A STUDY OF RELATIONSHIP BETWEEN TECHNOLOGICAL PEDAGOGICAL CONTENT KNOWLEDGE (TPACK) AND TECHNOLOGY ANXIETY OF STUDENT TEACHERS OF UNIVERSITY OF CALICUT

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Abstract: *Information and Communication Technology (ICT) offer countless technological instruments that have power to enhance the teaching-learning scenario. The latest technologies like augmented reality and second life provide children real world experience of learning contents. But, how far the teachers and student employ technology in teaching and learning is a question to be explored. Adoption of technology in the process of teaching-learning, requires knowledge in three basic aspects; technology, pedagogy and content. Comparatively a recent terminology introduced by Koehler & Mishra, technological pedagogical content knowledge (TPACK), explicates the knowledge of person in these components. Technological pedagogical content knowledge (TPACK) is defined as "a framework of teacher knowledge for technology integration. Teacher knowledge is defined as a complex interaction and intersection among three bodies of knowledge within the framework of TPACK: content, pedagogy and technology" (Koehler & Mishra, 2008). Someone who desire to adopt technology is expected to possess proficiency on these components, but many of them take it for granted. At the same time, those who are proficient, really wont employ technology for many reasons; one among is technology anxiety. In this context, the present research investigates the student teachers TPACK and its relationship on their technology anxiety. The study revealed, relationship exist among TPACK and technology anxiety of male student teachers.*

Key Words: *Technological Pedagogical Knowledge (TPACK), Technology Anxiety.*

1. INTRODUCTION:

In the traditional old classroom, students were passive listeners. They sit quiet, listens the class lecture, receive the information and are reproduced in various contexts mainly in term end evaluation tests to qualify for getting admission in higher classes. Such an era has given prominent place and respect for the teacher community. Whatever the teacher communicate is considered and treated as the profound knowledge and students were eager in getting new and newer knowledge. Teachers were considered to be the treasure house of knowledge. But as time passed, there has been a tremendous change in the way knowledge is generated, transmitted, shared and acquired. Nowadays, we won't wonder if we say, a class can be conducted even without the physical presence of a teacher. We have reached such a situation where, students have opportunity to receive information in multiple ways.

The present day leaner community is tech savvy and they spent huge amount of their time engaged with electronic devices especially in internet. The magical world, 'internet', is able to provide any information as the client wish. In teaching- learning process both teacher and students have equal role to produce a fruitful result. If we keep on using the old traditional devices of teaching-learning, we would end up producing a younger generation that would find difficult to cope up with the changing demands of the competitive world. The world today is demanding skills and competencies that enable any individual to excel and perform at workplaces and at places of living. It is the educational institution where children develop these abilities. When educational institutions fail to perform the designated functions, it disappoints the whole functionaries and meaningless generations are fabricated.

Today the condition is so pathetic that, many of the educational institutions are not performing the way they were expected to work and perform. It is a reality that the teaching –learning has turned to a mechanical activity. The teacher community is busy in completing the curriculum workload, which goes beyond the academic year. Students pay less attention to the classroom learning activities as they love to experience learning via modern electronic gadgets. This has created a big dilemma. Thus the curriculum makers and policy planners has emphasized the need of ICT in teaching-learning and much effort is put in place to adopt electronic and modern internet related strategies in teaching –learning. But it remains in papers and policy statements. Even though, we have exceptional cases of educational organizations that effectively make use of ICT in teaching-learning activities.

Schools have a great role in molding and developing the cognitive capabilities of any children. The cognitive domain expands as children acquire new knowledge and experiences. But the question lies in the delivery of presenting

experiences. As discussed, in early days, teachers were presenting learning contents and they enjoyed a dominative role in the classrooms. But the scenario changed. Children prefer learning in multiple ways and modern devices and internet are inseparable to their learning culture. But it is sad to say, still many teachers fail to organise technical rich classroom learning activities. A science teacher can make use of virtual classroom to demonstrate experiments that are practically impossible. A history teacher can show the collection of historically important personalities via internet. We can enlist many more examples. But, still teachers prefer to follow the traditional classroom style. Why is it so? If we analyze the reasons, we could see that, the teacher education colleges show reluctance in training the teacher trainees to use modern teaching devices.

