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Augmenting Techno-Pedagogical Competencies of Pre-Service Trainees for Designing E-Content through Collaborative Training Model

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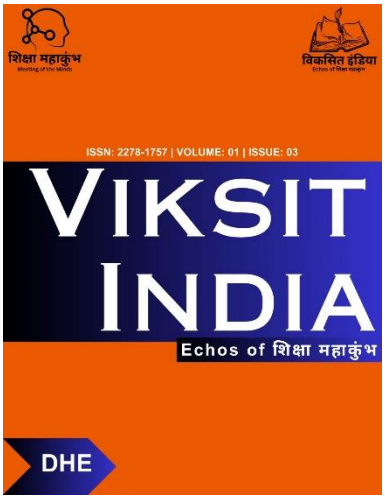

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Abstract

Purpose: The present research work tried to develop a new training model "collaborative teaching model" (CTM) for would-be teachers and teacher educators to be trained and competent enough in the present era of technology-driven teaching-learning environment along with the theoretical knowledge of the things.

Design/Methodology/Approach: For this researcher employed the quasi-experimental design with single group pre and post-test. Data was collected from the sample of 34 pre-service trainees (M.Ed. & B.Ed. Students) by employing the single group pre-test and post-test design.

Findings: The findings of the study discovered a significant difference in the overall Technological Pedagogical and Content Knowledge (TPACK) competencies in the experimental group, along with three other subdimensions of the Technological Pedagogical and Content Knowledge (TPACK) that is technology-based instructional preparedness, technology-mediated Presentation skills and competencies, and technology-based evaluation competencies.

Research limitations/implications: The study's findings discovered a significant difference in the overall Technological Pedagogical and Content Knowledge competencies of learners who are trained in three main aspects of content, pedagogy, and technology analysis after the intervention of Collaborative Training Model. This further indicates that if we provide sufficient skills and training to the future teachers with collaborative pedagogical approach then, it will lead to have competent and skilled teachers.

Keywords: Technological Pedagogical and Content Knowledge (TPACK), Collaborative Pedagogy, e-content.

Introduction

Teacher education is one of the vital needs for shaping the next generation of the country and the preparation of the future teachers requires multidisciplinary involvement of values and tradition of the Indian culture, along with this they should also well versed in latest advancement in technology as well as pedagogy in education (NPE, 2020). As per Shulman (1986), there should be an emphasis on organised and constructed professional development of teachers so that they reflect both on content as well as on the process of teaching by having appropriate knowledge about general and specific pedagogies. In current context, technology involvement in every field makes it as a part and parcel of modern human life, so mere knowledge of using current technology is not enough being a teacher. Teachers experienced additional challenges in the classroom as a result of technological advancements, such as how to acquire technical expertise and combine it with content, teaching, and learning in a specific environment. The technology in question is the one that can improve teachers in representing concepts, principles, or laws (Juanda, Shidiq & Nasrudin, 2021). Teachers must do more than being a technocrat that is besides having the knowledge and skill of how to use technology in the classroom they must also reflect upon the how that technology to be incorporated with reference to specific content (Mishra & Kohler, 2006). As a result, technological expertise becomes a significant part of a teacher's total understanding. Technological Pedagogical and Content Knowledge framework actually provide the construct to the teachers to think and reflect their pedagogical knowledge to use technological tools in a very constructive way so as to teach the specific content (Mishra & Kohler, 2009).

Tantrarungroj & Suwannatthachote (2012) conducted research on self-efficacy and Technological Pedagogical and Content Knowledge of pre-service teachers to design digital media through instructional support of self-regulated learning for online project-based learning. About 232 pre-service teachers were taken as a sample in this experimental study where four different instructional strategies employed by the researchers. The results of the data discovered the significant difference in the pre and post test scores of self-efficacies and Technological.

Pedagogical and Content Knowledge. Further, it was also recommended that information and communication technology necessitate more consideration in the training of teachers.

Absari, Priyanto & Muslikhin (2020) investigated the effect of technology, pedagogy, and content knowledge in learning. They also tried to explore various factors that actually affects in learning of different component of the Technological Pedagogical and Content Knowledge framework. This made the authors to employ the quantitative method for the present research which involved about 200 teachers by using simple random technique. The results of the paper discovered that the ability of teachers to present concepts in the classroom learning process has a considerable impact on the ability to mix Technological Knowledge (TK), Pedagogical Knowledge (PK), and Content Knowledge (CK) in the instructional process. Besides this, it was also endorsed that the teachers should have a good understanding and ability to apply a variety of instructional strategies in the classroom. The age factor emerged in the discussions of the results to be held responsible to resist one from learning the technology knowledge.

