American International Journal of Research in Humanities, Arts and Social Sciences

Available online at http://www.iasir.net

ISSN (Print): 2328-3734, ISSN (Online): 2328-3696, ISSN (CD-ROM): 2328-3688

AIJRHASS is a refereed, indexed, peer-reviewed, multidisciplinary and open access journal published by International Association of Scientific Innovation and Research (IASIR), USA

(An Association Unifying the Sciences, Engineering, and Applied Research)

Measuring the Technological Pedagogical Content Knowledge (TPACK) of Pre-service Teachers in relation to their Gender and Streams

Shibli Naaz*; ZebunNisa Khan**

*Research Scholar, Aligarh Muslim University, Aligarh, India.

**Associate Professor, Aligarh Muslim University, Aligarh, India.

Abstract: *The present study is aimed to find out the level of Technological Pedagogical Content Knowledge (TPACK) of Pre-service teachers. The study also finds out the effect of gender and streams on TPACK of Pre-service teachers. For this purpose a sample consist of 131 pre-service teachers of department of Education, Aligarh Muslim University Aligarh were selected by using Simple Random Sampling technique. TPACK scale developed by* ***Hosseini, Z., & Anand, K.(2012)****was used for data collection purpose. Data were analyzed by Mean, Standard Deviation, t-test and ANOVA. The findings of the study revealed the fact that on TPACK scale Pre-service teachers have high mean score in Technological Knowledge and low mean score in Technological Content Knowledge. The present study indicates that, both male and female differs in Technological Knowledge, but overall TPACK of pre-service teachers have no difference on the basis of gender. Similarly there exists no significant difference in Technological pedagogical Content knowledge of pre-service teachers among different streams (science, art and social-sciences).*

Key Words: *Technological Pedagogical Content Knowledge (TPACK), Pre-service Teachers, Gender and Streams*

I. Introduction

Technological pedagogical content knowledge (TPACK) is the knowledge required for effective technology integration in teaching. The TPACK concept builds on Shulman's idea of pedagogical content knowledge. Koehler and Mishra (2008) observed that TPACK describes how teachers‟ understanding of technologies and pedagogical content knowledge interact to produce effective teaching with technology. Graham et al. (2009) claimed that TPACK is achieved when a "teacher knows how technological tools transform pedagogical strategies and content representations for teaching particular topics and how technology tools and representations impact a student's understanding of these topics". The TPACK framework has been accepted as a helpful framework for thinking about the knowledge that teachers require in order to successfully integrate technology into their classrooms (Kereluik et al., 2011).The TPCK framework acronym was renamed TPACK (pronounced "tee-pack") for the purpose of making it easier to remember and to form a more integrated whole for the three kinds of knowledge addressed: technology, pedagogy, and content (Thompson & Mishra, 2007–2008).

The three major components of teacher knowledge are content knowledge (CK), pedagogical knowledge (PK), and technology knowledge (TK). There are equally important that the significant interactions between and among these three types of knowledge. These comprise pedagogical content knowledge (PCK), technological content knowledge (TCK), technological pedagogical knowledge (TPK), and technological pedagogical content knowledge (TPACK) (Koehler & Mishra, 2005, 2008, 2009; Mishra & Koehler, 2006).

These seven categories are briefly defined as follows:

1) Content knowledge (CK) refers to the "knowledge about actual subject matter that is to be learned or taught"(Koehler & Mishra, 2008, p. 13). Teachers need to know about both what they are going to teach (i.e., the subject matter) and how that knowledge differs for other content areas.

2) Pedagogical knowledge (PK) is "deep knowledge about the processes and practices or methods of teachingand learning and encompasses (among other things) overall educational purposes, values, and aims" (Koehler &Mishra, 2008, p. 14). It comprises a 'generic' type of knowledge in methods, approaches, teaching techniques, assessment, lesson plan development, classroom management, and student learning.

3) Pedagogical content knowledge (PCK) means the content knowledge that applies to the teaching of the specific subject matter (Schulman, 1987). PCK is different for various content areas because it combines content and pedagogy by aiming at developing better teaching practices in specific content areas (Schmidt et al., 2009).

4) Technology knowledge (TK) is continually in a state of change and includes the knowledge about various digital technologies such as computers, internet, mobile devices, interactive whiteboards, digital video, and software applications (Koehler & Mishra, 2008; Schmidt et al., 2009).

