

# Assessment of Pre Service Teacher's Perceptions on Technological Pedagogical and Content Knowledge (TPACK) in Karachi Pakistan

Zahid Ali<sup>1</sup>, Dr. Martin Thomas<sup>2</sup>, Nazir Ahmed<sup>3</sup>, Imran Ahmed<sup>4</sup>, Ishtiaq Ahmed<sup>5</sup>

**Abstract-**This is 21<sup>st</sup> century, an era of aligns standardized curriculum, advanced technologies and integrated knowledge. To meet the challenges of this changing world there is a need to enhance the certain core competencies of teachers such as collaboration, digital literacy, critical thinking, problem-solving and the knowledge of teaching and technology to achieve the goals of quality of education and students achievement. Technological Pedagogical and Content Knowledge (TPACK) is a technical framework of collective and composite knowledge required for teachers teaching practices in the classrooms with technology integration. This research focused on the professional knowledge of pre services teachers and their teaching practices with the use of technologies as contexts for the awareness of technology integration in teaching learning process. So in this study the perceptions of pre service teacher's level of understandings about TPACK and its related domains were assessed through cross sectional survey. The research reveals that all pre-service teachers have sound knowledge about TPACK, though their level is different, yet the value is insignificant statistically. The objective of the study was sought to explore the perceptions of pre service teachers' technological pedagogical content knowledge (TPACK), the relationship of its domains and the competency level of teachers' professional knowledge of technology integration at Elementary School level. A questionnaire based survey research design with purposive sampling was administered. The scale was used regarding, Technology 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). Every scale was determined through different questions and a 5 point Likert scale was used in which 1 for strongly disagreed and 5 were for strongly agreed. The mean score 4.0 and above indicate that they were confident teachers and can easily use the technologies in their teaching according to the requirement of the day. The results of demographic information mean and St. Deviations shows that Out of total 290 teachers, 249(85.9%) were females and 41(14.1%) were males. The female male ratio was 1:0.17. According to age group distribution, majority i.e.59.6% was between the ages of 18-26 years. Out of these participants 76.6% were graduates and overall 64.8% were currently pursuing a degree of B.Ed. In Technology Knowledge, female technology knowledge mean was 3.51 to 3.72 whereas mean of male technology knowledge was 3.51 to 4.10. In content knowledge, the overall mathematics mean was 3.52 to 3.57. Although males mean was 3.54 to 3.80 but as males were in less in our study so that it did not make any effect on the overall conclusion mean. In pedagogical content knowledge, the highest percentage was in science and lowest was in mathematics, i.e. 72.1 to 63.7% who agreed or strongly agreed with the positive approaches in their field of studies. Technological pedagogical knowledge mean score of the replies was 3.72 to 4.10 which shows a good attitude of the teachers to adopt current technologies in their teaching performance according to the contents. Technology pedagogy and content knowledge mean score at this stage was extremely low from 3.52 to 3.75. Technology pedagogy and content knowledge mean score was extremely low from 3.52 to 3.75. This shows that either they were not confident on combination of all the things or they were un-cleared about the use of technology in each parable specially females.

**Index Terms-**TPACK, Teachers' Perceptions, Teaching Practices,

## 1 Introduction:

The teacher is the most pivotal person during the implementation of all education reforms at the base line in education. A teacher plays a crucial role in the upbringing and intellectual nourishment of students. A qualified and skillful teacher is the one who can build the nation and determines the values, gives priority to learning first over teaching. The academic qualifications, knowledge of content, good competence level, pedagogical knowhow and teachers' willingness played an important role in the teaching-learning process. The able teacher can bring a great change in society through his believes in the broader perspective of education, which completely transforms an individual (National Education Policy 1998-2010). Teachers should be well equipped with the knowledge of their subject, its delivering methods and skill for its management (UNESCO, 2006). Shahid (2007) expressed that, to get teaching excellence and commitment to professional it is necessary to get a preparation before interring to teaching service. During such activities where a teacher is required to instruct their students, technology use play an important role so that students must remain engaged in learning process. (Kuzu & Günüç, 2014).