Adipat (2021) tried to develop the Technological Pedagogical and Content Knowledge (TPACK) competencies of pre-service teachers through technology enhanced content and language integrated learning instruction by using the experimental design of single group time series on the sample of about 30 preservice teachers. The sample was selected by using simple random technique. The results of the preset research work illustrated that technology enabled content and language integrated instructions definitely enhances the Technological Pedagogical and Content Knowledge skills among the pre-service teachers. Additionally, it was also recommended that preservice teachers in teacher education programmes should be given opportunity to participate in real experiences of classroom which that let them to examine the way of using technology to support pedagogical goal, this will lead to have a better understanding of how to make the best use of technology which will improve educational techniques that have a good impact on how students engage and retain knowledge through practical application of content.

Aktas & Ozmen (2021) assessed the performance of 46 pre-service science teachers in Technological Pedagogical and Content Knowledge course of turkey and data was collected from the lesson plan as well as video recordings of lessons made by the preservice teachers. While attempting to teach science subjects with technology, the analysis indicated that Pre-Service Teachers' Technological Pedagogical and Content Knowledge implementation levels increased through total score, particularly in the items trying to guide, that provide active student participation, generating assessment and evaluation, relevance of selected teaching techniques, and precision of said assigned information/concepts.

Alimuddin et al. (2021) aimed to research the enhancing pedagogical expertise & content knowledge through a blended model of Pedagogical Content Knowledge (PCK) with the help of action learning. The quasi-experimental research design had been used with pre and posttest analysis of 40 high school teachers. It was found in the analysis that blended model of reflective Pedagogical Content Knowledge (PCK) could significantly improves teachers Pedagogical Content Knowledge.

Assadi & Hibi (2020) aimed to assess the changes in the Technological Pedagogical and Content Knowledge competencies and skill of mathematics pre-service teachers. The researchers took the sample of 22 pre-service teachers and collected the data by using different tools viz observation forms, project videos, self-evaluation form, interviews and instructional plans. After the analysis of the data, it was revealed that progress in Technological Pedagogical and Content Knowledge components seen when pre-service teachers try to build their lesson plans by using GeoGebra in their training programme.

Darkwa & Agyei (2021) focused on the development of Technological Pedagogical and Content Knowledge in pre-service teachers by integrating audio visual aids in teaching concepts of accounting. With this objective, the researchers selected sample of 80 participants by using purposive sampling technique. The data was collected by using the Technological Pedagogical and Content Knowledge questionnaire for pre-service teachers along with interview guide and lesson artefacts designed by pre-service teachers. Both the qualitative as well as the quantitative analysis of the data had done which further depicted that the audio video lessons designed by pre-service accounting teachers have developed their Technological Pedagogical and Content Knowledge competencies after going through professional development training. As a result, the study proposed that strengthening teachers' Information & communication Technology (ICT) skills will be included in the creation of professional development plans for both aspiring and practicing teachers.

In the study, Kirana & Nabhan (2021) explored the in-service English teachers' perspective about Technological Pedagogical and Content Knowledge through the case study method. The sample was selected by using purposive sampling technique through three techniques namely unstructured interview, observation, and documents. The results of the study found that each teacher had his or her own perspective on technology pedagogical content knowledge and most of the teachers believed that various initiatives to be taken up by the government through seminars, workshops, and other professional development programme in order to support teachers' Technological Pedagogical and Content Knowledge competencies.

Juanda, Shidiq, & Nasrudin (2021) inspected the readiness of the biology teachers in order to face online learning process during the Covid-19 outbreak. For this, the data was collected from the sample of 121 biology teachers by using purposive sampling technique through questionnaire as well as online interview. The findings of the study indicated that biology teachers have sufficient knowledge of skills to implement the Technological Pedagogical and Content Knowledge in the online learning whereas there is need to improve in technologies capacities so that they will be able to create their own instructional videos, animated videos, evaluation tools and other practical works in virtual laboratories on their teaching learning process.

Kim et al. (2021) carried their research on analyzing teacher competency with Technological Pedagogical and Content

Knowledge for K 12 AI education. They recommended that teacher competencies for K-12 Artificial Intelligence (AI) education based on the findings of assessing the Technological Pedagogical and Content Knowledge (TPACK) framework that is used to create Artificial Intelligence (AI) courses and resources. It was also suggested that teachers of Artificial Intelligence (AI) should use Technological Pedagogical and Content Knowledge to create, plan, and support project-based lessons that incorporate Artificial Intelligence technology to address problems.

Koyuncuoğlu (2020) explored and compared the Technological Pedagogical and Content Knowledge of graduate students with respect to gender, graduate education level and field. Researcher used the convenient sampling for selecting the sample of 196 from master and doctorate level of education. In this research paper, causal comparative and correlation research design was employed. The data was collected by using the Technological Pedagogical and Content Knowledge Scale developed by Mishra and Kohler in 2006. It was discovered through analysis of the data that there exists a gender difference in the Technological Pedagogical and Content Knowledge competencies. Along with this it was also indicated that perception related to Technological Pedagogical and Content Knowledge (TPACK) competencies varied as per the graduation level in education and type of field which may include natural sciences, social sciences, and educational sciences. With the above insight, it was suggested that at the university level the primary concerns of the education should be the involvement of interactive and innovative technique with the help of information and communication technologies especially at the graduate level.