5) Technological content knowledge (TCK) refers to the knowledge of how technology can provide affordances for new representations of content areas (Koehler & Mishra, 2008). This means that teachers need to know not only the specific content they teach but also how the specific content can be changed by using technology. Briefly, TCK deals with how ICT and content influence each other.
6) Technological pedagogical knowledge (TPK) means knowing how numerous technologies can be used in teaching, and understanding that using particular technologies may change how teachers teach in classrooms (Koehler & Mishra, 2008; Schmidt et al., 2009).
7) Technological pedagogical content knowledge (TPACK) integrates knowledge of technology, pedagogy, and content at the same time. It "is different from knowledge of all three concepts individually" and "is the basis of effective teaching with technology" (Koehler & Mishra, 2008).

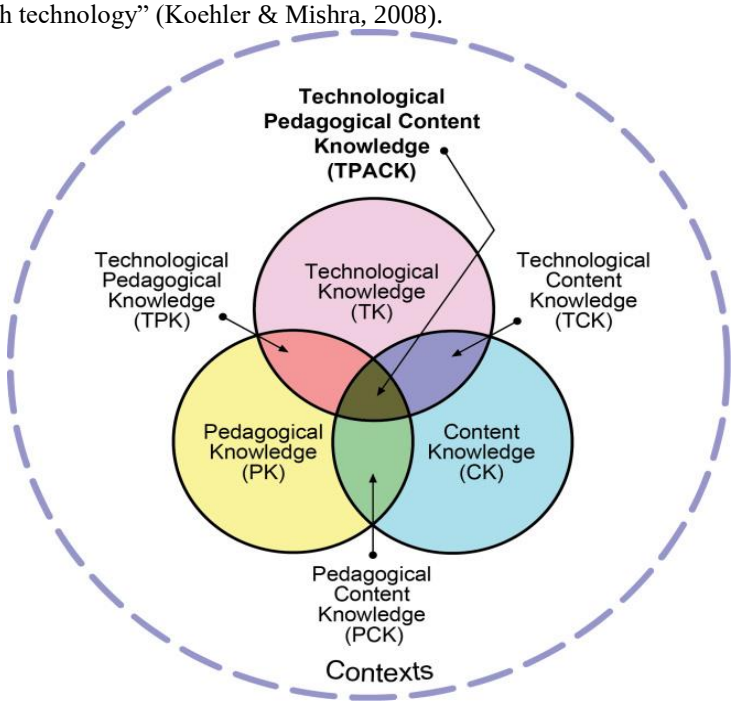

Fig. 1: Graphic representation of technological pedagogical content knowledge (From http://tpack.org)

II. Significance of the study

Today's era is an era of science and technology. Every nook and corner is being affected by technology so do our education system. As a result of advancement of science and technology there is a dire need of effective use of technology in the teaching learning process. It is the evident from the fact the there is deficiencyin the use of modern technologies in the teaching learning process. TPACK is a complex area that enables the teacher to select suitable technological tools to teach a particular content through a specific method in order to make the teaching learning process a great success. TPACK is helpful in providing the platform for the development of teacher's knowledge about the technology.

In India unlike of developed countries technology is not very evident; hence one can easily see lesser number of teachers using modern technologies in teaching. Thereforethe researcher felt a dire need to carry out the study on TPACK of pre-service teachers in relation to gender and different streams. It is further observed by the researcher that majority of the studies carried out on TPACK of pre-service teachers was in United State of America, some parts of China, Malaysia and no studies are conducted in Indian context hence a need arose to carry out the research on TPACK of pre-service teachers in relation to gender and streams.

III. Review of Related Literature

Hosseini, Z., & Anand, K.(2013) conducted study on 236 pre service and in-service teachers to measures the Technological Pedagogical Content Knowledge (TPACK). The findings showed that participants have low Technological Pedagogical Knowledge (TPK) and high Pedagogical knowledge (PK). The study indicated that there was no effect of age and gender on TPACK and its components. On other hand teaching experience and participant's field of study were significantly related to their TPACK. Furthermore study also examined that there was no significant relationship between participants' attitude toward using technology and TPACK.

Hamilton Christina (2013) carried out the study on university teacher education faculty, findings of the study clearly revealed that, there is no relationship among age, rank and gender with their technological content knowledge (TCK), technological pedagogical knowledge (TPK), and technological pedagogical content knowledge (TPACK).