The 21st century is quite different from previous centuries. Appearance in current century required technological tools for better communication and forward the information in an effective way in our environment, (Alayyar, Fisser, & Voogt, 2012) along with the learning in teaching. Mishra and Koehler (2006) developed constructive steps which are

based on the concept that in most of the fields, digital technology has changed the normal practice of our work. The same has been developed in education and use of technology becomes the part of it. Giving arguments in favor of technology believe that it is an understandable teaching process in general and science in special circumstances which helps to think the environment with reference to its organism. The same were applied on use of technology in education and main argument for it was that it developmental absorption covers the hole properties of any system makes it possible through different actions which remains a long-lasting effect to encouraging specific learner behaviors. Niess et al. (2009) on the challenged developed by the International Society for Technology and Education to teachers has made conceptualization of the technological skills and knowledge which students needs in the current scenario.

Having involvement of technologies provides readily available information, the teacher is bond to provide it being the facilitator, advisor or as a mentor. The role of a teacher is to develop an environment in which he can guide them in the right direction and students learn a lot through it. Therefore researchers have agreed that teachers must be compatible to combined technology with their pedagogical skills and content knowledge accordingly (Chai et al., 2010; Mishra & Koehler, 2006; Otrell-Cass et al., 2010). The teacher education in Pakistan focuses attention on major issues, and challenges at all levels confronting teacher education in Pakistan (Government of Pakistan, 2002, Jamil, 2004; Academy for Educational Development, 2005;

UNESCO, 2008; Barber, 2010; USAID, 2012). Qazi, Rawat and Thomas (2012) have cited Darling-Hammond who claimed that teachers who have professional qualification normally show better performance, even if they given special tasks needs skills which can solve the problem.

It is accepted generally that teachers need to blend their classroom practices with technological knowledge for the bigger success of learners. It has a consolidated with mechanical learning, pedagogical information and substance learning. As it were, Koehler and Mishra (2005) have broadened the Shulman's concept of PCK thought by including the space of innovation. At that point, one of the adjustment types of PCK, which is innovative pedagogical substance information (TPCK or TPACK), has risen. The first type of the term is TPCK, yet TPCK is later changed to TPACK to make elocution simpler (Thompson and Mishra, 2008). TPACK is basically the knowledge that required for combination of technology with teaching skills. It is a knowledge that builds technology; pedagogy and content develop effectiveness of teaching performance. It (TPACK) facilitates the meaningful use of technology for educational purposes. Teacher's attitude for technology plays a critical role which has been in the focus of many empirical studies (Scherer R 2018).

The definition of technology covers all kind of digital devices in technologies (Koehler & Mishra, 2009) that could be used for teaching of science. (McCrorry, 2008). It was observed that pre-service teachers have high-level ability in both digital and TPACK which make easier to implement it for practice and future studies (Chai CS 2018; and Yurdakul IK (2018). Koehler and Mishra (2009) clearly settle the mind of the reads, emphasizing it that for practical significance, technologies mostly undertaken in consideration is a new concept in recent literature that in other way is difficult to implement. Shulman (1986) expressed that there was a sharp refinement in the middle of instructional method and substance in old times. Shulman proposed a build which was named as pedagogical substance information (PCK). In this development; Shulman proposes a relationship between educator's pedagogical learning and substance information.

### 1.2 Significance of the study

This research focuses on knowledge of teaching and technology and teaching practices with the use of technologies as contexts for the awareness of technology integration in teaching learning process for pre-service teachers. The purpose of the study is also sought to explore the perceptions of pre service teachers' technological pedagogical content knowledge (TPACK), the relationship of its domains and the competency level of teachers' professional knowledge of technology integration. In doing so, survey whose items were adapted from already developed "Survey of Pre-service Teachers' Knowledge of Teaching and Technology" (Schmidt et al., 2009) were distributed among 350 teachers into three educational institutions to measure their understanding regarding various concepts of TPACK and 290 teacher candidates responded. Mishra and Koehler (2006) tested the TPACK model and assess the teacher's behavior in adaptation for use technology in teaching.

