Enhancing Teaching Skills among Pre-Service Teacher through TPACK Framework

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Abstract
Studies related with ICT integration have indicated that teachers are not efficiently trained in the use of technology. At the same time various learning technologies increasingly become available in schools, but teachers are not using them for instructional purposes. Hence researchers conducted a teachers' development programme for improving the knowledge of the Technological Pedagogical Content Knowledge (TPACK) of pre-service teachers in college of education in Maharashtra, India. The purpose of this study was to experiment the use of TPACK intervention programme in updating TPACK of pre-service teachers. The study employed a single group pre-training and post-training quasi-experimental design methodology in the collection of quantitative data from a sample of forty two Pre-service teachers which were taken as a purposive sample for the study. Data was collected using a survey questionnaire, interview and lesson plans. The study found Statistical significant differences between the scores of pre and post tests. The results indicated significant improvement among pre-service teachers TPACK. These results suggest that opportunities should be created for pre-service teachers to get acquainted with the TPACK framework during their lesson planning and practice. Further investigation will also help us to understand more about how we can help our future teachers to develop micro-teaching skills using the TPACK framework to plan and implement their lessons effectively.

Keywords: *TPACK Framework, TPACK intervention programme, Lesson plan, pre-service teacher education.*

I. Introduction

Covid-19 has brought into light that ICT plays an important role in education. Though online teaching has many challenges still it made us realize that both digital natives and immigrants have the benefit of using online teaching. Due to the fact that students are familiar with technology and they will learn better within a technology-based environment, the issue of ICT integration in schools, specifically in the classroom is vital (Ghavifekr, 2015). Nkwenti Ndongfack (2010) conducted a study on the classroom use of ICT in some public primary schools in Cameroon and the findings revealed that: i) teachers hardly use the tool to support learning across the curriculum; ii) the use of ICT for instructional processes has not kept pace with the increasing availability of the tool; iii) teachers lack technology pedagogic-integration skills. Many studies also indicated that one of the reasons for which teachers do not use the tools is because they have not been effectively trained (Nkwenti Ndongfack, 2015; Ertmer et al., 2012). Pravat (2020) stated about the current unpreparedness of teachers/students for online education. Johnson et al., (2016) suggested training on TPACK should be given to the teachers for using technology in the classroom. This is also supported by Mishra and Koehler (2006) as the 21st century teachers need three kinds of knowledge for effectively adopting ICT in their classrooms notably: technology, pedagogy and content. Without an effective on-going professional development of teachers on these knowledge domains, they might not be able to use technology adequately (Bos, 2011). Considering the essentialness of using ICT in classrooms the researchers designed a TPACK intervention programme to support development of their TPACK. The study answers the following research question-

RQ. What effect does TPACK intervention programme have on TPACK of pre-service teachers?

Hence the researchers designed a TPACK intervention programme with the objective to support pre-service teachers' development of TPACK for judiciously integrating technology in classroom practices

II. Literature review

Shulman in 1986 believed that the usual idea of knowledge in teaching is that teachers have a set of content knowledge - specific knowledge about the subject they are teaching and a set of pedagogical knowledge – knowledge about how to teach including specific teaching methods. He calls this pedagogical content knowledge or PCK (McGraw-Hill, 2019). According to Bos (2011) understandings of technology, pedagogy, and content can interact with one another to produce effective teaching with educational technologies. TPACK framework contains content knowledge (CK), pedagogical knowledge (PK), technology knowledge (TK), four interacted knowledge, pedagogical content knowledge (PCK), technological content knowledge (TCK),

technological pedagogical knowledge (TPK) and technological pedagogical content knowledge (TPACK) (Koehler & Mishra, 2006). TPACK is a Total PACKage as described by Zhang & Tang (2021) for the integration of knowledge, pedagogy and technology. It is a term used increasingly to describe what teachers need to know for effective integration of technology into their teaching practices (Schmidt, 2009). Hence, to give the understanding about the effective integration of technology for classroom instructions researchers plan the TPACK intervention programme to evaluate them on the seven constructs of TPACK.