For the last few years, Technological Pedagogical Content Knowledge (TPACK) has become the buss word in teaching learning. What is TPACK? The technological pedagogical content knowledge is abbreviated as TPACK and refers to the knowledge of teacher that they posses in three areas technology, pedagogy and content while integrating a technical device in teaching. The term TPACK has originated from the studies conducted by Shulman's (1986) related to pedagogical content knowledge abbreviated as PCK. Thus TPACK is defined as "Technological Pedagogical Content Knowledge (TPACK) is basically defined as a framework of teacher knowledge for technology integration. Teacher knowledge is defined as a complex interaction and intersection among three bodies of knowledge within the framework of TPACK: content, pedagogy and technology" (Koehler & Mishra, 2008; Mishra & Koehler, 2006). Thus it is recommended that, every teacher should posses TPACK to judiciously employ a technological device in teaching learning.
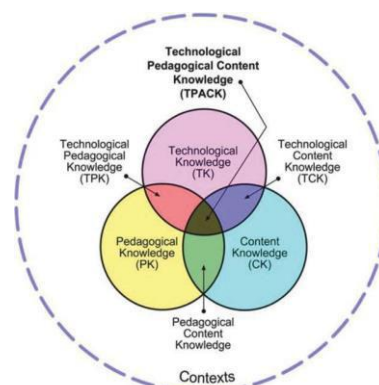

Figure 1. The components of the TPACK framework (graphic from http://tpack.org)

The second aspect of adopting technology in classroom depends on the psychological parameter, the anxiety of teachers. In the case of technology, a more apt term would be the   "Technology Anxiety". "Technology anxiety is a negative emotional state or a negative cognition experienced by an individual when he/she uses technology or technology equipment" (Bozionelos, 2001).Even if, teachers own skill of utilizing technology, many tend to deviate as they are anxious. This is one of the driving forces to continue lecturing classes. This may be reduced by providing adequate amount of hands owns experiences during the training period. The present study is an attempt to identify the TPACK and technology anxiety levels of student teachers. Similarly the relationship among these variables will also be explored.

2. NEED AND SIGNIFICANCE OF THE STUDY:

What is the status of knowledge of teachers regarding educational technology and other ICT components? This is to be understood in two ways i.e. the knowledge of a school teacher who uses ICT in the real teaching-learning context and the knowledge of a teacher educator, who prepare the future teachers capable of handling and directing the younger generations. If the teacher educators himself lack the quality to train teacher trainees to make use of ICT deceives during professional, training sessions, we would end up in developing inefficient teacher trainees (future teachers) who find hard to use technology in real teaching –learning context. Thus, the knowledge of various aspects of technology is unavoidable with regard to the whole teacher community including teacher trainees.

In the present study, the investigator felt that the knowledge of teacher trainees regarding ICT has to be subjected to research. Technological pedagogical content knowledge refers to the knowledge of an individual in technology, pedagogy and content. If a teacher wish to use any technology to transact any particular topic, he/she is expected to have profound knowledge in content which he/she teach, the pedagogy to transact the selected topic and the technology suitable to deliver that content. It is not that, the teacher can use any technology. Whenever a teacher selects any technology to deliver a particular content, the three factors, knowledge in technology, knowledge in pedagogy and knowledge in content is to be taken care off. Hence a teacher is expected to have proficient knowledge

in these three factors. From where will the teacher practice such a skill? Teacher education colleges are the place. It is the teacher education colleges, who impart necessary skills in using technology effectively. But whether the teacher education colleges perform such activities?   Keeping this view, the investigator has decided to identify the technological pedagogical content knowledge level of teacher trainees.

