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Self-Assessment of Prospective Teachers' Technological Pedagogical and Content Knowledge (TPACK)

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Abstract

The current study investigates the prospective teachers' Pedagogical Technological and Content Knowledge (TPACK). It was aimed to explore: 1) the level of Technological Pedagogical Content Knowledge (TPACK) of prospective teachers. 2) and the prospective teachers' weak and strong areas of TPACK knowledge. The study group consisted of 85 prospective teachers enrolled in B.Ed (Hons) degree programs at Karakoram International University. The survey data was analysed using the SPSS 22 software. Standard deviation and Mean were used to illustrate the level of pre-service teachers regarding various TPACK knowledge domains. Pedagogical Knowledge (PK) of pre-service teachers has the highest score. The Technological Pedagogical Knowledge (TPK) contains the second-highest score. Technological Knowledge (TK) has the third highest value. The Pedagogical Content Knowledge (PCK) has the fourth-highest score. The Content Knowledge (CK) has the second-lowest score, and the Technological Pedagogical & Content Knowledge (TPACK) domain has the lowest score. It is suggested that there should be more courses to improve the teacher's level of technology integration in relation to content and pedagogy.

Key words: *TPACK, PK, TK, PCK, CK, TPK, Pre-service Teachers, B.Ed (Hons)*

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Introduction

We are living in an era of technology. Modern technologies influence almost every field of life. The development of technology leads to the use of effective technology in the instructional process. Today, technology integration in instructional practice is getting wide attention from the educational world. The question of whether we should integrate technologies in instructions is replaced by how effectively we can integrate technology into instructional practice. It is well realized that modern instructional technologies can facilitate teaching and learning processes (Padmavathi, 2013, p. 7; Damar, Boz, & Günbatar, 2017). However, many studies on educational technology revealed that the use of technology in education settings is a challenging task for 21st-century teachers.

Teaching with modern technological integration is difficult for teachers when facing newer technological challenges (Koehler, Mishra, & Cain, 2013). Teachers' training programs should not be concern merely with learning technology; relatively, they must grasp technology as an instrument for improving the teaching developments (Durdu & Dag, 2017). The new generations growing up with innovative technologies could have differences in their learning styles compared to past generations (Gözüm, & Demir, 2021). In addition to technological expertise, teachers also need the right attitudes on how to apply technological skills in the teaching process (Marthese & Rundgren, 2018).

Numerous studies explored that teachers do not utilize technologies effectively in teaching and learning processes (Niederhauser & Stoddart, 2000; Smeets, 2005; Damar et al., 2017). There is not only an absence in teachers' technological usage but also in their incorporation of technology into their teaching practices (Ersanli, 2016). The application of modern technologies in the education process can be viewed better by studying the different types of knowledge that instructors require to incorporate technology in their classrooms. According to Koehler et al. (2013) "Teaching is a complex preparation that needs an investigation of numerous types of specialized knowledge." The technology Pedagogy and Content Knowledge (TPACK) model is an important tool for discovering teachers' knowledge competencies (Valtonen et al., 2017). The TPACK framework offers a system to investigate numerous knowledge domains that are apparent in teaching practice when instructors apply their personal experience of subject knowledge into instruction in which pedagogies and technology facilitate students' knowledge creation and understanding" (Kinuthia, Brantley-Dias, & Clarke, 2010; Redmond & Lock, 2019).

The TPACK model helps to assist the development of efficient procedures for describing and discovering the technological-based teachers' knowledge and practices. Educators can understand the discrepancy in levels of technology integration by better understanding the types of teacher's knowledge in the form of content, technology, pedagogy, and their interactions. The TPACK proposes numerous opportunities for promoting research in teachers' use of technology and teacher education (Koehler et al.

2013). TPACK has been adopted as a framework by many researchers for exploring teachers' expertise and skills about using technologies in the learning process (Schmidt et al., 2009; Fisser, Voogt, Braak, & Tondeur, 2015).

Most of the literature reviews on TPACK indicated that the majority of the researches on TPACK were performed in the context of the developed world, and most of the studies used self-reported instruments (Schmid, Brianza, & Petko, 2021; Wan, Schmidt-Crawford, & Jin, 2018; Rahman & Harun, 2018; Gür & Karamete, 2015; Moreno, Montoro, & Colón, 2019; Voogt, Fisser, Roblin, & Tondeur, 2012; Willermark 2018).