III. Present Study

For supporting Pre-service teachers development of TPACK online TPACK intervention programme was planned and conducted using the Zoom platform (as shown in Appendix 1). An introductory session was conducted before the training session for convincing the purpose of the study and the expected work done by pre-service teachers. In this session the researchers administered the pre-training survey questionnaire to 42 Pre-service teachers to determine the previous knowledge about the various constraints of TPACK. A course was designed to give them an understanding about the gap in their knowledge for integrating technology in classrooms. Eleven online training sessions were conducted with 2 hours per session. At the end of each session the researcher shared a task. The participant had to submit the completed task before the next session on the shared drive. The various tasks gave the idea about the prospects of using various constructs. In the ninth session a sample format of TPACK lesson plan was discussed with the participants. The Pre-service teachers were requested to write a lesson plan using the given format and shared it on the drive. At the end of all the sessions the researcher administered the post-training survey questionnaire which was followed by a semi-structured interview.

IV. Methodology

This study targeted 42 Pre-service teachers from the college of education in Maharashtra, India. Single group pre-training and post-training quasi-experimental design was employed to evaluate the Pre-service teachers' technological, pedagogical and content knowledge prior to and after they took part in the TPACK intervention programme, in addition Lesson plans were analyzed using rubric based on the study conducted by Nkwenti Ndongfack (2015). An interview of ten pre-service teachers who attended all the sessions and submitted their TPACK lesson plan was conducted to know their perception towards integrating and using technology in classrooms.

Data Collection

Data was collected using -
i) Pre-Post survey instrument developed by Schmidt et al. (2009)
ii) TPACK Lesson Plans submitted by the Pre-service teachers and
iii) Semi-structured Interview

To collect the data a reliable and valid survey instrument designed by Schmidt, Baran, Thompson, Mishra, Koehler, & Shin (2009) to assess pre-service teachers' development of TPACK was administered (Nkwenti Ndongfack, 2015). The instrument uses a five-point Likert scale format (from 5-strongly agree to 1-strongly disagree). The internal consistency reliability (coefficient alpha) ranged from 0.75 to 0.92 for the seven TPACK subscales (Schmidt et al., 2009). The questionnaire comprised 47 items grouped under seven (7) constructs as shown in Appendix 2). Data was also collected from the submitted lesson plans and semi-structured interview.

V. Analysis

Analysis of the survey was done using descriptive statistics and t-test and the lesson plans were used to verify teacher-participants' self-reported knowledge of technology, pedagogy and content using a rubric which is based on the study conducted by Nkwenti Ndongfack (2015). And content analysis was used for the analysis of the interview. These analyses are discussed in detail in the below sections.

i) Analysis of survey

Table: 1
Mean of the pre-training and post-training constructs.

Construct	N	M1	M2	SD1	SD2	Gains
TK	42	2.29	4.05	0.66	0.54	1.76

CK	42	3.89	4.03	0.74	0.78	0.14
PK	42	4.12	4.35	0.65	0.47	0.23
PCK	42	4.17	4.45	0.85	0.67	0.28
TCK	42	2.05	3.9	0.79	0.69	1.85
TPK	42	2.2	4.01	0.66	0.53	1.81
TPACK	42	2.1	3.96	0.88	0.55	1.86

Table 1 shows the descriptive statistics of the variables being tested for statistical significance. It compares the mean of the pre-training (M1) and post-training scores (M1) on each construct. Comparing mean of pre-training and post-training scores, it can be observed that the mean scores of post-training are higher as compared to mean scores of pre-training. Gain shows an increase in the mean scores of TK, TCK, TPK and TPACK (>1) as compared to CK, PK, PCK (<0.3) after the training programme. It shows that Pre-service teachers reported an increase in their knowledge of technology, pedagogy and content after the training programme.