Koh & Chai (2011) conducted the study on pre service teachers and noticed that the constructs of TPACK had significant impact on pre-service teachers' TPACK perceptions whereas the demographic variables such gender and age were not significant. It was also found that only TCK and TPK were significant predictors of TPACK among the TPACK constructs.

Koh, Chai and Tsai (2010) examined 1185 pre-service teachers TPACK and noticed that participants were not able to conceptual distinctions between TPACK constructs such as TCK (technological content knowledge) and TPK (technological pedagogical knowledge). According to this study pre-service teachers had moderately high confidence about their Technological knowledge, content knowledge and Pedagogical knowledge. This study shows that there exists significant difference between the perceptions of male and female teachers. Male pre-service teachers had higher TK than females. On other hand age and level of teaching were not significant.

Lee at all (2008) conducted the study on pre service teachers, and findings clearly revealed that pre service teachers had moderately high confidence about their technological knowledge (TK), content knowledge (CK), and pedagogical knowledge (PK). The study was also examined that the age, teaching level and gender were not strongly related to their TPACK perceptions.

IV. Objectives of the Study

1. To assess the level of Technological Pedagogical Content Knowledge (TPACK) of Pre-Service Teachers.
2. To compare the Technological Pedagogical Content Knowledge (TPACK) of Male and Female Pre-Service Teachers.
3. To compare the Technological Pedagogical Content Knowledge of pre-service teachers among different streams (Science, Art and Social-sciences).

V. Null Hypotheses

1. There exists no significant difference in Technological Pedagogical Content Knowledge between male and female Pre Service teachers.
2. There exists no significant difference in Technological Pedagogical Content Knowledge of pre-service teachers among different streams (science, art and social-sciences).

VI. Methodology

The researcherused descriptive survey methodology for the present study. For this purpose, data have been collected from 131 Pre-service teachers, selected randomly from Aligarh Muslim University, Aligarh. Technological Pedagogical Content Knowledge scale developed by Zahra Hosseini and Kamal Anand (2012) was used for data collection. Mean (M), Standard Deviation (SD), t-test and ANOVA are the statistical techniques used in the present study.

VII. Data Analysis and Interpretation

Table 1- Showing to know the level of Technological Pedagogical Content Knowledge (TPACK) of Pre-Service Teachers.

N	Mean	Standard Deviation	Skewness (Sk)	Kurtosis (Ku)	Z-Value of Sk	Z-Value of Ku
131	204.23	15.824	-0.084	0.044	-0.39	0.10

The table-1 reveals that the mean and standard deviation (SD) of the pre- service teachers are 204.23 and 15.824 respectively. The Z-value of skewness (-0.39) and kurtosis (0.10) are underlying the standard of Z ($\pm$1.96) value (Doane and Seward, 2011). This indicates that the data is approximately normal.

Table 2- Showing the level of components wise TPACK of Pre-Service Teachers

Component	No. of Items	No. of Responses	Mean	Standard Deviation (SD)
TK	11	131	4.08	0.390
PK	07	131	3.97	0.550
CK	06	131	4.01	0.480
TPK	10	131	4.04	0.441
PCK	07	131	3.56	0.720
TCK	05	131	3.45	0.630
TPCK	07	131	3.95	0.510

Table-2 revealed that the mean score of pre-service teachers in Technological Knowledge (TK) is 4.08 that is highest value among all values and mean score of Technological content Knowledge (TCK) that is 3.45, which is lowest value. Its means pre-service teachers have deep knowledge of technology (PK) whereas pre-service teachers have less technological content knowledge. **Lee at all (2008)** also found the pre-service teachers had

moderately high confidence about their TK, CK and PK. In contrast according to **Hosseini, Z., & Anand, K. (2013)** clearly revealed that participants have high PK & PCK and low TPK in the perceived knowledge of components of TPACK.