TPACK is rising as a dominant structure for investigating prospective teacher's proficiencies in the digital world (Bas & Senturk, 2018; Schmid, Brianza, & Petko, 2021). In Pakistan, unlike the developed countries, the ground of educational technology in relation to teachers' preparation programs is not getting much attention from educational researchers. Prospective teachers, who update their instructions with the TPACK model, will have a better consideration of how to deal with the complication of technology incorporation to make healthy and expressive instructions for students (Redmond & Lock, 2019). The majority of the studies carried out on TPACK of prospective teachers were in the United States of America, some parts of China, Malaysia (Naaz & Khan, 2018), and turkey (Bas & Senturk, 2018). Chai, Koh, & Tsai (2013) evaluated 74 research studies and determined that TPACK is a growing research domain having much practice in the North area of America. TPACK is a well-known theoretical approach to examine technology integration in the instruction process (Muhaimin et al., 2019).

As per the National Education Policy of Pakistan (2009) and National Professional Standards for Teachers (2009), educators should have strong knowledge of technological inventions (Rahman, Hussain, & Khalid, 2018). In Pakistan, numerous research studies investigated the use of modern educational technologies in teaching practices (Rahman, Hussain, & Khalid, 2018). However, so far, no study has investigated Prospective teacher's knowledge perceptions in light of the TPACK framework in Pakistan. Therefore, it is necessary to explore the prospective teachers' TPACK knowledge in Gilgit Baltistan.

TPACK Framework

The term Pedagogical Content Knowledge (PCK) was first time devised by Shulman (1986). It explores the interrelation of pedagogy and content. Besides Pedagogical Content Knowledge (CK) and Knowledge (PK), Pedagogical Content Knowledge (PCK) was also considered as a fundamental knowledge domain for effective teaching practices. The paradigm shifts of merging pedagogy with content lead to drastic changes in pre-service instructor's training (Young, Young, & Shaker, 2012). Mishra & Koehler (2006) upgraded the Pedagogical Content Knowledge (PCK) conception of Shulman's

(1986) by indicating the Technological Pedagogical and Content Knowledge (TPACK) model. Mishra & Koehler (2006) proposed the TPACK model to analyze the effective use of technology in teaching practices. TPACK indicated the interrelationship among pedagogy, content, and technology knowledge. This paradigm launched seven essential knowledge domains for teachers. Various knowledge concepts involved in the TPACK framework are presented in Figure 1.

Content Knowledge (CK), Technological Knowledge (TK), and Pedagogical Knowledge (PK) are the basic building blocks of the TPACK Model. The mutual interaction s of the three knowledge domains leads to further three more complex knowledge domains: Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK), and Pedagogical Content Knowledge (PCK). The interplay of TPK, TCK, and PCK develop the most complex knowledge domain that is Technological Pedagogical and Content Knowledge TPACK (Initially called TPCK). Those Teachers who have advanced knowledge of TPACK can plain effective ICT integrated lessons (Chai, Koh, Tsai & Tan, 2011; Chai, Koh, Ho, & Tsai, 2012; Marino, Sameshima & Beecher, 2009; Koehler & Mishra, 2005).