### 1.3 Objective of the research:

To assess the teacher's personal assessment of technological pedagogical content knowledge (TPACK), relationship of its domains, the competency level of teachers' professional knowledge of technology integration and its use in their teaching practices.

**2 Methodology:** the study was conducted through a questionnaire considered appropriate. The instrument of this study included 46 items adapted with modified 5 demographic items. Its English version of "Survey of Pre-service Teachers' Knowledge of Teaching and Technology" (Schmidt et al., 2009) which is used in most of the TPACK studies in the literature due to the high statistical results. For this purpose, Cronbach's alpha reliability test was used. The scale have seven components of knowledge i.e. Technological Knowledge (TK), Content Knowledge (CK), Pedagogical Knowledge (PK) Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK), and Technological Pedagogical Content Knowledge (TPACK). Every scale was determined through different questions and a 5 point Linkert scale was used in which 1 for strongly disagreed and 5 were for strongly agreed. The mean score 4.0 and above indicate that they were very confident teachers and felt comfortable with using technologies as a teacher tool to address the demand of the contents.

Before conducting the study, a pilot study on 50 pre service teachers' was carried out other than the main population of the study to assess the feasibility of the actual study. The study has been conducted in three educational institutions 1. UoK 40 forms were distributed and 29 forms were collected, except pilot study. 2. J M GCE 80 forms were distributed and 65 were collected and 3. GCE.FB area, 220 forms were distributed and 196 forms were returned. Study was conducted through Survey research study design. Realizing the need, the purposive sampling technique was applied to this study to cover the whole study population having same parameters (Specific current skills, knowledge, exposure to teaching and technology etc.). Regarding ethical issues, the researcher informed the participants about the consciousness of multiple and consent rules, confidentiality and privacy. The formal permission was granted from the IUGC regarding the research field work in three educational institutes in Karachi. Furthermore, respondents had been given free hands to withdraw them self at any stage of the study. They were also assured that their names or identification could not be given to anyone for any other purposes.

### 3 Results

In this study we have included 290 teachers who were agreed to participate in the study. Out of these 249(85.9%) were females and 41(14.1%) were males. The female male ratio was 1:0.17. According to age group distribution, majority i.e.59.6% was between the ages of 18-26 years. Only 3.1% participants were above the age of 37 years. Regarding marital status of the subject are concerned, majority (70.7%) were unmarried whereas rest of the participants were married. Out of 290 participants 76.6% were graduates and overall 64.8% were currently pursuing a degree of B.Ed. (Table 1)

### Demographic Information of study participant

Demographic Information	n	%
Gender		

Table 1

Female	249	85.9
Male	41	14.1
<b>Age Groups</b>		
18-22 years	85	29.3
23-26 years	88	30.3
27-32 years	76	26.2
33-37 years	32	11.0
37 > years	9	3.1
<b>Marital Status</b>		
Married	85	29.3
Unmarried	205	70.7
<b>Qualifications</b>		
Undergraduate	68	23.4
Graduate	127	43.8
Postgraduate	95	32.8
<b>Currently pursuing degree</b>		
ADE program	13	4.5
BSEd / BEd Hons	50	17.2
BEd	188	64.8
MEd	39	13.4

For analysis purposes, all the participants were assessed through six point scales which were Technology Knowledge (TK), Content Knowledge (CK), Pedagogical Knowledge (PK), Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK), and Technological Pedagogical Knowledge (TPK). Then finally on the basis of 4 steps we have assessed combine final assessment through Technology Pedagogy and Content Knowledge (TPACK)

**1 Technology Knowledge (TK)**

This was a six question assessment and we have divided it into gender wise and with over all through mean ± S.D. of their Linkert scale scores. The mean of the total participants regarding Technology knowledge were 3.53 to 3.72 with S.D. 0.963 to 1.034. The female technology knowledge mean was 3.51 to 3.72 whereas mean of male technology knowledge was 3.51 to 4.10. This shows that male have more attitudes for technology knowledge as compared to females. (Table 2)