Figure: 1

Mean and standard deviation of each construct in the pre-training

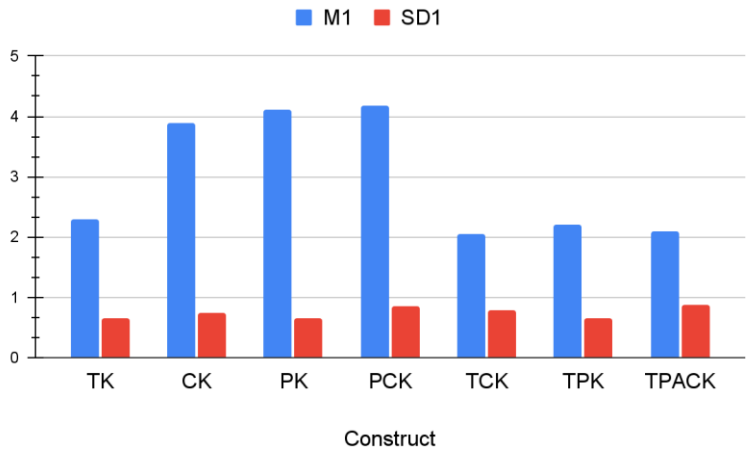

Figure 1 depicts 42 pre-service teachers' pre-training scores in seven constructs presented in terms of mean and standard deviation. Four constructs: Technological Knowledge (TK); Technological Content Knowledge (TCK); Technological Pedagogical Knowledge (TPK) and Technological Pedagogical Content Knowledge (TPACK) recorded lower mean (M1 < 3.00) than the constructs of; Content Knowledge (CK); Pedagogical Knowledge (PK) and Pedagogical Content Knowledge (PCK) which is recorded as (M1 >3.00).

Figure: 2
Mean and standard deviation of post-training constructs

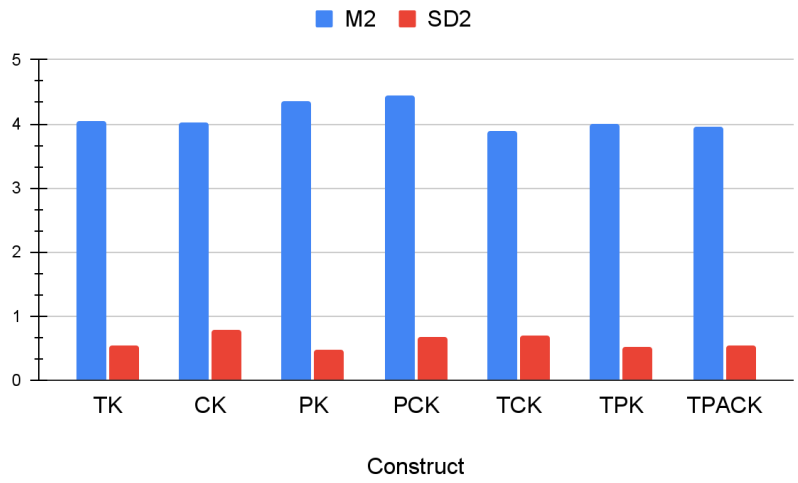

Figure 2 depicts 42 pre-service teachers' post-training scores in seven constructs presented in terms of mean and standard deviation. Four constructs: Pedagogical Knowledge (PK); Pedagogical Content Knowledge (PCK); Technological Pedagogical Knowledge (TPK) and Technological Knowledge (TK) recorded higher mean (M2 > 4.00). On the other hand, the constructs of; Technological Content Knowledge (TCK); and Technological Pedagogical Content Knowledge (TPACK) recorded slightly lower mean (M2< 4.00) than the previous constructs. The standard deviation for all the constructs is SD2< 0.8. A small standard deviation indicates that there was very little variation or deviation from the mean.

Figure: 3
Mean of the pre-training and post-training constructs

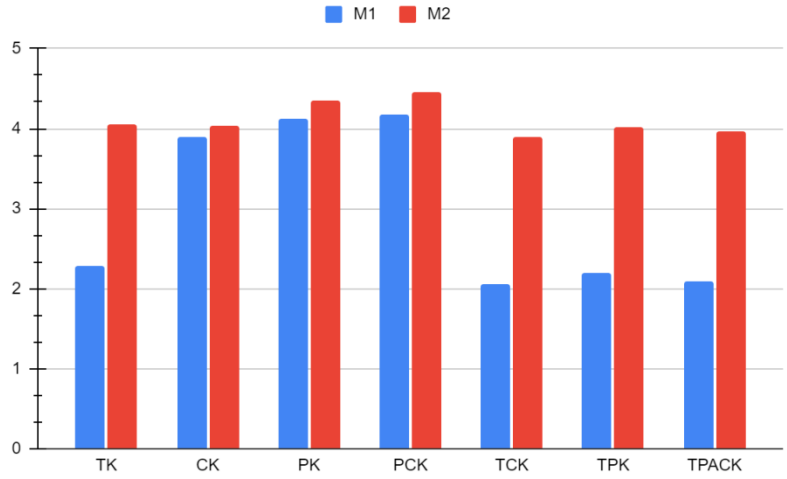

Figure 3 compares the M1 and M2 scores of TK, CK, PK, PCK, TCK, TPK and TPACK recorded during the pre-training and the post-training. M1 is the mean of each construct recorded during the pre-training and M2 represents the mean of each construct recorded during the post-training. The graph shows that the mean of each construct in the post-training improved as compared to those of the pre-training. From the chart it can be observed that the technological constructs improved more than the other constructs, it may be interpreted as the TPACK intervention programme focused more on them. To confirm if there is any statistically significant difference, the paired sample t-test was used. Data was first evaluated for satisfying the conditions of assumptions for homogeneity and reliability.