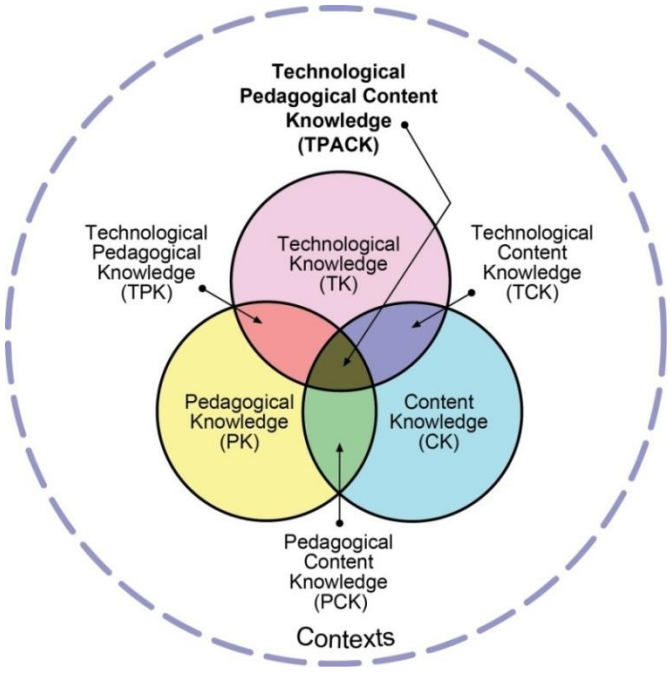

*Figure 1: The graphic representation of TPACK (*www.tpack.org*)*

Content knowledge (CK)

CK means the subject knowledge to be educated (Mishra & Koehler, 2006) and established approaches and practices toward developing such knowledge in a certain field (Shulman, 1986; Harris, Mishra, & Koehler, 2009).

Pedagogical knowledge (PK)

PK contains knowledge about the strategies and techniques used in the classroom. Pedagogical Knowledge deals with a comprehension of social, developmental and cognitive theories of teaching and how they apply to learners in the instructional settings (Harris, Mishra, & Koehler, 2009).

Pedagogical Content Knowledge (PCK)

PCK domain involves consideration of what teaching strategies and procedures are better adjusted to the content and how the numerous features of content can be operated for the active learning process (Moreno, Montoro, & Colón, 2019). PCK includes content-specific activities, subject-specific Knowledge, or topic-specific representations (Zhang, Liu, & Cai, 2019).

Technological Pedagogical Knowledge (TPK)

It means the familiarity of integrating modern technologies in education to support common pedagogical activities (Zhang, Liu, & Cai, 2019). Technological Pedagogical Knowledge (TPK) is considerate of how learning and teaching can be enhanced when educational technologies are applied in specific ways (Koehler, Mishra, & Cain, 2013)

Technological Content Knowledge (TCK)

It deals with how technology supports (Schmidt et al., 2009) and makes new demonstrations for definite content (Baran, Chuang, & Thompson, 2011). According to Vila , Andrés , & Medrano (2015) “Technological Content Knowledge is related with the approach in which technology can generate innovative learning situations for particular content”.

Technology Pedagogy and Content Knowledge (TPACK)

Technological Pedagogical Content Knowledge (TPACK) is a growing type of knowledge framework that drives beyond all three “basic” domains (technology pedagogy, content, and content) (Koehler, Mishra, & Cain, 2013). TPACK Knowledge is the heart of PCK, PTK, and TCK. It alludes to how technology is utilized to teach particular content by using effective pedagogy.

Statement of the Problem

Integrating technology in teacher education is catching wide attention in the scholarly world. As a result, many frameworks are striving to understand the notion of technology integration into teachers' preparation programs. TPACK is the widely used framework for considering prospective teachers' skills and knowledge in the developed world. In Pakistan, B.Ed (Hons) is a contemporary pre-service teachers training program where technology is being included. However, very few studies have been undertaken for investigating teachers' skills and knowledge in light of technological usage in educational settings. Hence, the current study is designed to examine the pre-service teachers' knowledge of TPACK domains. The study is conducted in the pre-owner higher educational institute of B.Ed (Hons) degree in Pakistan.

Research Objectives

The study explores:

- Prospective teacher's Technological Pedagogical Content Knowledge (TPACK) level.
- The prospective teachers' strong and weak areas of TPACK knowledge.

Research Questions

- What is the prospective teachers' level of Technological Pedagogical Content Knowledge (TPACK)?
- What are the prospective teachers' weak and strong areas of TPACK knowledge?

Significance of the Study

The research is significant in many ways. Firstly, it guides the curriculum developers while updating or adding more courses in B.Ed (Hons) degree program because the results of the study are exploring strong and weak TPACK based knowledge areas of the prospective teachers. Secondly, the trainers who are part of the B.Ed (Hons) program can concentrate on prospective teachers' weak knowledge areas. Thirdly, the results of the study indicate the weak and strong knowledge of TPACK. The prospective teachers can prepare themselves for future classrooms by giving special attention to their weak knowledge areas. Furthermore, it is an addition to the existing literature on technology and teachers' training programs in Pakistan. The study presents implications for conducting further researches in the field of incorporating technology into teacher education.