Naparan & Alinsug (2021) in their research study examined various classroom strategies for multigrade teachers. For this purpose, they selected about six multigrade schools as a sample where at least two grades were handled by single teachers. The data was collected by using semi structured face to face interview. The results of the study revealed that among various other strategies technology integration found to be one of the useful and beneficial strategies to teach students in the multigrade classroom. Further, it was also explained that technology plays an important role as through the use of technology in the classroom and could be seen as a sequence of processes towards the more effective use of technology to improve instruction and learning.

Saria et al. (2021) tried to examine that how reflective practices can be effective strategy in enhancing the Technological Pedagogical and Content Knowledge (TPACK) competencies of in-service teachers. The authors employed the qualitative research method in the narrative enquiry by using multiple sources including interviews, observation, and reflective journals. The findings of the present research work revealed that the relationship between content knowledge (CK) and technological skills (TK) led to the development of technological content knowledge (TCK), in which teachers learned to analyze how usage of technology corresponds to students' demands for learning the subject.

Thappa & Bailya (2021) presented the futuristic implications of the Technological Pedagogical and Content Knowledge in their research article. The authors defined the framework and its seven separate components with this insight, as well as the value of the framework for many stakeholders who are directly or indirectly involved in the field of education. Furthermore, the current article advised that curriculum and pedagogy to be reframed in pre-service and in-service programmes, as well as solid infrastructure and practical skills, to be provided with the appropriate teacher training programmes that leads to develop technological and pedagogical skills among them.

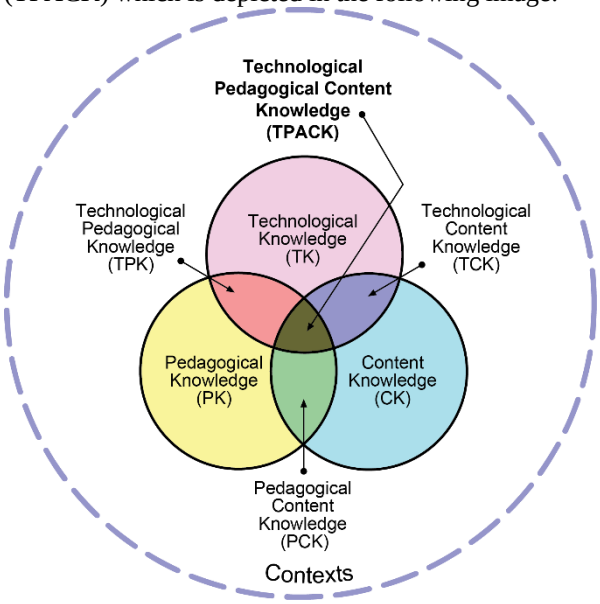
Thappa & Baliya (2021) carried out an investigation with the goal of determining the level of awareness of technological pedagogical and content knowledge among pre-service teachers. The authors of this work used a descriptive exploratory research method on a sample of 100 pre-service applicants at both the undergraduate and graduate levels to accomplish this. According to the findings of the study, students at both the undergraduate and graduate levels have individualized levels of awareness about each component, but they are unmindful of the entire framework. It was also suggested that we provide teachers with the necessary skills and competences to integrate technology into specific material in accordance with suitable pedagogy.
Thohir et al. (2021) led the research work with an objective of exploring the relationship between the personality traits and Technological Pedagogical and Content Knowledge Web of pre-service teachers. The data was collected from the sample of 309 pre-service teachers from nine different universities which was selected by using random sampling technique. The analysis of the collected data revealed that there exists a significant correlation between the personality traits and Technological Pedagogical and Content Knowledge web. Further it was also recommended in the present research work that there is need to develop the favorable traits before integration of web based Technological Pedagogical and Content Knowledge competencies among pre-service teachers.

The authors of the present paper lays their worthful effort in developing competencies related to Technological Pedagogical and Content Knowledge (TPACK) framework at pre-service level which also recommended by various research studies in their suggestions Thohir et al., 2021; Thappa & Baliya, 2021; Darkwa & Agyei, 2021; Aktas & Ozmen 2021 and such experimentation for developing the techno-pedagogical practices will lead to have a solution of the problem which is right in front of us in the form of providing effective online learning environments. With this insight, there is a potent need for the Technological Pedagogical and Content Knowledge (TPACK) competencies among teachers both at pre-service and in service level of teacher education especially in the Indian context as per the variability in terms of geography, culture, social structure, and technological disparities.