**Table 2 Pre-service Teachers' Technological Knowledge**

Gender	Female		Male		Total	
	Mean	SD	Mean	SD	Mean	SD
TK Items						
TK 1	3.59	1.052	3.98	.851	3.64	1.034
TK2	3.66	1.012	4.10	.490	3.72	.967
TK3	3.61	.962	3.93	.787	3.65	.945
TK4	3.53	.967	3.51	.952	3.53	.963
TK5	3.51	.996	3.76	1.019	3.54	1.002
TK6	3.72	.955	3.76	.943	3.72	.952

**2 Content Knowledge (CK)**

In this part, the participated teachers were asked for their knowledge regarding subjects i.e. Mathematics, Social studies, Science, and literature separately. For each subject, three statements were given to reply on the basis of Likert scale score. For mathematics over all mean was 3.52 to 3.57. Although males mean was 3.54 to 3.80 but as males were in less in our study so that it did not make any effect on the overall

conclusion mean. Similar situation was found in other subjects' i.e. social sciences, science and literature where male means were higher than the female teachers. (Table 3)

**Table 3 Pre-service Teachers' content Knowledge**

**3 Pedagogical Knowledge (PK):-**

This was based on assessment of students by a teacher. Although, it does not give a definite response whether they can adopt teaching style to cater for divers' learners or not. However majority of the respondent's reply was high attitude to maintain a good performance for their teaching style and student decorum. The mean in this era was 3.81 to 4.16. However, here also the male were found more dynamic and having ability to mold themselves according to the situation. Majority of the

Gender	Female		Male		Total	
	Mean	SD	Mean	SD	Mean	SD
CK Items						
Mathematics						
CKMATH_item7	3.53	1.092	3.80	1.054	3.57	1.089
CKMATH_item8	3.53	1.016	3.78	1.013	3.57	1.017
CKMATH_item9	3.51	1.040	3.54	1.098	3.52	1.046
Social Studies						
CKSST_item10	3.55	1.046	3.83	.863	3.59	1.026
CKSST_item11	3.41	1.060	3.66	.990	3.45	1.052
CKSST_item12	3.53	.988	3.73	1.025	3.56	.994
Science						
CKSC_item13	3.76	.988	3.90	.917	3.78	.978
CKSC_item14	3.79	.953	3.93	.959	3.81	.953
CKSC_item15	3.76	.984	3.78	.936	3.76	.976
Literacy						
CKLIT_item16	3.38	.981	3.78	.759	3.43	.962
CKLIT_item17	3.54	.924	3.66	.825	3.56	.911
CKLIT_item18	3.43	1.006	3.66	.855	3.46	.988

participants were strongly agreed with the statement. The mean of male was 4.02 top 4.24 whereas mean of female was 3.77 to 4.14. (Table 4)

**Table 4 Pre-service Teachers' pedagogical Knowledge**

Gender	Female		Male		Total	
	Mean	SD	Mean	SD	Mean	SD
PK Items						
PK 1	3.98	.820	4.17	.704	4.01	.807
PK2	3.94	.838	4.17	.771	3.97	.831
PK3	4.14	.762	4.24	.663	4.16	.749
PK4	3.96	.837	4.22	.690	4.00	.821
PK5	3.77	.857	4.02	.790	3.81	.851
PK6	3.87	.853	4.02	.880	3.89	.857
PK7	4.10	.865	4.10	.664	4.10	.839

**4 Pedagogical Content Knowledge (PCK)**

It is basically an intersection of PK and CK from the TPACK frame work. Majority remains non-committed to always target aspect of nature of science in their teaching. This was a 4 question tool. The overall mean was 3.60 to 3.83 with S.D. 0.892 to 0.973. The female mean score was just 3.57 to 3.82 whereas mean score of male was 3.76 to 4.1. It showed that majority were either agreeing with the statement or they were strongly agreed with them. (Table 5)