Delimitations of the study

This study was delimited to Schmidt et al.'s., (2009) TPACK measuring instrument. The results are also delimited to only B.Ed (Hons) elementary teacher's degree program in Gilgit Baltistan.

Context of the study

The context of the study was a pre-service teacher's training program at the Department of Educational Development, Karakoram International University. The study was done with prospective teachers of elementary teaching. The university offers four years of B.Ed (Hons) Elementary teachers training program. The degree contains 14 content courses, one technological course, five pedagogical courses, nine pedagogical content courses, and one technological pedagogical course, whereas no course is directly related to Technological Pedagogical & Content knowledge (TPACK) and Technological Content Knowledge (TCK). The courses of B.Ed (Hons) degree program can be observed via the lens of the TPACK framework. Therefore, the researcher explored the pre-service teacher's knowledge of different TPCK domains through a self-reported survey instrument.

Research Methodology

The descriptive survey design is followed for the self-assessment of prospective teachers regarding their TPACK knowledge. The seven knowledge domains of TPACK are considered latent variables in this study. The latent variables are measured with the assistance of different five-point Likert scale statements. The study was processed in many steps. Firstly, the literature review was started that continued throughout the research process. Secondly, in parallel to the literature review, the pilot testing was conducted, and the instrument was finalized. Thirdly, the survey for data collection was processed. In the next step, the data were transformed by using SPSS 22, and results were reported. In the last step, the discussion was presented, and implications were made by comparing research findings with other similar studies.

Participants

The enrolled students of four years B.Ed (Hons) teachers training program in Spring Semester 2019 at the Department of Educational Development, KIU, were the targeted population. The rationale for selecting Karakoram International University for the survey is that the B.Ed (Hons) degree program was first launched in Pakistan by this institute. The sample was selected from those students who were enrolled in the spring semester of 2019.

The purposive sampling methodology was employed to choose the sample from a total of 139 targeted students. The criteria for the sample was that only those students were

the part of the sample who have passed one technological course (Introduction to computing), one technology pedagogy course (ICT's in education), five content courses (Islamic studies, Pakistan studies, General science, Functional English and General mathematics) and five pedagogical content course (Teaching Islamic Studies, Teaching Literacy Skills, Teaching of Pakistan studies, teaching of general science and teaching of mathematics).

Only those students fall in the above criteria that have passed at least the first four semesters of their degree program. At the time of data collection, 120 students descended on the sampling criteria. Among them, 21 students (16% of the total sample) were selected for pilot testing, while 85 students were included in the sampling frame.

In this way, 85 pre-service teachers were surveyed using a quantitative survey instrument customized from Schmidt et al. (2009). The reason for using purposive sampling is to include only the relevant participants to whom the TPACK framework could be applied. Therefore, it was possible to include all the available participants in the sample who fall in the given criteria. That's why no further sampling was made.

Instrumentation

The available TPACK instruments could be employed to explore teachers' TPACK knowledge competencies in technology integration. According to Mishra & Koehler (2006) "use of same instrument in similar studies makes it possible to compare results between different samples, nationally and internationally". The survey questionnaire was made by adapting an instrument constructed by Schmidt et al., (2009). The adapted instrument was specifically constructed for self-assessment of pre-service instructors TPACK knowledge.

Schmidt et.al's (2009) survey instrument was used by many researchers and showed reliable outcomes (Fisser et al. 2015). Exploratory Factor Analysis (EFA) conducted in various contexts showed good reliability and validity of Schmidt et.al's (2009) questionaire (Handal et al, 2013). The application of Confirmatory factor analysis (CFA) by Ondes, Faekah, & Ariffin (2016), EFA by Koh, Chai, & Tsai (2011) and the application of both EFA and CFA by Chai, Koh, & Tsai (2010) found significant relibality and validity of the Schmidt et.al's (2009) survey instrument (Valtonen et al., 2017). That's why it was carefully adapted with slight cotextual modifications.