Theoretical Background

Teachers play a significant role in moulding the future of any nation; however, teacher education has been questioned in the past for its usual too technical and outdated pedagogy, which is not applicable in modern India where digitalisation has revolutionary brought change in every sector (Dangwal & Srivastava, 2016). The integration of technology in teaching is not an easy task as the nature of technology is dynamic and ever evolving so we must find solution of

wicked problems to be faced by teachers in choosing right combinations of technologies, teaching approaches and instructional goals (Mishra & Kohler, 2008). Mishra and Kohler (2006) with other academicians added one more component to Shulman's idea of Pedagogy and Content Knowledge that is considered as the heart of teaching. They added one extra component in Pedagogical Content Knowledge (PCK) construct of Shulman which is Technology and came out novel theory & construct that is Technological Pedagogical and Content Knowledge (TPACK) which is depicted in the following image:



Source: http://tpack.org

This framework comprised of three core components namely Technology, Pedagogy and Content and the interaction between and among these core components gave another four components which are equally important as the core components named as Technological Content Knowledge (TCK), Pedagogical Content Knowledge (PCK), Technological Pedagogical Knowledge (TPK) and Technological Pedagogical and Content Knowledge (TPACK).

- **Technological Knowledge (T)-** This component includes the knowledge and familiarity of hardware and software approaches related to various technological tools which may include the basic technology tools like books, charts, flashcards etc. and advanced technology tools like use of Internet, Video creations and editing, using various educational software and applications.
- **Pedagogical Knowledge (P)-** The other main component of this framework is the pedagogical knowledge which may include the awareness and knowledge about various processes, methods and techniques of transaction the content, besides this, it also includes knowledge and strategies of managing the classroom, designing the lessons plans along with its implementations with the help of educational theories, laws and practices.
- **Content Knowledge (C)-** It implies the knowledge about the understanding of the actual subject matter to be taught. Content knowledge in the TPACK refers to the actual subject matter having theories, laws, principles and rules must be in the knowledge of an individual.
- **Pedagogical Content Knowledge (PCK)-** It embraces the understanding of the two core components that is content and pedagogy and the fundamental question while thinking about the relationship between content and pedagogy is how disciplines differ from one another and if disciplines can or should be taught using the same instructional methodologies (Mishra & Kohler,2008).

In mathematical form we can write

$$PCK = P \cap C$$

Where, P is the Pedagogical Knowledge
C is the Content Knowledge

- **Technological Content Knowledge (TCK)-** This component emerged by having an interaction between the content and technology component as it allows an individual to select the technology according to the nature of the content, availability of the resources and need and requirements of the child's learning. Teachers, according to Mishra and Kohler, must understand which technologies are best suited for addressing subject-matter learning in respective disciplines, as well as how content influences or even transforms technology, and vice versa. The mathematical expression of this component can be written as

TCK= T∩C

Where, T is the Technological Knowledge
C is the Content Knowledge

- **Technological Pedagogical Knowledge (TPK)-** Third interaction between the rest two components i.e., technology and pedagogy gave the TP component where the teaching approaches to be taken into consideration while using the particular technology. Knowing the pedagogical benefits and risks of a variety of technological tools in connection to discipline and proper educational styles and methods is an example of this. This necessitates a fuller insight of technological limitations and possibilities, including the disciplinary contexts in which they operate (Mishra & Kohler). In the form of mathematics, we may write

TPK = T∩P

Where, T is the Technological Knowledge
P is the Pedagogical Knowledge

- **Technological Pedagogical and Content Knowledge (TPACK)-** The prime intersection among three main components leads to give the TPACK Framework which forms the focus point of thinking for the whole community of teaching and learning. This component tries to go beyond the mere isolated knowledge of the things as it will give the construct and thinking ideas to the teachers to reflect on the pedagogical analysis for the suitable technology of the particular subject matter so that effective and optimal learning of the students has been achieved. We may express this mathematically as

TPACK= T∩P∩C

Where, T is the Technological Knowledge, P is the Pedagogical Knowledge and C is the Content Knowledge.

Collaborative Pedagogy

The practise of collaborative pedagogy is not new, it is also known as co-teaching or team teaching, has existed for a while under many names. It is defined as such way of teaching where two or more than two teachers, educators, instructors, or mentors who are experts in their respective content; teach to the same group of students. Teachers who employ collaborative learning strategies play a different role now. In a collaborative atmosphere, teachers operate as experts who build academic programmes for students, as instructors or mentors, particularly in the emergent learning process, rather than as experts who transfer knowledge to the students (Laal, Kermanshahi & Laal, 2014). Some of the tangible and intangible elements of collaborative teaching as per Tannock (2009) may include as follows:

- Develop written schedules for the classroom
- Scheduled meetings
- Specific questioning techniques
- Reviewing student work; these are some tangible things for collaborative experiences in the process of teaching learning. Whereas, the intangible elements of the collaborative teaching are mentioned as follows:

✓ Listen and hear
✓ Common vision
✓ Mutual respect
✓ Nurturing relationships

Teachers who collaborate in terms of teaching with common goal and vision should meet frequently, respect each other's perspectives, plan together, analyse student progress, continually examine, and improve their vision, and convene as a team of encouraging professionals. Collaborative pedagogy suggests working with each other in a way that considers and emphasizes each person's strengths, skills, and contributions to the group. Members of the group share power and take accountability for the acts of the group. A learning exercise is only considered Collaborative pedagogy helps in learning that includes various aspects of positive interdependence, significant engagement, individual accountability, social skills, and group processing (Laal, Kermanshahi, & Laal, 2014). The use of online learning is both a solution and a problem for teachers who are not ready or could integrate technology, pedagogy, and subject knowledge (TPACK) into learning during the COVID-19 outbreak (Juanda, Shidiq, & Nasrudin, 2021). Thus, Technological Pedagogical and Content Knowledge (TPACK) is the emerging paradigm which needs an insight of all teachers, teacher educators, professors, and other persons in teaching profession for the online learning platforms.

Statement of the Problem

While realising the emergence of technological involvement in the teaching learning process due the outbreak of the COVID-19, teachers at every level should have competency related to Technological Pedagogical and Content Knowledge (TPACK) framework. With this thought process, the title of the study is stated as "Augmenting Techno-Pedagogical Competencies of Pre-Service Trainees for Designing E-Content through Collaborative Training Model."

Objectives of the Study

- To study the efficacy of Collaborative Training Model (CTM) on Techno-Pedagogical Competencies among pre-service trainees.
- To suggest some educational implications based on the findings of the study.

Hypotheses of the Study

Following are the hypotheses of the present research work:

1. There will be no significance difference in pre and post test scores of pre-service trainees in technology based instructional preparedness competencies after the intervention of Collaborative Training Model.
2. There will be no significance difference in pre and post test scores of pre-service trainees in technology driven motivation competencies after the intervention of Collaborative Training Model.
3. There will be no significance difference in pre and post test scores of pre-service trainees in technology mediated presentation skills & competencies after the intervention of Collaborative Training Model.
4. There will be no significance difference in pre and post test scores of pre-service trainees in technology-based evaluation competencies after the intervention of Collaborative Training Model.
5. There will be no significance difference in pre and post test scores of pre-service trainees in overall Techno-Pedagogical Competencies after the intervention of Collaborative Training Model.

Research Method and Procedure

In the present research study, the investigators employed the quasi-experimental design with single group pre and post-test. The following research design has been used in the study

Table 1: Showing the Research Design Employed

Research Design			
Experimental Group	Pre-Test	Intervention	Post-Test

The research procedure for conducting the experiment includes the following phases:

1. **Pre testing phase**: In this stage of the experiment, the researcher(s) initiated the pre testing of the dependent variable that is techno-pedagogical competency so that the after effect of the intervention has been assessed by comparing the initial and final competencies among pre-service teacher trainees.
2. **Intervention phase**: After the pre testing, the participants in the experimental group had been given the intervention mainly related to the components of the Technological Pedagogical and Content Knowledge (TPACK) framework through Collaborative Training Model (CTM) which can be done at three levels:

a) **Collaboration at Trainers level**: Firstly, there is collaboration at trainers' level where all the trainers collaboratively decided the schedule for the intervention along with the specific topic to be taught as per their expertise.

b) **Collaboration at Trainees Level**: Secondly, the collaboration at the trainee's level by engaging them in collaborative group for the various task and assignments related to experimentation.

c) **Collaboration at Training Strategies**: Thirdly, such training strategies to be adopted by the trainers that helps in collaborative learning thus, not only making the students as active learners but also makes them actors in the process of learning which subsequently make the role of trainers as guide and facilitators.

d) The intervention in the present research work had been done in the following ways:

- **Content Analysis**: Sequencing of the content, splitting up into the digestible form for students
- **Analysis of the content for suitable pedagogical approach**: Make students aware of framing the instructional objectives in terms of behavioural form, different approaches for framing behavioural objectives.
- **Practical knowledge of various technological tools for creating e-content**

➢ PDF/Transcript Creation: Microsoft tool, Google Docs
➢ Audio file Creation Apps: Audicity, Recorder
➢ Video Creating and Editing Tools: Filmora, Inshot Editor, Kinemaster

- Discussion Forum Tools: Google Classroom, Padlet, Blog and Kialo
- Evaluation Tool: Kahoot, Google Forum and Quizizz

3. **Learning by Design phase**: The learning by design phase is given by Mishra and Kohler (2008) as it includes the learning by doing concept. Here, the participants were advised to select the subject of their expertise and do the things in the following manner:

- Content analysis
- Pedagogical analysis
- Technological Analysis

The participants must create the e-content by using the four quadrants of online course by selecting the technological apps as per the nature of the content so that learning will become more effective and optimal for the target audience.

4. **Post testing phase**: After the submission of the e content assignment task by each participant, the researcher again applied the Techno-pedagogical tool for assessing the positive change in the skill and competencies among pre-service teacher trainees.

