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Implementation of Tpack: Preservice Teacher Motivation

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Abstract

Science education today has been transformed to adapt towards the advancement of technology. Thus, it is important for teachers today to have technological knowledge so that they can suitably integrate technology into their teaching in the classroom. For that reason, this study is made to discover pre-service science teacher preparedness towards the implementation of technological pedagogical content knowledge (TPACK) by their knowledge in TPACK and their motivation to implement it. The TPACK survey instrument and the motivation survey were distributed to pre-service teachers in Puncak Alam, Selangor in purpose answer each research question. Results indicate that among seven TPACK domains which are TK, CK PK, PCK, TCK, TPK, and TPACK, TPACK domain was found to have the highest mean score. It is also found that pre-service teachers have high motivation towards implementing TPACK. The correlation test analysis shows that there is no significant relationship between pre-service teacher knowledge in TPACK and their motivation.

Keywords: TPACK, Implementation, Pre-Service Teacher Motivation

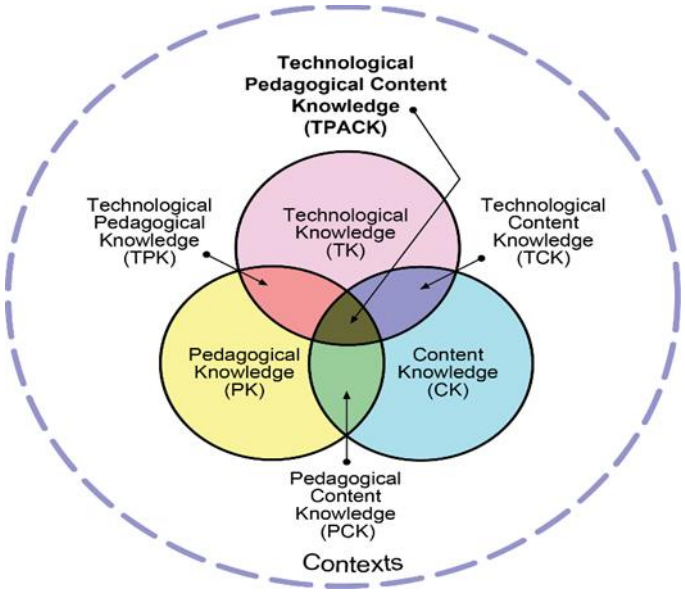
Introduction

TPACK

Science has been important and become necessity in human's life. Hence, it is crucial for individuals to aware and acknowledge the use of science in their daily life. For that reason, science education is necessary for each of individual to have. In a few decades ago, science education is quite independent in the absence of technology. In school, teachers practicing traditional methods to educate their students. Traditional method such as chalk and talk or lecture method is used to be used in a science lesson as well as other lesson. As the technology become advanced, science is greatly explored and advanced as well and there comes terms like "21st century skills" and "21st century learning" that start to emerge.

However, technologies still have not been utilized effectively for science and mathematics instruction. The purpose of this study was to explore preservice teachers' perceptions of effective use of technology for teaching science and mathematics, and how situated learning impact preservice teachers' understanding of effective use of technology for teaching science and mathematics. The findings by Sun (2023), revealed preservice teachers benefited from the modelling of instructors, collaborating with peers, and the contextualized learning. Their

understanding of effective use of technology in teaching science and mathematics moved from teacher-centre technology usage to student-centred approach. Garba et. al. (2013) in their study on the effects of technology in teacher education pedagogical practice by using the inquiry approach highlight that if teacher's educator integrates advance technology in their pedagogical practice, pre-service teacher performance in the use and application of technology would be higher as well as their performance in integrating technology during their practicum. The integration of three curricular component which are technology, pedagogy and content into single curricular component during pre-service teacher training would make the TPACK better applied in the classroom. However, several issues had raised regarding the implementation of TPACK in classroom.