Schmidt et.al (2009) utilized statements for the content of science, literacy, mathematics and social studies. On the recommendations of experts an additional content area, Islamic Studies, was included. Moreover, the three essay type questions included in actual instrument were removed due to time constraint.

Pilot testing

Pilot testing was accompanied on 21 pre-service teachers to ensure the reliability and validity of the instrument. To ensure content validity, the expert judgment method was used. Three experts of educational technology reviewed the surveys and helped to finalize the survey with slight modifications. The internal consistency reliability was ensured using Cronbach's α. 10 Questionnaire items were skipped from the original questionnaire based on pilot testing. The overall Cronbach's Alpha for finalized 43 items was = 0.932.

Data Collection and Analysis

The data was gathered via an adapted quantitative questionnaire. The data received via a self-reported survey was analyzed using the SPSS Package 22. The 5-point Likert scale items (arranged from strongly agree to strongly disagree) were labeled from scores 1 to 5 (1 for strongly disagree and 5 for strongly agree). The level of pre-service instructors regarding various TPACK knowledge domains is illustrated by using standard deviation and mean. The results are firstly compared with the similar studies conducted in different contexts to present the discussion. Then, the implications and suggestions are made based on results and discussions.

Research Ethics

First and foremost, the permission was taken from the Dean of the Department of Educational Development, Karakoram International University. Permission was also taken from the author of the adapted questionnaire through Email. Participants were informed via a consent statement before the beginning of the questionnaire. Participants voluntarily contributed to the study, and they had the option to leave the study at any time. Participants' confidentiality is ensured throughout the research process.

Results

The outcomes from the data analysis accompanied for this study are presented in this section. First, the demographic information of participants is presented. Next, the TPACK level of prospective teachers is presented.

Table: 4.1

Participants Profile

Variables		**Participants (N:25)**	**Percentage (%)**
Gender	Female	62	72.9

	Male	23	27.1
Age Range	18-20	36	42.35
	23-26	45	52.94
	27-32	3	3.5
	32+	1	1.2
Current Semester	5th	32	37.6
	7th	36	42.4
	8th	17	20.0

The participants are enrolled in 4 years B.Ed (Hons) degree program at Karakoram International University (KIU). 90 questionnaires were distributed and 85 were received. The response rate was 94 %.

The TPACK level of prospective teachers

In order to explain the prospective teachers' knowledge level of TPACK, the mean, standard deviation, and Cronbach alpha for different knowledge domains were separately calculated and presented in tables (from Table: 4.2 to Table: 4.7). The Pedagogical Knowledge domain has the highest score (Mean: 4.110929 and SD: 0.724857). The TPK contains the second-highest score (Mean: 3.960767 and SD: 0.7722). The TK has the third highest value (Mean: 3.912629 and SD: 0.877057). The PCK has the fourth-highest and third-lowest score (Mean: 3.87528 and SD: 0.79044. The CK has the second-lowest score (Mean: 3.851585 and SD: 0.84007). The TPACK has the lowest score (Mean: 3.83675 and SD: 0.768295).

Furthermore, within the domain of Content Knowledge: Content Knowledge of Islamic Studies has the first highest score (Mean: 4.14705, SD: 0.639135), Social Studies has the second-highest score (Mean: 3.9882 and SD: 0.79044), Content Knowledge of General Sciences has third highest value (Mean:

3.91765, SD: 0.647655), Content Knowledge of Literacy has the next highest value (Mean: 3.6353, SD: 1.06258), and Content Knowledge of Mathematics has the lowest value of (Mean: 3.6902, SD: 0.98388).

The Cronbach alpha for the TPK domain is low (∞=0.677) whereas, the remaining domains have an acceptable range of Cronbach alpha. The value of Cronbach alpha for all other domains ranged from 0.781 to 0.865.

Table: 4.1*Technological Knowledge*

Knowledge Domain	**Mean**	**SD**	∞
Technological Knowledge (7 items)	3.912629	0.877057	.865
TK -1	3.8000	.65101	
TK -2	4.0000	.70711	
TK -3	3.8824	1.08465	
TK -4	3.9412	.85011	
TK -5	3.9412	.96797	
TK -6	3.9765	.77115	
TK -7	3.8471	1.10740	

Table 2 shows pre-service teachers Technological Knowledge (TK). There were seven items related to TK. The mean of different items ranged from 3.8 to 4.0. The average mean was 3.91, with an alpha value of 0.865.