Table 3: Showing components wise TPCK of Pre-Service Teachersin relation to their Gender

Component	Gender	N	Mean	SD	t-value	Sig(2tailed)
TK	Male	63	40.84	5.472	2.964	0.004*
	Female	68	38.03	5.381		
PK	Male	63	27.90	2.769	0.259	0.796
	Female	68	27.78	2.769		NS
CK	Male	63	23.41	2.525	-0.733	0.465
	Female	68	23.74	2.507		NS
TCK	Male	63	19.59	2.728	0.536	0.593
	Female	68	19.35	2.271		NS
PCK	Male	63	27.41	2.888	0.382	0.703
	Female	68	27.24	2.420		NS
TPK	Male	63	39.62	4.416	0.439	0.661
	Female	68	39.28	4.431		NS
TPACK	Male	63	27.16	3.470	-0.129	0.879
	Female	68	27.64	3.306		NS

*Significant at 0 .05 level

The above table-3 shows that only for Technological Knowledge (TK), the t-value (t=2.964, P<0.05) of male and female pre-service teachers is significant at 0.05 level of confidence which indicates that there exist significant difference between Male and Female Pre-Service Teachers knowledge in Technology (TK). Male pre-service teachers have high technological Knowledge in comparison to female. This was consistent with research findings of **Koh, Chai and Tsai (2010)** that male teachers had higher Technological Knowledge than female. But the table-3 also shows that all other components of TPACK such as PK, CK, TCK, PCK, TPK and TPACK have the t-values 0.259, -0.733, 0.536, 0.382, 0.439, and -0.129 respectively. All these components have greater p- values than 0.05 (P>0.05). These values are not significant at 0.05 level of confidence which indicates that there exists no significant difference between Male and Female Pre-Service Teachers in Technological Pedagogical content knowledge (TPACK).

Table 4: Showing over all TPACK of Pre-Service Teachers in relation totheir Gender

Gender	N	Mean	SD	df	t-value	Significant
Male	63	205.94	16.543	129	1.191	0.236 NS
Female	68	202.65	15.078			

Table- 4 shows that the Mean values of male and female of overall TPACK are 205.94 and 202.65. SD values of male and female of overall TPACK are16.543 and 15.078respectively. The above table-4 shows that the t-value (t=0.236, P>0.938) for pre-service male and female teachers are not significant at 0.05 level of confidence. Therefore hypothesis i.e., "There exists no significant difference in Technological pedagogical Content knowledge between male and female pre-service teachers" is accepted. **Hosseini, Z., & Anand, K. (2013), Christina (2013) and Lee et al (2008)** were also found that there is no effect of gender on TPACK but in contrast **Koh et al (2010)** show that there exists significant difference between the perceptions of male and female teachers.

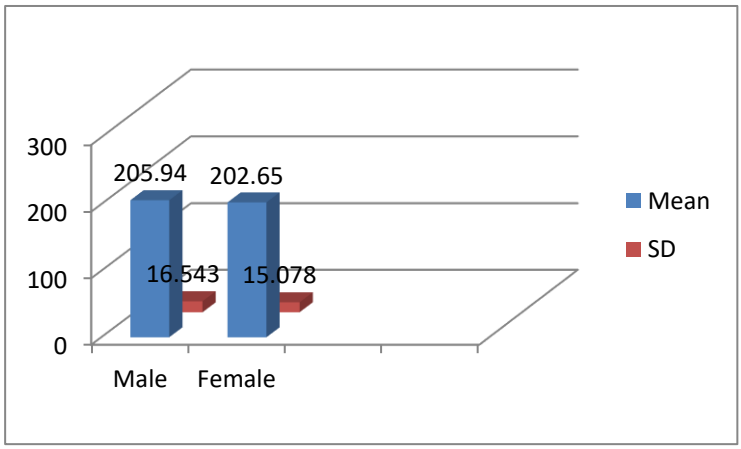

Fig. 2: Graph shows mean and standard deviation of Male and Female Pre-service teacher

Table 5: Showing TPACK of Pre-Service Teachers among different steams (Science, Art and Social-sciences)

Source of Variance	Sum of Squares	df	Mean Square	F	Significant
Between Groups	353.854	2	353.854	0.064	0.938
With in groups	32199.275	129	249.607		
Total	32553.130	130			

The above table-5 shows that the F-value (F=0.064, P>0.938) for pre-service teachers among different streams (science, art and social-sciences) is not significant at 0.05 level of confidence which indicates that there exist no significant difference among different streams (science, art and social-sciences) Pre-Service Teachers in Technological Pedagogical content knowledge (TPACK). Hence the second hypothesis, i.e., H0:2- "There exist no significant difference in Technological pedagogical Content knowledge of pre-service teachers among different streams (science, art and social-sciences)" is accepted.