In TPACK framework, there are three primary forms of knowledge: Content (CK), Pedagogy (PK), and Technology (TK). The approach of TPACK look into these three bases of knowledge separately. The TPACK framework go beyond as it is focusing on the knowledge at intersection of three knowledge bases which Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK), and Technological Pedagogical Content Knowledge (TPACK). Technology integration in the specific subject matter in classroom can be effective if the sensitivity to the dynamic and relationship between domains of TPACK is put in a unique context.

- **Content Knowledge (CK)** – Content knowledge is the teachers' knowledge about the subject matter that they need to teach to the students. Shulman (1968) stated that the knowledge of theories, concept, ideas, information on evidence and proof, organizational framework, established practices and method or approaches towards improving the knowledge are included in this knowledge of Content Knowledge (CK) (Koehler & Mishra, 2009).
- **Pedagogical Knowledge (PK)** – Teachers' knowledge on the methods or practice and processes of teaching. Not only that, it is also about values, aims or educational purpose of the educational practice done by teachers. Teachers' understanding on how students learn, their skills on classroom management, their planning on the lesson and assessment conducted on the students are among of this knowledge of Pedagogical Knowledge (PK) (Koehler & Mishra, 2009).

- **Technology Knowledge (TK)** – Knowledge on practices that use technology, tools and resources. This knowledge emphasize on the deep understanding om technology information to utilize it effectively in everyday life and at work, capable of identify the information technology that is suitable to be used and benefit for assisting towards the goal for particular achievement and capable to constantly fit themselves to the changes in information technology. (Koehler & Mishra, 2009).
- **Pedagogical Content Knowledge (PCK)** – "Align with the Shulman's idea of pedagogical knowledge as the knowledge can be used for the specific content. The content is delivered differently methods used for teaching but gives the same meaning to the students as teacher use various methods to deliver the content interpreted of the subject matter. Their material of instruction used suitable to gives value and meaning to students' prior knowledge. PCK is always about teaching methods, curriculum, learning and reporting (Koehler & Mishra, 2009).
- **Technological Content Knowledge (TCK)** – It is the knowledge on the relationship between technology and content of subject matter. Therefore, in order for the teacher to know what technologies that suit to students' learning on the subject matter, they must to master the knowledge on the content of the subject matter. Their presentation on the subject matter changes in a manner by the use of technologies in their teaching. So they need to know better what kind of technology that is suitable to be used to make the presentation of content meaningful to the students (Koehler & Mishra, 2009).
- **Technological Pedagogical Knowledge (TPK)** – Knowledge that focus on the relationship between technology and teaching method. Technologies that selected by teacher makes their teaching and learning in class to changed. It looks into the technology tools' perceived potential to develop the pedagogical design and planning (Koehler & Mishra, 2009).
- **Technological Pedagogical Content Knowledge (TPACK)** – The knowledge on the teaching skill that able to utilize technology effectively in the teaching. TPACK is about teaching effectively by using technology. It involves deep understanding on delivery of concept using technologies, constructive ways on using technologies in pedagogical strategies and techniques to teach the content, the way of making the concept easy to learn or difficult as to trigger thinking and how technology can students to cope their problem in learning and knowledge of how technologies can be utilized to develop students' existing knowledge (Koehler & Mishra, 2009).

Teachers' motivation to integrate technology

Motivation is important for learning. Santrock (2012) has define motivation as a process that energize, direct and sustain behaviour. In cognitive perspectives White (1959) highlighted the competence motivation concept. It comprises the understanding that someone is motivated to deal effectually with their environment, to master their world and to process information effectively. People are tending to perform such way as they are internally motivated to get connect effectively with the environment. Urdan and Turner (2005) define competence as a concern with mastery. The motive, or the incentive for action in a specific direction, is to enhance, to achieve, or to perform competence. In TPACK context, teachers' idea that motivates them internally to adapt and perform better in Technological Pedagogical Content Knowledge (TPACK) in classroom. In classroom practice, teacher teaching practice embrace social cognitive conceptualizations of motivation which are:

