. 2016. The State of the Empirical Research Literature on Stakeholder Involvement in Program Evaluation. https://doi.org/10.1177%2F1098214013503699
26. Lee, S., & Tsai, F. 2017. Developmental Trajectories and Origins of a Core Cognitive Vulnerability to Internalizing Symptoms in Middle Childhood. Published March 13, 2017 Research Article. https://doi.org/10.1177/2167702616679875
27. Lyublinksaya, I., & Tournaki, N. (2017). A study of special education teachers' TPACK development in mathematics and science through assessment of lesson plans. Journal of Technology and Teacher Education, 22(4), 449-470. DOI: 10.7176/JEP/10-35-12
28. Margeum-Leys, J.& Marx, R. 2016. Teacher Knowledge of Educational Technology: A Case Study of Student/Mentor Teacher Pairs. https://doi.org/10.2190%2FJXBR-2G0G-1E4T-7T4M
29. McCrory, R. (2018). A framework for understanding teaching with the Internet. American Educational Research Journal, 41(2), 447–488. DOI:10.3102/00028312041002447
30. Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College* from https://www.learntechlib.org/p/99246/.
31. Mishra, P., Koehler, M. J., & Henriksen, D. (2016). The 7 transdisciplinary habits of mind: Extending the TPACK framework towards 21st century learning. *Educational Technology, 51*(2), 22-28. https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.701.4293&rep=rep1&type=pdf
32. Mishra, P. & Mehta, R. (2017). What we educators get wrong about 21st-century learning: Results of a survey. *Journal of Digital Learning in Teacher Education, 33*(1), 6-19. https://doi.org/10.1080/21532974.2016.1242392
33. Murgatroyd, C. (2016). Examining preservice teachers' development of technological pedagogical content knowledge in an introductory instructional technology course.,23(3), 40–42. https://www.ascilite.org/conference
34. Niess, M. L. (2015). Preparing teachers to teach science and mathematics with technology: Developing a technology pedagogical content knowledge. Teaching and Teacher Education, 21(5), 509–523. https://doi.org/10.1016/j.tate.2005.03.006
35. Npeat, G. (2003). Constructing the teachers' attitudes toward computers (TAC) questionnaire. Paper presented to the Southwest Educational Research Association Annual Conference, New Orleans, Louisiana, January, 2003. https://doi.org/10.1177/1474904117725899
36. Pierson, M. E. (2015). Technology integration practice as a function of pedagogical expertise (Doctoral dissertation, Arizona State University). Dissertation Abstracts International, 60(03), 711. (AAT 9924200). DOI:10.12973/eu-jer.6.1.51
37. Rotherham, A.J., & Willingham, D. (2017). 21st century skills: the challenges ahead. Educational Leadership, 67(1), 16–21. http://www.ascd.org
38. Shulman, L.S.: Knowledge and teaching: foundations of the new reform. *Harv. Educ. Rev.* **57**, 1–23 (2015). https://doi.org/10.17763/haer.57.1.j463w79r56455411

ISSN: 0976-7797
Impact Factor: 4.843
Index Copernicus Value (ICV) = 76.35

39. Scardamalia, J., Bransford, M., Kozma, P., & Quellmalz, J., 2015. The TICKIT to teacher learning: Designing professional development according to situative principles. Journal of Educational Computing Research, 32(4), 329–340. https://citejournal.org/volume-4/issue-3-04/

40. Schmidt, D.A., Baran, E., Thompson, A.D., Mishra, P., Koehler, M.J., Shin, T.S. (2015).Technology Pedagogical Content Knowledge (TPACK): the development and validation of an assessment instrument for preservice teachers. *J. Res. Technol. Educ* **42**(2), 123–149.DOI: 541.302.3777

41. Schmidt, D., Baran, E., Thompson, A., Koehler, M.J., Mishra, P., & Shin, T. (2016, March). Examining preservice teachers' development of technological pedagogical content knowledge in an introductory instructional technology course. Paper presented at the International Conference of the Society for the Information and Technology & Teacher Education. DOI: 541.302.3777

42. Shulman, L. (2015). Those who understand: Knowledge growth in teaching. *Educational Researcher*, *15*(2), 4–14. https://doi.org/10.3102/0013189X015002004

43. Slough, S., & Connell, M. (2015). Defining technology and its natural corollary, technological content knowledge (TCK). In C. Crawford, D. Willis, R. Carlsen, I. Gibson, K. McFerrin, J. Price, & R. Weber (Eds.), Proceedings of Society for Information Technology and Teacher Education International Conference, 2006 (pp. 1053–1059). Chesapeake, VA: AACE. DOI:10.5281/zenodo.1160586

44. Sointu, E., et.al,. (2016). Developing a TPACK measurement instrument for 21st century pre-service teachers. *Seminar.Net* https://doi.org/10.1007/s40299-015-0240-7CrossRefGoogle Scholar

45. Thompson, A. & Mishra, P. (2017). The evaluation of technology-related professional development, Part 2. In C. Crawford et al. (Eds.), Proceedings of Society for Information Technology and Teacher Education International Conference 2005 (pp. 825–830). Chesapeake, VA: AACE. https://files.eric.ed.gov/fulltext/EJ868626.pdf

46. Valtonen, G., Kontakanen, J., Dillon, C.S., Kukkonen, D., & Vaisanen Y. 2015: Validation and profile of Chinese pre-service teachers' technological pedagogical content knowledge scale. Asia-Pac. J. Teach. Educ. **44**(1), 49–65 (2015). https://doi.org/10.1080/1359866X.2014.960800CrossRefGoogle Scholar

47. Voogt, J., Fisser, P., Pareja Roblin, N., Tondeur, J., & van Braak, J. (2016). Technological pedagogical content knowledge–A review of the literature. Journal of Computer Assisted Learning. DOI:10.1111/j.1365-2729.2012.00487.x

48. Voogt, J., K., Foulger, T. S., & Williams, M. K. (2018). The evolution of the required educational technology course. Journal of Computing in Teacher Education, 25(2), 67–71. http://www.aiscience.org/journal/paperInfo/jssh?paperId=4357

49. Zhao, Y. (2017). What teachers should know about technology: Perspectives and practices. Greenwich, CT: Information Age Publishing. https://eric.ed.gov/?id=ED479083