Table: 2
Test of Levene's test of Homogeneity

Source	SS	df	MS	
Between-treatments	191.87	1	191.87	F = 3.72
Within-treatments	4227.08	82	51.55	
Total	4418.95	83		

No violation of the homogeneity of variances assumption was detected in a Levene's test, F = 3.72, p = 0.057. The result is not significant at p < .05. The requirement of homogeneity is met.
The total experience data passed the Shapiro-Wilk test for normality (S-W = .95, df = 42, p = 0.07 for the Pre-test; S-W = 0.98, df = 42, p = 0.49 for the Post-test).

Table: 3
Paired-sample test.

	Observed	Confidence Intervals		t	df	P
		0.95	0.99			
$Mean_a$	119.24	±3.07	±4.10	+13.92	41	<.0001
$Mean_b$	84.29	±4.35	±5.82			
$Mean_a - Mean_b$ [Assuming equal sample variances.]	34.95	±5.07	±6.78			

Table 3 presents the results of the paired-sample t-test. It can be observed that the (t=13.92, 1, 41); p< 0.05; 2-tailed significance value is <.0001. The difference between the 2 means is 34.95. It was therefore concluded that there was a statistically significant difference between the scores. Therefore, the result may be interpreted as pre-service teachers' TAPCK improved and the change observed in the post-training mean is due to the participation in the TPACK intervention programme. This finding is in parallel to the study conducted by Ndongfack (2015).

At the end of the training ten Pre-service teachers were interviewed. The interviews were audio recorded and later transcribed verbatim. The interview was based on views towards integrating and using technology in the classrooms. The interview questions were based on views towards technology integration, knowledge about technological resources/tools, TPACK lesson plan and its constructs.

ii) Analysis of Interview
Analysis of Interview was done using content analysis which is based on the study conducted by Kurt, G. (2016). For the data analysis of the interview, codes were derived from the interview questions. These codes were about the views of Pre-service teachers towards technology and technology integration into teaching, TPACK lesson plan, and its constructs.

All participants reported that they understood the importance of integration of content, pedagogy and technology in education. They also understood how to plan and implement the lesson using TPACK. They found all tasks challenging and it helped them while designing the TPACK lesson plan.

More than half (7 0f 10) participants wished to integrate technology in their classroom teaching. They are of the opinion that teacher education programmes should include the TPACK framework in the curriculum. Few participants (2 of 10) mentioned that implementation of technology will help to engage students of various learning styles. Some participants (3 0f 10) found its use for blended learning. One of the participants claimed that the infrastructure of the classroom should not remain a concern for implementing technology, as we have experienced during Pandemic that technology can be a boon for education. Another participant claimed that

TCK and TPK are equally important as CK and PK for teaching the students of the 21st century. One of the participants shared that virtual labs in Science and Mathematics will give first hand learning experiences, further added online educational games helps the learner to practice the mathematical problems. A few participants (2 of 10) shared their views as implementation of useful digital tools as in-class or out-class activities will expand learning opportunities for the students. Most (8 of 10) of the participants realized that strong CK, PK and TK are essential for TPACK. The participants reported that for designing the TPACK lesson plan they searched for educational videos on YouTube, online gamification tools (2 of 10), interactive worksheets (4 of 10), Virtual labs (2 of 10) and they came across varied educational content. Further added, it puzzled them for choosing the appropriate content for engaging the learner. While designing the lesson plan the timely feedback was of great help. Everyone shares that experience plays a major role while designing the lesson plan of TPACK. One participant responded that selection of the appropriate online content depends upon the content which has to be delivered in the classroom, the way in which it is going to be delivered, also the classroom environment. Another participant shared that due to the pandemic the college conducted an online internship programme during which they came across difficulty of engaging the students and of using various tools and the supportive gadgets.

iii) Analysis of Lesson plan

Table 4 shows the performances of forty-two pre-service teachers in the TPACK lesson plans which they developed during the TPACK intervention programme. Below section discusses the analysis according to the constraints of TPACK.