- Self-efficacy beliefs

Bandura (1986) defines self-efficacy as people's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances. Self-efficacy is described as how people find their capabilities to finish their work to gain their expected performance. Lee and Tsai (2010) stated that if teachers have more self-efficacy beliefs with respect to their TPACK, they tend to integrate technology into their instruction effectively. However, researchers had mention that preservice teachers may unable to realize the strong relation between TPACK and self-efficacy or TPACK-SE, and TK, PK and CK (as cited in Aydın-Günbatar, Boz, & Yerdelen-Damar, 2017). Contrary with that, PK is the most available basic knowledge components that contribute to participants' TPACK-SE development. Researchers believe that TPACK self-efficacy can be developed if pre-service teacher develop PK, TK and CK to PCK, TCK and TPK. In science context, in terms of pedagogical content knowledge, self-efficacy among the pre-service biology teacher is justified through their competency in recognize teaching approaches that effective to generate students' cognitive process and their science learning. The pre-service reveal that they are aware and used to deal with many technologies. The advantages of technology help them in learning science. It is because they have integrated technology in the course they took. They apply technology and internet applications for answering projects and assignment reasons to how they can develop their TPACK.

- Intrinsic and Extrinsic Motivation

Intrinsic motivation by Ryan and Deci (2000) is defined as the doing of an activity for its inherent satisfactions rather than for some separable consequence. When intrinsically motivated a person is moved to act for the fun or challenge entailed rather than because of external prods, pressures, or rewards. While According to Santrock (2012), extrinsic motivation is defined as accomplish something to get something meaning that extrinsic motivation is influenced by external reason such as rewards and punishment. Deci and Ryan (2000); Ryan and Deci (2009) has emphasize that intrinsic motivation has a view that stress on self-determination. This view can be described as someone's beliefs that they do something because they are willing to not because of external reason or purpose. Grolnick, Friendly and Bellas (2009) said as it is their own will, they will inherently responsible to what they want to do (as cited in Santrock, 2012). Therefore, intrinsic motivation can be said as the most self-determined (Holland, 2014). In order to measure the intrinsic motivation within one self, it is depending on the feeling of interest and enjoyment while doing the activity (Ryan, 1982). In terms of TPACK application, a teacher has the interest and feel the enjoyment in applying TPACK. (Mohamed and Bakar, 2008) discover that there is relationship between attitudes concerning to computer integration in teaching and perceptions about their abilities to work such as data base graphics, electronic spreadsheet and word processing. Trainee teacher had high interest to use computer-technology. They also have the confidence to apply computer usage in classroom. Their perception on their abilities to use a number of software associated with their teaching determine their attitudes on the integration of computers in teaching. In achieving goals of Ministry of Education, TPACK should be practice effectively because its framework leads the pre-service teacher through important direction in to upkeep pre-service teacher development on their ability and confidence to integrate technology in their teaching.

Methodology

The purpose for this study is to determine to what extent pre-service science teacher prepare themselves to implement TPACK in the future. Thus, quantitative research and correlational research design is used to measure the level of knowledge in TPACK and level of motivation in implement TPACK among the pre-service science teacher. This research design is selected to establish the association between these two constructs as not many research done on the relationship between TPACK construct and motivation construct. Questionnaires are distributed to the sample population among the pre-service science teacher randomly to students from different area of specialization. The questionnaires consist of three parts. Section A is about demographic question, section B is an instrument of motivation survey and section C is instrument of TPACK survey.