Table 4.3*Content Knowledge*

Knowledge Domain	**Mean**	**SD**	∞
Content Knowledge (13 items)	3.851585	0.84007	0.805
Content Knowledge of Social Studies (3 items)	3.9882	0.7359	
CK-8	4.0000	.78680	
CK-9	3.9647	.73106	
CK-10	4.0000	.69007	
Content Knowledge of Science (2 items)	3.91765	0.647655	
CK-11	3.8706	.65079	
CK-12	3.9647	.64452	
Content Knowledge of Literacy (3 items)	3.6353	1.06258	
CK-13	3.6706	1.11684	
CK-14	3.6118	1.02463	
CK-15	3.6235	1.04627	

Content Knowledge of Islamic Studies (2 items)	4.14705	0.639135
CK-16	4.2353	.54874
CK-17	4.0588	.72953
Content Knowledge of Mathematics (3 items)	3.6902	0.983887
CK-18	3.6941	.96391
CK-19	3.6471	1.03171
CK-20	3.7294	.95604

Table 3 demonstrates the pre-service teachers' level of Content Knowledge (CK). There are 13 items related to CK. The overall mean value for 13 items related to CK is 3.85, with an overall alpha-value of 8.0. Furthermore, The mean value for three items related to Content Knowledge of Social Studies is 3.9882, the mean value for two items of Content Knowledge of General Sciences is 3.91765, the mean value for three items of Content Knowledge of Literacy is 3.6353, the mean value for two items of Content Knowledge of Islamic Studies is 4.14705, and the mean value for three items for Content Knowledge of Mathematics is 3.6902.

Table: 4.4*Pedagogical Knowledge*

Knowledge Domain	**Mean**	**SD**	∞
Pedagogical Knowledge (7 items)	4.110929	0.724857	0.805
PK- 21	4.0235	.81615	
PK- 22	4.1647	.70453	
PK- 23	4.1294	.72026	
PK- 24	4.0824	.77478	
PK- 25	4.1647	.55307	
PK- 26	4.0000	.83095	
PK- 27	4.2118	.67426	

Table 4 shows seven items for pre-service teacher's level of Pedagogical Knowledge (PK). The average mean for PK is 4.11, with an alpha value of 0.805.

Table: 4.2*Pedagogical Content Knowledge*

Knowledge Domain	**Mean**	**SD**	∞
Pedagogical Content Knowledge (7 items)	3.87528	0.79044	0.781
PCK -28	3.6941	.92612	
PCK -29	3.9529	.67092	
PCK -30	3.7647	.84017	
PCK -31	4.0471	.65294	
PCK -32	3.9176	.86205	

Table 5 represents five items related to the PCK of pre-service teachers. The average mean of PCK items is 3.87, with an alpha value of 0.781.

Table: 4.3*Technological Pedagogical Knowledge*

Knowledge Domain	**Mean**	**SD**	∞
Technological Pedagogical Knowledge (3 items)	3.960767	0.7722	0.677
TPK-33	3.8235	.87528	
TPK-34	3.9882	.80909	
TPK-35	4.0706	.63223	

Table 6 represents the TPK of prospective teachers. The average mean score of 3 PCK items is 3.96, with a low alpha value of 0.677.

Table: 4.4*Technological Pedagogical and Content Knowledge*

Knowledge Domain	**Mean**	**SD**	∞
Technological Pedagogical and Content Knowledge (3 items)	3.83675	0.768295	0.841
TPACK-36	3.7412	.81872	
TPACK-37	3.8353	.87078	
TPACK-38	3.7882	.78822	
TPACK-39	3.7176	.83967	
TPACK-40	3.9176	.69371	
TPACK-41	3.8941	.75630	

TPACK-42	3.8118	.71538
TPACK-43	3.9882	.66358

Table 7 shows that eight items are representing the TPACK of pre-service teachers. The average mean of 7 TPACK items is 3.83, with an alpha value of 0.841.