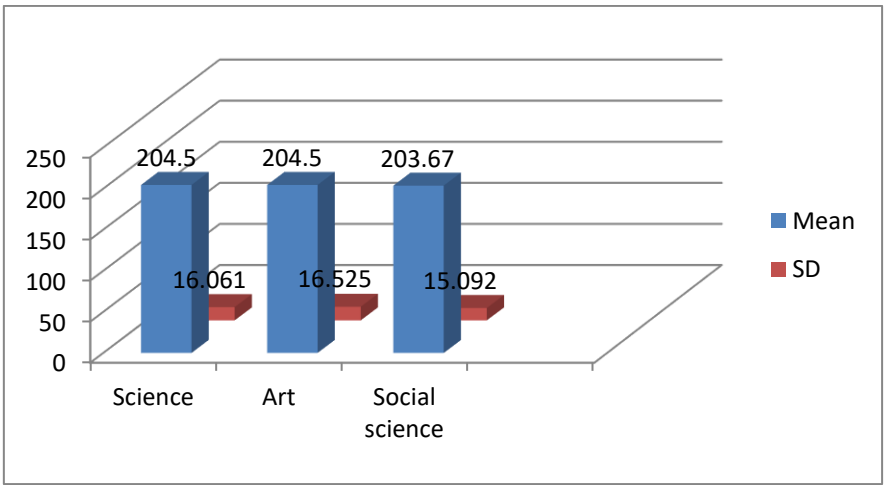

Fig. 3: Graph shows mean and standard deviation of Science, Art and Social Science Pre-service teachers

VIII. Findings and Discussion

1. TPACK of Pre-service teachers in Aligarh Muslim University fall underaverage category.
2. It can be concluded from table-2 are following:

a) Technological Knowledge (TK) of Pre- service teachers is 4.08, that is higher than the other components. It means pre-service teachers have good technological knowledge. The TK makes teachers enable to apply the technological knowledge effectively in students learning for their benefits and better increments in learning.

b) According to pre-service teachers responses they have high (4.04) Technological pedagogical Knowledge (TPK). This indicates that pre-service teachers have realised that learning and teaching both are made effective and efficient through using technological tools. TPK includes awareness of capabilities and limitations of tools in designing pedagogical strategies.

c) The average score of pre-service teachers in content knowledge (CK) is 4.01, which implies that teachers have good content knowledge, such as knowledge of concepts, theories, rules, laws and knowledge about practical approaches,

d) The mean score of Pedagogical Knowledge of Pre-service teachers is 3.97 which imply that pre-service teachers have sufficient knowledge about methodology of teaching and learning, teaching skills, teaching process and also meet the aims of subjects. In this manner they are able to contribute, to manage the classroom, educational scenario, student learning and conduct student assessment.

e) The Technological Pedagogical Content Knowledge score of pre-service teachers is 3.95, which shows that the pre-service teachers are aware of the intersection between Pedagogical Knowledge, Content Knowledge and Technological knowledge. Thus it appears that teachers could enhance teaching with unique combination of these three components of teaching i.e. content, pedagogy and technology.

f) The average scores for technological content Knowledge is 3.56. From above finding pre-service teachers have both Pedagogical Knowledge and good Content Knowledge but they seem to be less confident in transforming and applying effectively their Content Knowledge in their teaching process.

Therefore teachers having some problems while combining the pedagogical knowledge with specific content.

g) The average scores for technological content Knowledge is 3.45. The last component shows that pre-service teacher rate themselves with lower level in comparison to other components. It means that pre-service teachers have some difficulty in understanding of how technology and subject matter both correlate with each other. Therefore teachers feel to need the assistance in order to how technology use affects the subject matter. So it is very necessary to identify the technological tools which are most appropriate to specific content.

3. It is revealed from table-3 that there exists significant difference in technological knowledge (TK) between male and female pre-service teachers. Male pre-service teachers have high technological Knowledge in comparison to female.
4. With respect to overall TPACK, table-4 shows that there exists no significant difference in TPACK between pre-service male and female teach**ers**. It means there is no effect of gender on TPACK.
5. It is also indicated from table-5 that there exists no significant difference in TPACK of pre-service teachers among different streams (science, art and social-sciences). It shows that there is no effect of different streams pre-service teachers on TPACK.