The purpose of the TPACK survey was to "measure pre-service teachers' self-assessments of the TPACK domains, not their attitudes toward TPACK" (Schmidt et al., 2009). This survey is constructed by Schmidt et al. (2009) for pre-service teachers' self-assessment according to the seven domains within TPACK framework. These domains include technology knowledge (TK), content knowledge (CK), pedagogical knowledge (PK), pedagogical content knowledge (PCK), technological content knowledge (TCK), technological pedagogical knowledge (TPK), and finally, technological pedagogical content knowledge (TPACK). These 7 domains was intended to give clear understanding on the difference between them so pre-service teacher will be able to distinguish between the constructs (Ozden, 2015). This construct is adapted from study done by Schmidt et al. (2009). The construct focus on mathematics, social studies, science and literacy. As this study particularly look into TPACK knowledge among pre-service science teacher, the construct is modified to focus on TPACK knowledge for science classroom. TPACK knowledge of Likert scale is used from 1 for strongly disagree to 5 for strongly agree. Participant answered every question based on arranged Likert scale.

Findings

Table 3.1

Determine the pre-service science teachers' perceived levels of knowledge in TPACK.

Table 3.1

Technological Knowledge (TK)

	Mean	**Std. Deviation**
I know how to solve my problem	3.56	.733
I can learn technology easily	3.92	.778
I keep up with new important technologies	3.92	.853
I frequently play around with technology	4.18	.774
I know about a lot of different technologies	3.76	.822
I have technical skills I need to use technology	3.86	.639
I have had sufficient opportunities to work with different technologies.	3.74	.694

Mean Score Indicator: 1-1.50 (Strongly Disagree), 1.51-2.50 (Disagree), 2.51-3.50 (Neither Agree nor Disagree), 3.51-4.50 (Agree), 4.51-5.00 (Strongly Agree)

Table 3.1 states the result of pre-service science teacher knowledge on the first domain of Technological Pedagogical Content Knowledge (TPACK) which is Technological Knowledge (TK). The result shows that item "I frequently play around with technology" shows the highest mean score (Mean=4.18, SD=0.774). It indicates that the respondents agree with the

statement. The second highest mean is at statement "I can learn technology easily" (Mean=3.92, SD=0.778). The same mean also found at statement of "I keep up with new important technologies" (Mean=3.92, SD=0.853) which means that respondents agree with the statement. The statement of "I have technical skills I need to use technology" got the third highest mean (Mean=3.86, SD=0.639) as the respondents agree with the statement. The lowest mean is at the statement "I know how to solve my problem" indicates that respondents also agree with the statement. The total mean score value for entire domain is mean=3.8486, SD=0.57897 as the respondents agree with the statements.

Table 3.2
Content Knowledge (CK)

	Mean	**Std. Deviation**
I have sufficient knowledge about science	3.78	.465
I can use a scientific way of thinking	3.80	.571
I have various ways and strategies of developing my understanding of science	3.90	.416

Mean Score Indicator: 1-1.50 (Strongly Disagree), 1.51-2.50 (Disagree), 2.51-3.50 (Neither Agree nor Disagree), 3.51-4.50 (Agree), 4.51-5.00 (Strongly Agree)

Based on Table 3.2, It can be seen that statement "I have various ways and strategies of developing my understanding of science" had the highest mean score (Mean=3.90, SD=0.416) followed by the second highest mean score at the statement "I can use a scientific way of thinking" (Mean=3.80, SD=0.571). The lowest mean score is at the statement "I have sufficient knowledge about science" (Mean=3.78, SD=0465). All these three statements were agreed by respondents. The total mean score value for entire domain is mean=3.8267, SD=0.38826 as the respondents agree with the statements.

Table 3.3
Pedagogical Knowledge (PK)

	Mean	**Std. Deviation**
I know how to assess student performance in a classroom	4.04	.533
I can adapt my teaching based upon what students currently understand or do not understand	3.84	.548
I can adapt my teaching style to different learners	3.94	.682
I can assess student learning in multiple ways	3.86	.535
I can use a wide range of teaching approaches in a classroom setting	4.02	.553
I am familiar with common student understandings and misconceptions	3.76	.687
I know how to organize and maintain classroom management	3.92	.695