**Table 5 Pre-service Teachers' pedagogical content Knowledge**

Gender	Female		Male		Total	
	Mean	SD	Mean	SD	Mean	SD
PCK 1	3.58	.989	3.76	.860	3.60	.973
PCK 2	3.57	.977	3.85	.823	3.61	.961
PCK 3	3.82	.880	3.90	.970	3.83	.892
PCK 4	3.68	.951	4.10	.800	3.74	.941

**5 Technological Content Knowledge (TCK)**

This was a four point tool in which each question statement relates to one subject as specified under (Table 4.18.) It is basically mix up of technology and content of the subject used by a teacher. Here mean score of mathematics was 3.54; literacy 3.59; science 3.71 and social studies 3.66. This trend of score showed a low rate acceptances of teachers in combination of the technology related to content of the specified subject. At this stage the male and female both remains below 4.0 score which shows that they all were not confident and agree or strongly agreed but someone were un-cleared also. (Table 6)

**Table 6 Pre-service Teachers' Technological content Knowledge**

Gender	Female		Male		Total	
	Mean	SD	Mean	SD	Mean	SD
TCK 1	3.49	1.036	3.85	1.014	3.54	1.039
TCK 2	3.56	.953	3.76	.888	3.59	.945
TCK 3	3.63	.867	3.83	.834	3.66	.864
TCK 4	3.70	.933	3.73	.975	3.71	.938

**6 Technological Pedagogical Knowledge (TPK)**

This was a nine point statement to assess the teachers on technology and pedagogical Knowledge (learning and teaching approaches) used by a teacher. This way we can assess the persons how much they are motivated to upgrade their teaching style with the technologies used in their subject related performance. The mean score of the replies was 3.72 to 4.10 which shows a good attitude of the teachers to adopt current technologies in their teaching performance according to the contents. Here also male goes to super seed as compared to females as their mean score was mostly 4.0 or above. Regarding female score mean only at one point it is 4.11 whereas all the others are 3.7 to 3.98. (Table 7)

**Table 7 Pre-service Teachers' technological pedagogical Knowledge**

Gender	Female		Male		Total	
	Mean	SD	Mean	SD	Mean	SD
TPK 1	3.83	.969	4.07	.721	3.87	.941

TPK 2	3.97	.835	4.17	.587	4.00	.807
TPK 3	4.11	.862	4.02	.851	4.10	.859
TPK 4	3.90	.834	3.83	.892	3.89	.841
TPK 5	3.96	.848	4.02	.758	3.97	.835
TPK 6	3.98	.887	3.95	.805	3.98	.874
TPK 7	3.81	.891	4.00	.837	3.83	.884
TPK 8	3.70	.917	3.88	.812	3.72	.904
TPK 9	3.86	.919	4.00	.866	3.88	.911

**8 Overall assessment of Technology Pedagogy and Content Knowledge (TPACK)**

Finally overall knowledge was assess through 4 statement based on Likert Scale regarding content of each subject with technology and teaching approaches. The mean score at this stage was extremely low from 3.52 to 3.75. This shows that either they were not confident on combination of all the things or they were un-cleared about the use of technology in each para specially females. (Table 8)

**Table 8 pre service teachers' Technology Pedagogy and Content Knowledge**

Gender	Female		Male		Total	
	Mean	SD	Mean	SD	Mean	SD
TPACK 1	3.44	.919	3.98	.880	3.52	.931
TPACK 2	3.48	.907	3.78	.852	3.52	.904
TPACK 3	3.73	.927	4.02	1.012	3.77	.943
TPACK 4	3.70	.894	4.05	.631	3.75	.870

**4 Discussion**

This research emphasize on teachers education which should not remain isolated on basic issues of technologies required as per demand. They should convert their teaching through specific contents of technology in all courses. In a study (Isler C, 2018) it was concluded that high levels of perceptions on TPACK competences, and teacher's attitude toward personal interest, experience, knowledge on TPACK. They suggest that courses offered to pre-service teachers should include technology, content and pedagogy along with effective instruction in their subject field. The same was concluded in our study.