IX. Conclusion

According to the results in the seven components, pre-service teachers state that their knowledge is between the values 4.08 (TK) and 3.45 (TCK). The findings of study shows that Male pre-service teachers have high technological Knowledge in comparison to female but in overall TPACK, there is no effect of male and female on TPACK. The study also indicates that there is no significant difference among different streams pre-service teachers. Data collected can help set guidelines for training programs for pre-service teachers.Conferences and Workshops on TPACK can be conducted in concerned disciplines. Short term training, orientation courses, seminars and refresher courses can be held by Human Resource Development Centre for pre-service teachers to enhance their TPACK. On the other hand, special attention should be given towards the development of appropriate educational scenarios and examples from everyday life that can improve students' learning, students' achievement & progress, teachers' work and teacher's competency.

References

Archambault, L. M., & Barnett, J. H. (2010). Revisiting Technological Pedagogical Content Knowledge: Exploring the TPACK framework. *Computers & Education*, 55(4), 1656–1662

Chai, C. S., Koh, J. H. L., Tsai, C. C., & Tan, L. W. L. (2011). Modeling Primary School Pre-Service Teachers' Technological Pedagogical Content Knowledge (TPACK) for Meaningful Learning with Information and Communication Technology (ICT). *Computers & Education*, 57(1), 1184–1193.

Graham, R. C., Burgoyne, N., Cantrell, P., Smith, L., St. Clair, L., & Harris, R. (2009). Measuring the TPACK Confidence of In-service Science Teachers. Tech-Trends, 53(5), 70-79.

Hamilton Christina (2013). An Investigation into the Relationships between the Technological Pedagogical Content Knowledge of University Teacher Education Faculty and their age, rank, and gender, Published by *ProQuest* LLC (2015)

Hosseini, Z.,&Anand, K. (2012). Developing an Instrument to Measure Perceived Technology Integration Knowledge of Teachers. *Proceedings of International Conference of Advanced Information System, E- Education & Development* (ICAISED 2012). 7-8th February 2012. Kuala Lumpur. Malaysia.

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

Koehler, M. J., & Mishra, P. (2005). What Happens When Teachers Design Educational Technology? The Development of Technological Pedagogical Content Knowledge.*Journal of Educational Computing Research, 32*(2), 131-152.

Koehler, M. J., & Mishra, P. (2008). Introducing TPCK In J. A. Colbert, K. E. Boyd, K. A. Clark, S. Guan, J. B. Harris, M. A. Kelly & A. D. Thompson (Eds.), *Handbook of Technological Pedagogical Content Knowledge (TPCK) for Educators* (pp. 3-30). New York: Routledge.

Koehler, M. J., & Mishra, P. (2009). What is Technological Pedagogical Content Knowledge? *Contemporary Issues in Technology and Teacher Education, 9*(1), 60-70.

Koh& Chai (2011). Modeling Pre-service Teachers' Technological Pedagogical Content Knowledge (TPACK) Perceptions: The Influence of Demographic Factors and TPACK Constructs. *Proceedings ascilite 2011 Hobart*, 735-746

Koh, J. H. L., Chai, C. S., & Tsai, C. (2010). Examining the Technology Pedagogical Content Knowledge of Singapore Pre-service Teachers with a large-scale survey. *Journal of Computer Assisted Learning*, 26(6), 563-573.

Lee C.B., Chai C.S., Teo T. & Chen D. (2008). Preparing Pre-service Teachers' for the Integration of ICT based Student centred learning (SCL) Curriculum. *Journal of Education* 13, 15–28.

Mishra, P., & Koehler, M. J. (2006).Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge. Teachers College Record, 108(6), 1017-1054.

Schmidt, D. A., Baran, E., Thompson, A. D., Mishra, P., Koehler, M. J., & Shin, T. S. (2009). Technological Pedagogical Content Knowledge (TPACK): The development and validation of an assessment instrument for pre-service teachers.*Journal of Research on Technology in Education*, 42(2), 27.

Shulman, L. (1987). Knowledge and teaching: Foundations of the new reform. Harvard Educational Review, 57, 1-22.

Thompson, A., & Mishra, P. (2007). Breaking News: TPCK Becomes TPACK! *Journal of Computing in Teacher Education*, 240(2), 38-64