Mean Score Indicator: 1-1.50 (Strongly Disagree), 1.51-2.50 (Disagree), 2.51-3.50 (Neither Agree nor Disagree), 3.51-4.50 (Agree), 4.51-5.00 (Strongly Agree)

Tables 3.3 shows the results of pre-service science teacher level of knowledge in Pedagogical Knowledge (PK). Based on the result, the highest mean score is at the statement "I know how to assess student performance in a classroom" (Mean=4.04, SD=0.533) which the respondents agree with the statement followed by the second highest mean score

(Mean=3.94, SD=0.682) at the statement "I can adapt my teaching style to different learners" as the respondents agree with the statement same goes to the third highest mean score belongs to the statement "I know how to organize and maintain classroom management" (Mean=3.92, Sd=0.695). Respondents also agree with the statement that got the lowest mean score (Mean=3.76, SD=0.695) which is "I am familiar with common student understandings and misconceptions". The total mean score value for entire domain is mean=3.9114, SD=0.45715 as the respondents agree with the statements.

TPACK framework was used to test pre-service science teacher perceived knowledge in TPACK. It has been discussed that TPACK framework consist of seven domains which are Content Knowledge (CK), Pedagogical Knowledge (PK), Technological Knowledge (TK), Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK) and Technological Pedagogical Content Knowledge (TPACK). Each domain was analysed to examine teachers' proficiency on implement TPACK in classroom. The result of statistical analysis on finding the mean and standard deviation for each item in the TPACK framework instrument shows that pre-service science teacher use technology regularly as they use it every day. This is justified by the study Raman (2014) in his study on basic aspects of ICT knowledge of students from education programme in Universiti Utara Malaysia as there is a high level of students' their usage of ICT for personal usage and professional purpose. As t-test analysis was used for each domain of TPACK framework instrument, it is found that pre-service science teacher has knowledge on a Technological Pedagogical content Knowledge (TPACK) domain better than other domains. Overall, it can be said that pre-service science teacher has knowledge on each domain of TPACK framework. This is contrary with the study done by Mohamed and Bakar (2008) as they highlighted that pre-service teacher had few knowledge on the effective use of technology in education. This may because of the rapid development of technology makes todays' classroom a lot changing compare to several years back. Several years back, technology is not fully integrated in school especially for students' learning because it is limited to get internet access thus limit the access to source information. It is also hard to get access to the tool of technology to use it for teaching and learning purpose. Even todays' classroom in urban area facing the same problem as stressed by Garba, Byabazaire, and Busthami (2015) on the difficulty in get access to available facility as teachers need to wait for their turn to use technology tools for their teaching. Todays' schools have the frequent use of technology. The internet is easy access and the source of information is unlimited. But it depends on the area as it differentiates the frequent practice of technology based. This also answer of why Chen and Jang (2019) said that in-service science teacher rating high content knowledge and pedagogical content knowledge more than novice science teacher rate but novice teacher that absolutely have less experience have technology knowledge and technological content knowledge higher that teacher with more teaching experience as cited in Savec, 2017. Aktaş and Özmen (2022) stated possible reasons for the positive effect include using worksheets with technological tools such as simulation, the influence of the course lecturers as role models, the introduction of new technologies to the pre-service teachers in the training course, and using class discussions to provide feedback.

Conclusion

As a conclusion, it can be said that pre-service science teachers are well prepared in terms of their knowledge in TPACK and their motivation. Although pre-service science teacher motivation does not give any changes towards their knowledge in TPACK, it still contributes

towards the technology integration in the classroom. TPACK is very important for today's classroom as Malaysia education have prioritize the use of technology in school practice particularly in teaching and learning in class. The science teaching and learning is the one that have been mentioned in Malaysia Education Blueprint as one of the concerns is Science, Technology, Engineering and Mathematics (STEM). It is one of the efforts to develop thinking and learning towards producing 21st century skills through the subjects of science, technology, engineering and mathematics. Teacher is the part of this effort to ensure students are well equipped particularly with science learning by insert TPACK in classroom lesson.

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