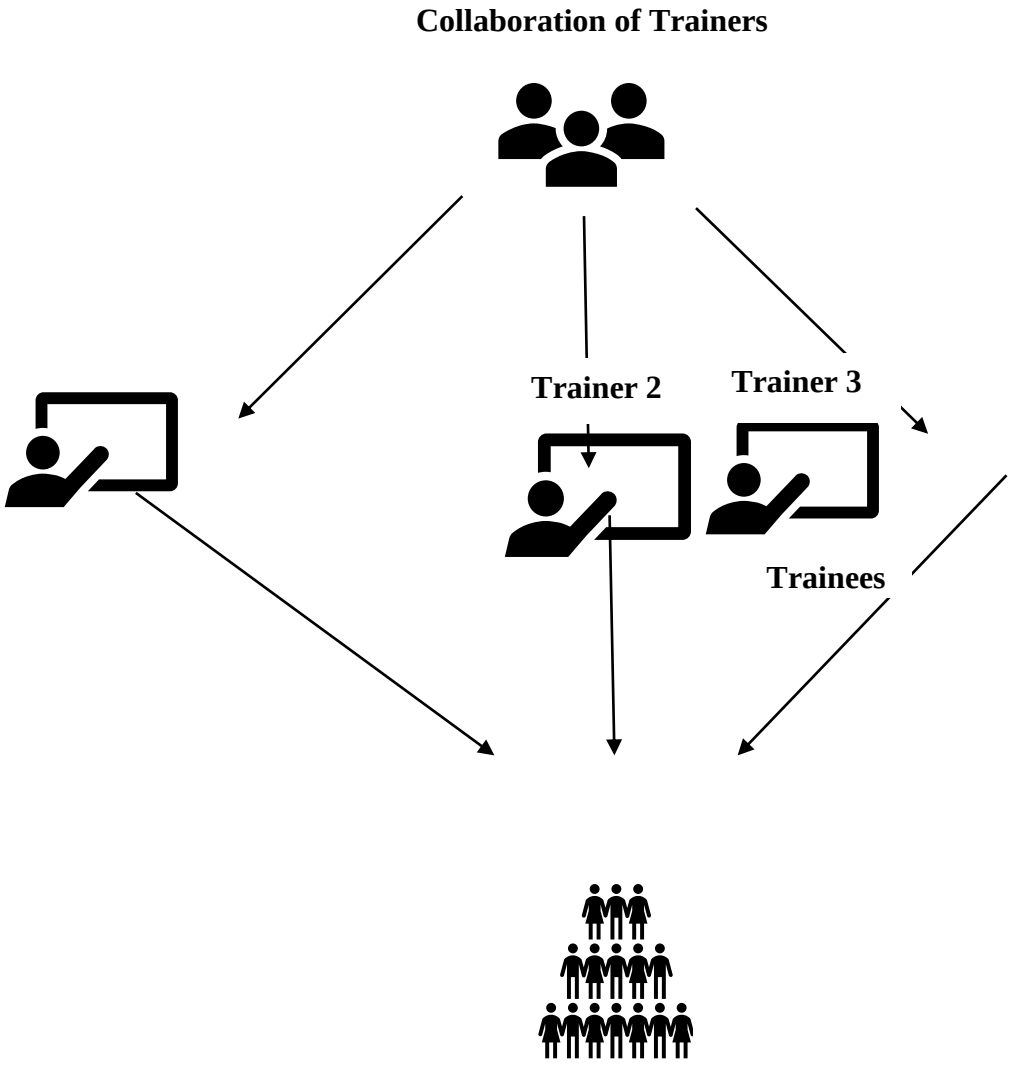
5. **Data Structure Used for the Collaborative Training Model**

Suppose

- Other Educational Applications: G comprise, Avogadro, 3D Bear, AR Solar System, NROER, DIKSHA etc.

T= Batch of pre-service trainees
S= Set of Students involved in Training
L= Set of Learning Activities
C= Set of Collaboration of Trainers
A= Set of Activities brought by trainers and needed to be selected as per the level and relevancy of their content
B= Set of selected activities for the students in the training programme,
F= Set of activities to be involved in the creation of e-content

Assume
$T= (t_1, t_2, t_3 \ldots\ldots\ldots t_n)$
Consider Set $S= (s_1, s_2, s_3 \ldots\ldots\ldots\ldots s_n)$, $S \subset T$, $n(T) \geq n(S)$
Where, $s_1 \cap s_2 = \emptyset$ & $\bigcup_{i=1}^{n} S_i \in T$
C is Set of Collaboration of Trainers. $C = \{C_j\}$, j=1,2,3…...5
Order pair (C_i, L_j), where $Ci \in C$ and $Lj \in L$
Let the cardinality of Set F = n
Cardinality of Set C= m
n/m= y= cardinality of B So, $\bigcup_{i=1}^{n} Bi$



Sample of the Study

The participants in this case study were 34 PSTs (M.Ed. and B.A.-B.Ed. students) who attended a two-week e-content designing workshop which was taught in the third semester of their 2nd year as they pursued a postgraduate and undergraduate degree in teacher education in India. Researchers chose them based on a suitable sampling approach of easily accessible subjects. Because the researcher was able to reach the participants more easily in their institution, the study's reliability enhanced. Furthermore, prior to the investigation, the Institution granted research approval. The participants were informed about the research's objectives, their data confidentiality was assured, and they consented to the use of their collected data. Moreover, participation in the study was completely voluntary. These PSTs had completed various pedagogy courses in their earlier undergraduate programmes, such as teaching science, social science, and commerce, among others.