Discussion

This research was conducted to explore pre-service teacher's knowledge of different TPACK domains. The results of the study found the highest level for the content knowledge of Islamic Studies, second-highest level for the content knowledge of Social Studies, the third-highest level for the content Knowledge of science, next highest value for the content knowledge of Mathematics, and lowest value for the content knowledge of literacy skills.

The study outcomes specified that pre-service teachers' perceptions are higher than moderate regarding their knowledge of PCK, CK, TPK, TK, PK, and TPACK with enough internal consistency reliability except for TPK. The research outcomes are parallel with the results of Giannakos, Doukakis, Pappas, Adamopoulos, & Giannopoulou (2015), where they found a high level of CK, PCK, TK, TPK, PK, and TPACK and low level of TCK. Ondes & Ciltas (2018) also found similar results. They found the lowest mean value for TCK and higher than the moderate mean value for all the remaining factors of TPACK. The results are related to the findings of Banas & York (2014), which reports high PCK, followed by TPK and TPACK. Bas & Senturk (2018) also found a moderate level for TPACK, CK, TPK, TK, PK, and PCK.

A contradiction is also found in some related studies. Kumar & Gangmei (2018) revealed a low level of TPACK. Vila, Andrés, & Medrano (2015) explored that teachers are good at CK and PK than in TK, whereas the current findings show that teachers are good at PK and TK than CK. Schmid, Brianza, & Petko, (2021) concluded that no single area of self-revealed TPACK is considerably higher for pre-service teachers that intend to utilize technology in their teaching.

Nordin, Davis, & Ariffin (2013) surveyed 107 pre-service teachers in Newzealand and showed the highest scores in Content Knowledge (CK) while the lowest scores in the Technological Knowledge (TK) domain. In contrast, the current study shows the highest score in Pedagogical Knowledge (PK) and the lowest score in TPACK. Saltan & Arslan (2017) also showed the lowest score of TPACK.

Conclusion

The outcomes of this investigation are highly significant for the integration of educational technologies into prospective teacher's training programs in the context of

Pakistan. The study explored 6 out of 7 TPACK knowledge domains of prospective teachers enrolled in B.Ed (Hons) at Karakoram International University. The prospective teachers perceived that they have sufficient knowledge of technology and are willing to use technology and pedagogy to deliver content. The study's findings showed that the mean of 6 knowledge areas (TPACK, TK, TPK, PK, PCK, and CK) ranged from 3.83 to 4.11. This illustrates that teachers are confident in using technology and pedagogy in their instructional practices. They also show confidence that they have sufficient content to deliver in elementary classrooms. The alpha value for six knowledge domains (TPACK, TK, TPK, PK, PCK, and CK) was satisfactory; it was ranged from 0.781 to 0.865, whereas TPK has a low alpha value (∞=0.677).

Pedagogical Knowledge (PK) of pre-service teachers has the highest score. The TPK contains the second-highest score. TK has the third highest value. The PCK has the fourth-highest score. The CK has the second-lowest score, and the TPACK domain has the lowest score. These results showed that prospective teachers of elementary education have satisfactory skills to integrate technology into their teaching practices. The prospective teachers showed the highest confidence for content knowledge of Islamic Studies, second highest for Social Studies, third highest for Science, next highest for Mathematics, and lowest value for the content knowledge of Literacy Skills.

Recommendations

1. It is recommended to include TCK and TPACK related courses in B.Ed (Hons) program. Like ICTs for teaching mathematics and ICTs for teaching English.
2. B. Ed (Hons) is one of the essential teacher training programs running throughout the country. It would be valuable to replicate this study in different institutions and contexts to compare findings and further progress of integrating technology in teacher training programs in the region.
3. The study depended on a self-reported assessment of prospective teachers. It would be valuable to conduct observational and longitudinal studies to explore teachers' knowledge in the relation of Technology Pedagogy and Content Knowledge (TPACK).
4. In order to explore the TPACK progress of prospective teachers, it is suggested that upcoming researches can use longitudinal studies such as pretest and posttest survey methodology earlier and afterward, the course of ICT in education.
5. The results of the current study rely only on a single questionnaire. Future studies can use multiple sources for good results. Also, the in-depth perceptions of pre-service teachers' TPACK may be examined through qualitative studies.

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