For CK - It can be observed that the subject matter of the most of the lesson plan (34 = 80.95%) produced by pre-service teachers was designed correctly and appropriately spelt out. Whereas pre-service teachers show (8 = 19.05%) minimal appropriateness. The general weighted mean on the content Knowledge of the pre-service teachers is 2.81 with an interpretation of “has strong knowledge”.

For PK - More than half (33 = 78.57%) pre-service teachers designed the lesson plans using appropriate pedagogy considering the content. Some of the pre-service teachers (8 = 19.05%) plan their lesson plan with minimum appropriateness. And one pre-service teacher had not chosen appropriate pedagogy. The general weighted mean on the Pedagogical Knowledge of the pre-service teachers is 2.76 with an interpretation of “has strong knowledge”.

For TK - Additionally, more than half (22 = 53.48%) of the lesson plans were clearly designed and used computer applications that enhanced the lesson comprehension. Whereas some pre-service teachers (18 = 42.86%) show minimal TK for using computer applications which will enhance the lesson comprehension. Whereas remaining pre-service teachers were found lacking TK. The general weighted mean on the Technology Knowledge of the pre-service teachers is 2.48 with an interpretation of “has strong knowledge”.

For PCK - Exactly half pre-service teachers (21 =50%) designed their lesson plan appropriately with a blend of content and pedagogy approaches to achieve the goals of the lesson. While some pre-service teachers (20 = 47.62%) show minimum appropriateness for blending the content and related pedagogy. While one pre-service teacher was unable to blend the content and pedagogy. The general weighted mean on the Pedagogical content Knowledge of the pre-service teachers is 2.48 with an interpretation of “has strong knowledge”.

For TCK - More than half pre-service teachers ensured that (22 = 52.38%) of their lesson plans should be aligned with computer applications with the goals of the lesson. Whereas some (18 = 42.86%) pre-service teachers show minimal alignment. While the remaining pre-service teachers were unable to align. The general weighted mean on the Technological Content Knowledge of the pre-service teachers is 2.47 with an interpretation of “has strong knowledge”.

For TPK - In the same view more than half pre-service teachers ensured that (22 = 52.38%) their lesson plans should be aligned with computer applications to support teaching approach. Whereas some (19 = 45.24%) pre-service teachers show minimal alignment. While a pre-service teacher was unable to align. The general weighted mean on the Technological Pedagogical Knowledge of the pre-service teachers is 2.38 with an interpretation of “has strong knowledge”.

For TPACK - More than half pre-service teachers ensured that (22 = 52.38%) their lesson plan should be aligned with computer applications appropriately to support teaching approaches and demonstrated appropriate blend of content, pedagogy and computer applications within the lesson plan. Whereas some (18 = 42.86%) pre-service teachers show minimal alignment. While the remaining pre-service teachers were unable to align. The general weighted mean on the Technological Pedagogical Content Knowledge of the pre-service teachers is 2.26 with an interpretation of “has strong knowledge”.

The general weighted mean on the overall TPACK construct of the pre-service teachers is between 2.26 - 2.81 with an interpretation of “has strong knowledge”. These responses are aligned to the statement of Santos & Castro (2021) as pre-service teachers show strong knowledge on all the areas of TPACK.

Table: 4
Assessment of lesson plans developed during the pre-service TPACK intervention programme.

Construct	Statement	Not at All	Minimal	Strong	N	Mean	SD
CK	Subject matter of the lesson designed correctly and appropriately spelt out	0	8 19.05%	34 80.95%	42	2.81	0.4
PK	Appropriate pedagogical approaches to support learning chosen	1 2.28%	8 19.05%	33 78.57%	42	2.76	0.48
TK	Clear design or use of computer application(s) that enhance(s) the lesson comprehension	2 4.76%	18 42.86%	22 53.38%	42	2.48	0.6
PCK	Appropriate blend of content and pedagogical approaches to achieve the goals of the lesson	1 2.28%	20 47.62%	21 50%	42	2.48	0.55
TCK	Align computer application(s) with the goals of the lesson	2 4.76%	18 42.86%	22 52.38%	42	2.47	0.59
TPK	Appropriate use of computer application(s) to support teaching approach	1 2.38%	19 45.24%	22 52.38%	42	2.38	0.55
TPACK	Appropriate blend of content and pedagogy and computer application(s) within the lesson plan.	2 4.76%	18 42.86%	22 52.38%	42	2.26	0.59