Tool Used

Data collection was done by using an instrument in the form of scale was modified as per need; Techno-pedagogical Competency Scale by Dr. S. Rajasekar & K. Sathiyaraj (2013). The scale comprised of forty statements and further categorize under four dimensions namely technology in preparation for teaching, technology in providing motivation, technology in presentation and technology in evaluation.

Analysis and Interpretations

For the analysis of the data, the authors have employed the t-test for the present research work:

Table 2: Depicting the t-Value between Pre-Test and Post-Test Situation of Experimental Group in Technology based Instructional Preparedness Competencies

Technology based Instructional Preparedness Competencies	**Situation**	**Mean**	**r**	**t-value**	**Result**
	Pre test	33.44	0.74	3.37**	Hypothesis 1 Rejected
	Post test	37.35			

***Significant at 0.05 level** ****Significant at 0.01 level**

As per table 2, t value between the mean scores in technology based instructional preparedness competencies of experimental group for pre and post-test situation came out to be 3.37, which is more than the value at 0.01 level of significance (i.e., 2.58). Hence, the difference between the mean scores of technology-based instructional preparedness competencies of experimental group in pre and post-test is significant at 0.01 level of significance. Thus, the hypothesis 1 stating that there will be no significance difference in pre and post test scores of pre-service trainees in technology based instructional preparedness competencies after the intervention of Collaborative Training Model.is rejected. It means that skills and competencies of pre-service trainees in relation to technology involvement for the preparation of teaching has been enhanced by giving some intervention/training effectively.

Table 3: Depicting the t-value between Pre-Test and Post-Test Situation of Experimental Group in Technology Driven Motivation Competencies

Technology Driven Motivation Competencies	**Situation**	**Mean**	**r**	**t-value**	**Result**
	Pre test	35.74	0.61	0.97	Hypothesis 2 accepted
	Post test	37.79			

***Significant at 0.05 level** ****Significant at 0.01 level**

Table 3 depicted that t-value between the mean scores of pre-service trainees in technology driven motivation competencies in the pre and post-test situation came out to be 0.97, which is less than the value at 0.05 level of significance (i.e., 1.96). Henceforth, it can be said that difference between the mean scores related to competencies in technology driven motivation of experimental group in pre and post-test is not significant even at 0.05 level of significance. Thus, the hypothesis 2 stating that there will be no significance difference in pre and post test scores of pre-service trainees in technology driven motivation competencies after the intervention of Collaborative Training Model is accepted. It further implies that competencies of pre-service trainees in providing technology driven motivation to their learners didn't change even after the intervention or we can say that they might already have those abilities to use the technology for giving motivation to learner during teaching learning process.

Table 4: Depicting the t-Value between Pre-Test and Post-Test Situation of Experimental Group in Technology mediated Presentation Skills & Competencies

Technology mediated Presentation Skills & Competencies	**Situation**	**Mean**	**r**	**t-value**	**Result**
	Pre test	35.21	0.80	3.19**	Hypothesis 3 rejected
	Post test	37.56			

***Significant at 0.05 level** ****Significant at 0.01 level**

After the analysis of the data, t-value from table 4 revealed between the mean scores of technologies mediated presentation skills through of experimental group in the pre and post-test situation came out to be 3.19 which is more than 2.58 value at 0.01 level of significance. Therefore, the mean scores difference with respect to technology mediated

presentation skills & competencies of experimental group in pre and post-test came to be significant at 0.01 level. This is analyzed from the data that the hypothesis third rejected which is stated as there will be no significance difference in pre and post test scores of pre-service trainees in technology mediated presentation skills t& competencies. It further interpreted from the data that Intervention programme of learning by design for Technological Pedagogical and Content Knowledge (TPACK) competencies has favorable impact on pre-service trainees for the proper development in presentation skill and competencies by using technology.