It is not that, teacher-training institutions do not show interest in providing training to use ICT devices. We have exceptional case of institutions that show attention to make their teacher trainees get trained in the use of educational technologies. Nevertheless, what is the mental status of teacher trainees, who is put in a situation like; he/she should use educational technology in teaching-learning. Being an individual, if we use any electronic device for the first time, we may feel little annoyed. This situation is psychological in nature. In some case, it grows like; few of individuals dare to use ICT devices for teaching- learning. Do the teacher trainees possess any kind of psychological disturbance in using technology for teaching –learning. Keeping this view, the investigator has chosen technology anxiety as the second variable of the study.

3. RESEARCH QUESTIONS:

The present study is designed to find answer to the following research questions:
1. Do the teacher trainees possess technological pedagogical content knowledge to effectively use any ICT device for teaching-learning
2. Do teacher trainees possess anxiety while using technology for teaching-learning?

4. STATEMENT OF THE PROBLEM:

In the present days, teacher education institutions give much emphasis to train their learners in using technological devices for teaching-learning. But unfortunately many of the teacher education colleges do not have adequate number of latest technological devices and ICT labs. This hinders the training and it results in producing teachers who lack skills and qualities to handle technology oriented teaching-learning. At this context the relevance of educational technology is discussed. As we know the present generation learner is tech savvy in nature and akin to employ latest electronic devices to gather learning information's. They are keen to keep aside the textual material and instead prefer learning via materials in electronic form. In addition, they prefer to use latest web based tools for learning. At this juncture, it is obligatory on the part of researchers to study various dimensions related to technology. The present study is designed to explore the relationship between technological pedagogical content knowledge and technology anxiety of student teachers. Hence the study is titled as **"A STUDY OF RELATIONSHIP BETWEEN TECHNOLOGICAL PEDAGOGICAL CONTENT KNOWLEDGE (TPACK) AND TECHNOLOGY ANXIETY OF STUDENT TEACHERS OF UNIVERSITY OF CALICUT"**

5. DEFINITION OF KEY TERMS:
Technological Pedagogical Content Knowledge (TPACK): Technological pedagogical content knowledge (TPACK) is defined as "a framework of teacher knowledge for technology integration. Teacher knowledge is defined as a complex interaction and intersection among three bodies of knowledge within the framework of TPACK: content, pedagogy and technology" (Koehler & Mishra, 2008). In the present study, Technological Pedagogical Content Knowledge (TPACK) refers to the individual and mutual knowledge in pedagogy, content and technology required to integrate a technical device in teaching learning process.
Technology Anxiety: "Technology anxiety is a negative emotional state or a negative cognition experienced by an individual when he/she uses technology or technology equipment" (Bozionelos, 2001). In the present study, Technology Anxiety refers to irrational fear or dislike of an individual towards web technology and its use for teaching-learning activity due to some reasons either known or unknown.

Student Teachers: In the present study, Student Teachers refers to the students studying B.Ed. degree course in the colleges of teacher education affiliated to University of Calicut

6. VARIABLES OF THE STUDY:

Independent Variables: Technological pedagogical content knowledge (TPACK) and
Dependent Variable: Technology anxiety

7. OBJECTIVES OF THE STUDY:

The following are the objectives of the study:

1) To find out the level of technological pedagogical content knowledge and technology anxiety of student teachers of colleges of teacher education affiliated to University of Calicut

2) To compare the mean scores technological pedagogical content knowledge (TPACK) and technology anxiety of student teachers for the subsamples based on gender and type of institution

3) To study the relationship between technological pedagogical content knowledge (TPACK) and technology anxiety of student teachers for the total sample and subsamples based on gender and type of institution

8. HYPOTHESES OF THE STUDY:

The following are the hypotheses of the study;

1) There exists significant difference in the mean scores of technological pedagogical content knowledge(TPACK) of student teachers for the subsamples male and female, government and private

2) There exists significant difference in the mean scores of technology anxiety of student teachers for the subsamples male and female, government and private

3) There exists significant relationship between technological pedagogical content knowledge(TPACK) and technology anxiety of student teachers for the total sample and subsamples male, female, government and private

9. METHODOLOGY:

The present study is intended to collect data regarding technological pedagogical content knowledge and technology anxiety of student teachers. Since the research focus on collecting data pertaining to present situation, the method selected for the study is normative survey method.