VI. Discussion

The present study comprises the effect of the TPACK intervention programme on the 42 pre-service teachers. In the beginning a pre-training questionnaire was administered to see the gap on seven constructs of TPACK. The result shows a better mastery of pre-service teachers on CK, PK and PCK before the training programme. On the contrary the results reported their weak knowledge with respect to related technological constructs of TPACK. After the implementation of the TPACK intervention programme the pre-service teachers show improvement in all the seven constructs as observed in the post-training questionnaire which is also seen in the data of the rubrics. This means the implementation of the programme was effective, which was supported by Darkwa & Agyei (2021).

The improvement in performance can be attributed firstly, to the design of the programme. As the researchers design the programme taking into consideration the gap which they observed from the results of the pre-training questionnaire. Secondly, the timely feedback from the researchers helped them improve, as they shared during the interview. Thirdly, the interaction of pre-service teachers at the end of every session with the researchers, with their colleagues and with the content helped them to perform better (Moore, 2009). And lastly as the pre-service teachers conducted their internship lessons during the pandemic and faced many problems as reported in interview they may have taken the programme seriously.

Though analysis of the lesson plan of some pre-service teachers shows minimal to no improvement on the constructs it may be interpreted as the students having minimal performance may have lower performance earlier and after the feedback they perform better. Also those participants lower on CK, PK and TK show lower performance on TCK, TPK and TPACK. Which may be interpreted as the knowledge of content, pedagogy and technology are the basis for their integrated knowledge which was also shared by pre-service teachers during the interview.

The result of the post questionnaire and the rubrics shows an improvement in TCK. It can be interpreted as pre-service teachers beginning to think which online tool will be appropriate to engage the learner and fulfill the objectives of the study, which is also reflected in interviews as they were searching for videos, gamification tools, interactive worksheets and Virtual labs. The post questionnaire and the rubrics show an

improvement in TPK which is related with the appropriate use of technology for the teaching approach. TPK was also taken into consideration by the pre-service teachers as they shared in an interview that they were thinking about the selection of appropriate tools on the basis of the content delivery and the surrounding atmosphere.

The general weighted mean on the overall TPACK construct of the pre-service teachers which is indicated by the analysis of the lesson plan is 52.38% which is the same for their TPK and TCK (52.38%) with an interpretation of "has strong knowledge". Whereas the percentage of Pre-service teachers having minimal scores on TPK (45.24%) and TCK (42.86%) shows significantly the same percentage of scores on TPACK (52.38%) with an interpretation of "has minimal knowledge". It means TPK and TCK influences the application of TPACK (Santos & Castro 2021).

VII. Conclusions

According to Parkes et al., (2015) today's learners are at ease and familiar with digital technology. Hence the 'digital native' generations who have entered the teaching profession should be able to quickly adapt to the online teaching challenges and are expected to be relatively competent in using online teaching applications (Prensky, 2001). Considering the challenges of online teaching during covid-19 the present study implemented TPACK intervention programme and results indicated that the improvement of TCK, TPK and TPACK, depends upon teachers' CK, PK and TK. In addition, TPK and TCK influence the application of TPACK.

The improvement in the scores of lesson plan, and Post-training questionnaires was observed on the seven constraints of TPACK of Pre-service teachers. The study found more than half (52.38%) Pre-service teachers show 'strong knowledge' in the seven elements of TPACK, whereas nearly 45% Pre-service teachers show 'minimal knowledge' after the training programme. This can be considered as the effect of the feedback given by researchers for the improvement of their lesson plans. As instructional strategies and teaching aids (Naziri, et al. 2019 & Slavin, 1995) show positive effect on the motivation and performance of learners, the teachers' expertise on TPACK can be used in motivating the learner using flipped, gamified, gamified flipped teaching strategies etc. and online teaching tools.

VIII. Recommendations

This study recommends pre-service teacher training for improvement of TPACK which will help in professional development which in turn positively impacts learners' motivation and outcomes.

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Appendix 1

Session No.	Implementation of TPACK intervention programme.