Table 5: Depicting the t-Value between Pre-Test and Post-Test Situation of Experimental Group in Technology based Evaluation Competencies

Technology- based Evaluation Competencies	**Situation**	**Mean**	**r**	**t-value**	**Result**
	Pre test	34.59	0.64	2.76**	Hypothesis 4 rejected
	Post test	37.82			

***Significant at 0.05 level** ****Significant at 0.01 level**

The t-value from table 5 portrayed that between the mean scores of the experimental group to use technology-based evaluation skills in the pre and post-test situation calculated as 2.76. The calculated t-value more than the value 2.58 at 0.01 level of significance. Consequently, we can say that the difference in mean scores of preservice trainees for technological based evaluation competencies to assess their learners at pre and post-test situation is significant at 0.01 level. According to the analysis, it was reflected that there will be no significance difference in pre and post test scores of pre-service trainees in technology-based evaluation competencies rejected, which is fourth hypotheses of the present research study.

Table 6: Depicting the t-Value between Pre-Test and Post-Test Situation of Experimental Group in overall Techno-Pedagogical Competencies

Overall Techno-Pedagogical Competencies	**Situation**	**Mean**	**r**	**t-value**	**Result**
	Pre test	138.50	0.83	4.02**	Hypothesis 5 rejected
	Post test	149.51			

***Significant at 0.05 level** ****Significant at 0.01 level**

From table 6, t-value represented the difference in pre and post-test mean scores of pre-service trainees in relation to overall Techno-Pedagogical Competencies is 4.02 which is more than value at 0.01 level that is 2.58. So, the mean scores difference in overall Techno-Pedagogical Competencies after the intervention of Collaborative Training Model rejected. It further interpreted from the data that Intervention programme of learning by design for Technological Pedagogical and Content Knowledge (TPACK) competencies has favorable impact on pre-service trainees for the proper development of presentation skill by using technology. This obviates the further indication of positive impact on the overall techno-pedagogical skills of the target group.

Discussion and Recommendations

The findings of the study revealed that there is an increase in the competencies of pre-service trainees in the utilization of technology based instructional preparedness by using various open educational resources like audio, video, pdf, slides etc. for specific level of students which lined with the results of Tantrarungroj & Suwannatthachote, 2012. It was also suggested in the paper that providing instructional support for online project-based learning helped pre-service teachers understand and enhance their Technological Pedagogical and Content Knowledge (TPCK) competencies by boosting their self-efficacy in creating digital media.

Whereas, when we talk about the competencies among the pre-service trainees related to provide motivation to their learner by using technology shows no significant improvement which is contradiction to the results of the Aktaş & Özmen, 2021. The reason behind this might the participants were already having skills and competencies related to give motivation to students by using proper technological involvement.

Competencies of experimental group in pre and post-test situation came to be significant at 0.01 level. This infers that the fifth hypothesis which is stated as 5. There will be no significance difference in pre and post test scores of pre-service trainees in overall Techno-Pedagogical

Besides this, there is a significant growth in the technology mediated presentation skills and abilities among pre-service trainees as they were engaged in designing the lesson plan so that learned things may turn into practice. This also develop an insight and reflective thinking among target audience to align their lesson as per the construct of Technological Pedagogical and Content Knowledge (TPACK) framework, which aligned with the findings of Sointu et. al., 2016. They discovered that lesson planning, pedagogical techniques, and appropriate ICT tools for presenting lesson content in problematic circumstances such as non-formal settings, as well as systematic feedback from experts, appear to be helpful in Technological Pedagogical and Content Knowledge (TPACK). This strategy, in particular, encourages pre-service teachers to work together to negotiate the difficult TPACK (Technological Pedagogical and Content Knowledge) framework.

While talking about the competencies of pre-service trainees in evaluation which is more of technology based has also improved after the intervention which means that if teacher education programme made suitable space for practicing things in the assessment and evaluation of learners then they will develop enough potentialities to use it effectively during their teaching learning process.

This finding goes with the finding of Aktaş & Özmen, 2021, which clearly elaborated in their corresponding study that by TPACK (Technological Pedagogical and Content Knowledge) lesson plan definitely brought significant

improvement in the assessment and evaluation as it was cleared from their before and after presentation of the lesson plan. On the other hand, when we talked about overall and complete skills and competencies of Technological Pedagogical and Content Knowledge (TPACK) framework, it consequently has significant effect after the intervention of the TPACK (Technological Pedagogical and Content Knowledge) based learning by design module which goes with the findings of Joan, 2013; Darkwa & Agyei, 2021; and Agyei & Keengwe, 2012.

Conclusion

It can be concluded that duty of the contemporary teacher in the twenty-first century is substantially different from that of former teachers, whose primary objective was to impart wisdom to individuals. Although people now can access the content through search engines, knowledge is being digitised or made openly available, and jobs are fluctuating rapidly, teachers must help students become lifelong learners and manage sophisticated methods of thinking and functioning that computer cannot readily replace. When preparing teachers to teach with technology, these highlights demonstrate that teachers' TPACK (Technological Pedagogical and Content Knowledge) is a requirement for effective use of ICT in the classroom, and that the framework has the potential to develop teachers' experiences and the set of competencies they need to successfully integrate technology into their educational practises. (Sointu et. al., 2016).

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