Population and Sample
Teacher training colleges affiliated to University of Calicut offering training in graduate level teacher education programme that lead to Bachelor in Education (B.Ed.) degree, constitute the population of the study. For the present study, using stratified random sampling method 620 student teachers from two districts namely Malappuram and Calicut were selected.

Tools Used
For the present study, the following tools jointly prepared and standardized by the investigator and supervising guide were used:
- Technological Pedagogical Content Knowledge Inventory (Aruna & Kumar, 2015)
- Technology Anxiety Scale (Aruna & Kumar, 2015)

Statistical Techniques Used
In order to analyze the data collected, the following statistical techniques were used;
- Descriptive statistics like mean, median, mode and standard deviation to analyse the nature and distribution of sample
- Inferential statistics like Karl Pearson's product moment coefficient of correlation and t-test to find the relationship among variables

10. DELIMITATIONS OF THE STUDY:

The study has the following limitations:
- The study is confined to the student teachers of University of Calicut
- The study is confined to two districts of Kerala
- The study was conducted selecting second year B.Ed. student teachers only
- The study consists of only 620 samples
- The study is confined to few subsamples. The subsamples like optional subject, rural/urban, marital status were not considered.

11. RESULTS AND DISCUSSIONS:

Objective 1: The first objective was to find the Level of TPACK and technology anxiety of student teachers for the total sample. To find the level of TPACK of student teachers belonging to colleges of teacher education affiliated to University of Calicut; the conventional procedure of 'σ' distance from mean M is used. The student teachers were grouped into three groups based on the scores obtained namely High TPACK, Average TPACK and Low TPACK. High TPACK student teachers obtained scores greater than M+σ and for Low TPACK student teachers the scores

were less than M-σ. The Average TPACK student teachers obtained scores between M+σ and M+σ. The details of levels of TPACK of student teachers for the total sample are given in table 1.

Table 1

Number and Percentages of the Levels of TPACK of Student Teachers

Variable	No. of Total Student Teachers	Level of Scores	No. of Student Teachers	% of Student Teachers
TPACK	620	High	98	15.80
		Average	402	64.84
		Low	120	19.36

The table 1 reveals that among the total student teachers selected for the study, 15.80% of student teachers belong to high TPACK, 64.84% average TPACK and 19.36% low TPACK. Thus it is concluded that, majority of the student teachers falls under average TPACK group. The graphical representation of levels of TPACK is shown in figure 2
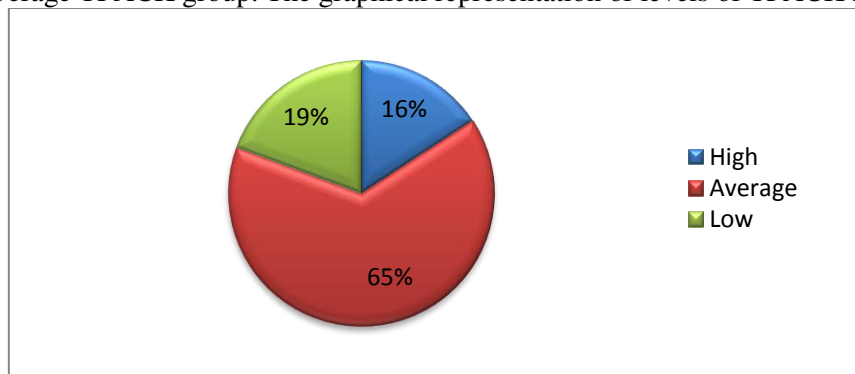