In another study (Cem, 2018) it was concluded that Content, technological and pedagogical skills should taught and modeled together in an integrated manner. Pre-service teachers did not receive adequate training for technological education during the courses of their study at faculty of educations. It is necessary that effectiveness and efficiency that resources other than human and human power are handled in a more realistic way.

Koehler and Mishra (2009) suggest that it should be developed in their teaching process with latest technology as an add-on and in such a way that should be taken into consideration the classroom contexts. These all aspect also find in our study at the same level.

**5 Conclusion:**

As per conclusion of the study results, it was determined that participant's teachers have more clear understanding and perceptions of TPACK contents. The data of ADE, B.Ed, B.Ed (Hons) and M.Ed degree pursuing pre-service teachers mean scores were analyzed. Though there is a difference among the participants, but the difference is insignificant statistically. The data reveals that Out of total 290 teachers, 249(85.9%) were females and 41(14.1%) were males. The female male ratio was 1:0.17. According to age group distribution, majority i.e.59.6% was between the ages of 18-26 years. Out of these

participants 76.6% were graduates and overall 64.8% were currently pursuing a degree of B.Ed. In Technology Knowledge, female technology knowledge mean was 3.51 to 3.72 whereas mean of male technology knowledge was 3.51 to 4.10. In content knowledge, the overall mathematics mean was 3.52 to 3.57. Although males mean was 3.54 to 3.80 but as males were in less in our study so that it did not make any effect on the overall conclusion mean.

In pedagogical content knowledge, the highest percentage was in science and lowest was in mathematics, who agreed or strongly agreed with the positive approaches in their field of studies. Technological pedagogical knowledge mean score of the replies was 3.72 to 4.10 which shows a good attitude of the teachers to adopt current technologies in their teaching performance according to the contents. Technology pedagogy and content knowledge mean score at this stage was extremely low from 3.52 to 3.75. This shows that either they were not confident on combination of all the things or they were un-cleared about the use of technology in each parable specially females.

## 6 Recommendations and suggestions

1. TPACK should be included in the basics of the teacher's education programs. Curriculum should have a positive approach of teaching with technology of the subject.
2. The TPACK should be processed in such way through which student learning could be improved the ultimate goal of teaching.
3. For proper implication, more research is required in urban and rural as well as public and private sector to assess other contextual issues during the practical application of TPACK.

## 7 Limitation and Delimitation of the Study

1. The study was delimited to three Teacher Education Institutions, having only one type of quantitative data collection tool (questionnaire).
2. The questionnaire was not translated in Urdu language; therefore, some teachers might have misunderstood some questions.