	Introductory session	
1	Discussion on Objectives for conducting the intervention Expected work done by pre-service teachers Administered the pre-training survey questionnaire	
Understanding TPACK Constructs		
Topic		Task
2	-Knowledge -CK	1. Teachers have content knowledge 2. Learners come to class with their own content knowledge. -What is the role of the teacher considering the above sentences? -Explain the difference between teachers' and learners' CK.
3	PK	What criteria should be considered while choosing an appropriate teaching strategy?
4	PCK -Models of PCK- -Lee Shulman's (1986, 87); Magnusson et al (1999)	What do these models mean in practice for - - pre-service & experienced teachers' PCK? - How can a pre-service teacher become an expert?
5	TK	Is it enough to know how to use the technologies? -How will it assist your class? Write your opinion.
6	TCK	What criteria should be considered while choosing an appropriate technology?
7	TPK	What is the need to know pedagogical approaches while using technology in the classroom?
8	TPACK	Write the need and suggest strategies for its implementation in the classroom?
9	Designing of TPACK Lesson Plan	Prepare a lesson plan based on TPACK as per your method and medium.
10	Administered the post-training survey questionnaire	
11	Semi structured Interview	

Appendix 2

Strongly Disagree = SD Disagree = D Neither Agree/Disagree = N Agree = A Strongly Agree = SA					

	Pre Score					Post Score				
Items	SD	D	N	A	SA	SD	D	N	A	SA
Technology Knowledge (TK)										
1. I know how to solve my own technical problems.										
2. I can learn technology easily										
3. I keep up with important new technologies.										
4. I frequently play around with technology.										
5. I know about a lot of different technologies.										
6. I have the technical skills I need to use technology.										
7. I have had sufficient opportunities to work with different technologies.										
Content Knowledge (CK)										
8. I have sufficient knowledge about mathematics.										
9. I can use a mathematical way of thinking.										
10. I have various ways and strategies of developing my understanding of mathematics.										
11. I have sufficient knowledge about social studies.										
12. I can use a historical way of thinking.										
13. I have various ways and strategies of developing my understanding of social studies.										
14. I have sufficient knowledge about science.										
15. I can use a scientific way of thinking.										
16. I have various ways and strategies of developing my understanding of science.										
17. I have sufficient knowledge about literacy.										
18. I can use a literary way of thinking.										
19. I have various ways and strategies of developing my understanding of literacy.										

Pedagogical Knowledge (PK)										
20. I know how to assess student performance in a classroom.										
21. I can adapt my teaching based upon what students currently understand or do not understand.										
22. I can adapt my teaching style to different learners.										
23. I can assess student learning in multiple ways.										
24. I can use a wide range of teaching approaches in a classroom setting.										
25. I am familiar with common student understandings and misconceptions.										
26. I know how to organize and maintain classroom management.										
Pedagogical Content Knowledge (PCK)										
27. I can select effective teaching approaches to guide student thinking and learning in mathematics										
28. I can select effective teaching approaches to guide student thinking and learning in literacy										
29. I can select effective teaching approaches to guide student thinking and learning in science.										
30. I can select effective teaching approaches to guide student thinking and learning in social studies.										
Technological Content Knowledge										
31. I know about technologies that I can use for understanding and doing mathematics.										
32. I know about technologies that I can use for understanding and doing literacy.										
33. I know about technologies that I can use for understanding and doing science.										
34. I know about technologies that I can use for understanding and doing social studies										
Technological Pedagogical Knowledge (TPK)										

35. I can choose technologies that enhance the teaching approaches for a lesson.										
36. I can choose technologies that enhance students' learning for a lesson.										
37. My teacher education program has caused me to think more deeply about how technology could influence the teaching approaches I use in my classroom.										
38. I am thinking critically about how to use technology in my classroom										
39. I can adapt the use of the technologies that I am learning about to different teaching activities										
Technological Pedagogical Content Knowledge (TPACK)										
40. I can teach lessons that appropriately combine mathematics, technologies, and teaching approaches.										
41. I can teach lessons that appropriately combine literacy, technologies, and teaching approaches.										
42. I can teach lessons that appropriately combine science, technologies, and teaching approaches.										
43. I can teach lessons that appropriately combine social studies, technologies, and teaching approaches										
44. I can select technologies to use in my classroom that enhance what I teach, how I teach, and what students learn.										
45. I can use strategies that combine content, technologies, and teaching approaches that I learned about in my coursework in my classroom.										
46. I can provide leadership in helping others to coordinate the use of content, technologies, and teaching approaches at my school and/or district.										
47. I can choose technologies that enhance the content for a lesson										