Figure 2: Pie-diagram representing levels of TPACK

Similarly to find the level of technology anxiety of student teachers belonging to colleges of teacher education affiliated to University of Calicut, the conventional procedure of 'σ' distance from mean M is used. The student teachers were grouped into three groups based on the scores obtained namely High technology anxiety, Average technology anxiety and Low technology anxiety. High technology anxiety student teachers obtained scores greater than M+σ and for Low technology anxiety student teachers the scores were less than M-σ. The Average technology anxiety student teachers obtained scores between M+σ and M-σ. The details of levels of technology anxiety of student teachers for the total sample are given in table 2.

Table 2

Number and Percentages of the Levels of Technology Anxiety of Student Teachers

Variable	No. of Total Student Teachers	Level of Scores	No. of Student Teachers	% of Student Teachers
Technology Anxiety	620	High	99	15.97
		Average	405	65.33
		Low	116	18.70

The table 2 reveals that among the total student teachers selected for the study, 15.97% of student teachers belong to high technology anxiety, 65.33% average technology anxiety and 18.70% low technology anxiety. Thus it is concluded that, majority of the student teachers falls under average technology anxiety group. The graphical representation of levels of technology anxiety is shown in figure 3
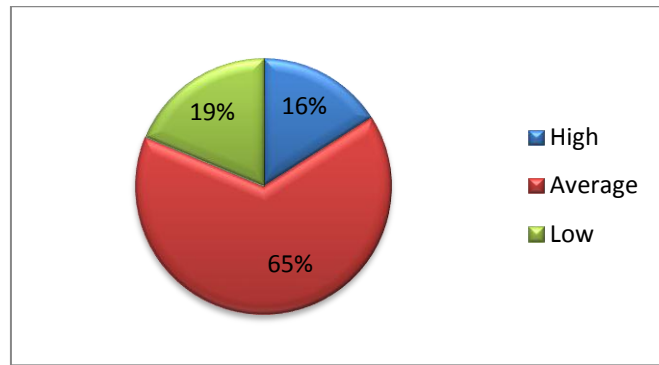
Figure 3: Pie-diagram representing levels of technology anxiety

12. TESTING OF HYPOTHESES:

Hypotheses 1: There exists significant difference in the mean scores of TPACK of student teachers for the subsamples male and female, government and private

To test the above hypotheses the collected data was grouped based on the gender and type of institution of student teachers and the mean scores and SD were calculated. After that, critical ratio was calculated to find out the difference in the mean scores of TPACK between male and government and private student teachers. The results of test are shown in table 3.

Table 3
Mean Values, SDs and Critical Ratios

Nature of Sample	Sub Sample	Number of Samples	Mean	S.D	Critical Ratio	Level of Significance
Gender	Male	82	48.29	7.033	0.021	NS
	Female	538	48.31	7.248		
Type of Institution	Govt.	79	47.70	7.572	0.807	NS
	Private	541	48.40	7.163		

The table reveals that there is no significant difference in the mean scores of technological pedagogical content knowledge (TPACK) of student teachers for the subsamples male and female, government and private. Hence the first hypothesis is rejected. Thus, it is concluded that there is no significant effect of gender and type of institution on TPACK.

Hypotheses 2: There exists significant difference in the mean scores of technology anxiety of student teachers for the subsamples male and female, government and private

To test the above hypotheses the collected data was grouped based on the gender and type of institution of student teachers and the mean scores and SD were calculated. After that, critical ratio was calculated to find out the difference in the mean scores of technology anxiety between male and government and private student teachers. The results are shown in table 4.