## References:

1. Alayyar, G. M., Fisser, P., & Voogt, J. (2012). Developing technological pedagogical content knowledge in pre-service science teachers: Support from blended learning. *Australasian Journal of Educational Technology*, 28(8):1298-1316.
2. Chai, C. S., Chin, C. K., Koh, J. H. L., & Tan, C. L. (2013). Exploring Singaporean Chinese language teachers' technological pedagogical content knowledge and its relationship to the teachers' pedagogical beliefs. *The Asia-Pacific Education Researcher*, 1-10.
3. Chai, C.S., Koh, J. H. L. & Chai, C. C. T. (2010) Facilitating Preservice Teachers' Development of Technological, Pedagogical, and Content Knowledge (TPACK). *Journal of Educational Technology & Society*, 13 (4): 63-73.
4. Chai, C.S., Koh, J. H. L., & Teo, Y. H. (2018). Enhancing and Modeling Teachers' Design Beliefs and Efficacy of Technological Pedagogical Content Knowledge for 21st Century Quality Learning. *Journal of education computer research*, 56(1): 1-25.
5. Cuhader, C. (2018). Investigation of Pre-Service Teachers' Levels of Readiness to Technology Integration in Education. *Contemporary educational technology*, 9(1): 61-75.
6. Graham, C. R. (2011). Theoretical considerations for understanding technological pedagogical content knowledge (TPACK). *Computers & Education*, 57: 1953-1960.
7. Günüç, S., & Kuzu, A. (2014). Factors Influencing Student Engagement and the Role of Technology in Student Engagement in Higher Education: Campus-Class-Technology Theory. *Turkish Online Journal of Qualitative Inquiry*, 5(4): 86-113.
8. Horzum, M. B. (2013). An investigation of the technological pedagogical content knowledge of pre-service teachers. *Technology, Pedagogy and Education*, 22(3): 303-317.
9. Isler, C., Yildirim, O. (2018). Perceptions of Turkish pre-service EFL teachers and their Technological content knowledge. *Journal of Education and Future*, 13:145-60.
10. Kereluik, K., Mishra, P., & Koehler, M. J. (2011). On learning to subvert signs: Literacy, technology and the TPACK framework. *California Reader*, 44(2):12-18.
11. Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record*, 108(6):1017-1054.
12. Mishra, P., Koehler, M. J., & Kereluik, K. (2009). The song remains the same: Looking back to the future of educational technology. *Techtrends*, 53(5):48-53.
13. National Education Policy 1998-2010. (2010). Islamabad: Government of Pakistan.
14. Niess, M. L. (2012). Teacher knowledge for teaching with technology: A TPACK lens. In *Educational technology, teacher knowledge, and classroom impact: A research handbook on frameworks and approaches* (pp. 1-15). IGI Global.
15. Niess, M. L., Ronau, R. N., Shafer, K. G., Driskell, S. O., Harper S. R., Johnston, C., Browning, C., Özgün-Koca, S. A., & Kersaint, G. (2009). Mathematics teacher TPACK standards and development model. *Contemporary Issues in Technology and Teacher Education*, 9(1): 4-24.
16. Pakistan, U. S. A. I. D. (2006). Situation analysis of teacher education in Pakistan: Towards a strategic framework for teacher education and professional development. Government of Pakistan 2006c, 2002a; Sultana, 2001; World Bank 2006).
17. Pamuk, S., Ergun, M., Cakir, R., Yilmaz, H. B., & Ayas, C. (2013). Exploring relationships among TPACK components and development of the TPACK instrument. *Education and Information Technologies*, 1-23.
18. Policy and Planning Wing Ministry of Education Government of Pakistan. (2009). National professional standards for teachers in Pakistan. Islamabad: Government of Pakistan.
19. Scherer, R., Tondeur, J., Siddiq F., Baran, E. (2018). the importance of attitudes towards technology for pre service teacher's technological, pedagogical, and content knowledge: comparing structural equation modeling approaches. *journal of computers in human behavior*, 80:67-80.
20. Selwyn, N. (2008). From state-of-the-art to state-of-the-actual? Introduction to a special issue. *Technology, Pedagogy and Education*, 17(2): 83-87.
21. Shahid, M. S. (2007). The professional relevance primary school teachers: A neglected area of teacher education. Paper presented in National Conference on the Changing Role of Teacher Education in the Era of Globalization, Institute of Education and Research, University of the Punjab, Lahore (April 16-17).
22. Shulman, L. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher*, 15(2), 4-14.
23. Thomas, M. (2013). Teachers' Beliefs about Classroom Teaching - Teachers' Knowledge and Teaching Approaches. *Procedia Social and Behavioral Sciences*, 89:31-9.
24. Thompson, A., & Mishra, P. (2007). Breaking News: TPACK Becomes TPACK! *Journal of Computing in Teacher Education*, 24(2): 38-64.
25. Voogt, J., Fisser, P., N., Pareja R., Tondeur, J., & van Braak, J. (2013). Technological pedagogical content knowledge – a review of the literature. *Journal of Computer Assisted Learning*, 29(2), 109-121.
26. Yurdakul, IK. (2018). Modeling the relationship between pre-service teachers' TPACK and digital nativity. *Educational Technology Research and Development*, 66(2): 267-81.

Corresponding author:

Zahid Ali

Ph.D Scholar (Education)

Department of Education and Social Sciences

IQRA University, Karachi Pakistan

03339246888

Zarajput77@gmail.com

IJSER