Table 4
Mean Values, SDs and Critical Ratios

Nature of Sample	Sub Sample	No. of Samples	Mean	S.D	Critical Ratio	Level of Significance
Gender	Male	82	51.00	11.582	0.807	NS
	Female	538	49.80	12.688		
Type of Institution	Govt.	79	46.14	11.692	2.914	Significant at 0.01
	Private	541	50.52	12.578		

The table reveals that there exists significant difference in the mean scores of technology anxiety of student teachers for the subsamples government and private. Thus, it is concluded that there is significant effect of type of institution on technology anxiety. But there is no significant difference in the mean scores of technology anxiety of student teachers for the subsamples male and female. Thus, it is concluded that there is no significant effect of gender of student teachers on technology anxiety. Hence the hypothesis is partially substantiated.

Hypothesis 3: There exists significant relationship between TPACK and technology anxiety of student teachers for the total sample and subsamples male, female, government and private.

To test the above hypotheses, the Karl Pearson's Product Moment Method was used. Thereafter t-value was found out. The data and results corresponding to independent variable TPACK and dependent variable technology anxiety are given in table 5

Table 5

Correlation between TPACK and Technology Anxiety of Student Teachers

Sample	N	r(Coefficient of Correlation)	t value	Level of Significance
Total	620	0.057	1.423	Not Significant
Male	82	0.289	2.701	Significant at 0.01
Female	538	0.026	0.602	Not Significant
Govt.	79	0.131	1.159	Not Significant
Private	541	0.043	0.999	Not Significant

The table 5 shows that, for the total sample, the coefficient of correlation is 0.057 and the value is positive. This marks that, there is an indifferent or negligible relationship between TPACK and technology anxiety of student teachers (Garret, 2007). In addition, it is inferred from the table that, the t-value corresponding to 'r' for the total sample is 1.423 and is below the table value both at 0.01 and 0.05 level of significance. Hence it is concluded that, there doesn't exist any significant relation between TPACK and technology anxiety of student teachers for the total sample.

With respect to the sub sample males, the coefficient of correlation is 0.289 and the value is positive. This marks that, there is a low or slight relationship between TPACK and technology anxiety of male student teachers (Garret, 2007). In addition, it is inferred from the table that, the t-value corresponding to 'r' for the total sample is 2.701 and is above the table value at 0.01 level of significance. Hence it is concluded that, there exist a significant positive relation between TPACK and technology anxiety of male student teachers. For the sub sample females, the coefficient of correlation is 0.026 and the value is positive. This marks that, there is a low or slight relationship between TPACK and technology anxiety of male student teachers (Garret, 2007). In addition, it is inferred from the table that, the t-value corresponding to 'r' for the total sample is 0.602 and is below the table value both at 0.01 and 0.05 level of significance. Hence, it is concluded that, there doesn't exist any significant relation between TPACK and technology anxiety of student teachers for the total sample.

With respect to the sub sample Govt., the coefficient of correlation is 0.131 and the value is positive. This marks that, there is a low or slight relationship between TPACK and technology anxiety of student teachers studying in Govt. institution (Garret, 2007). In addition, it is inferred from the table that, the t-value corresponding to 'r' for the total sample is 1.159 and is below the table value both at 0.01 and 0.05 level of significance. Hence, it is concluded that, there doesn't exist any significant relation between TPACK and technology anxiety of student teachers belonging to Govt. institutions. With respect to the sub sample private, the coefficient of correlation is 0.043 and the value is positive. This marks that, there is a low or slight relationship between TPACK and technology anxiety of student teachers studying in private institutions (Garret, 2007). In addition, it is inferred from the table that, the t-value corresponding to 'r' for the total sample is 0.999 and is below the table value both at 0.01 and 0.05 level of significance. Hence, it is concluded that, there doesn't exist any significant relation between TPACK and technology anxiety of student teachers belonging to private institutions.

As summary, it is concluded that there exists significant relationship between TPACK and technology anxiety of male student teachers. But there is no significant relationship between TPACK and technology anxiety of student teachers for the total sample and subsamples female, government and private. Hence the fourth hypothesis is partially substantiated.

13. IMPORTANT FINDINGS:

- The results revealed that, among the total student teachers selected for the study, 15.80% of student teachers belong to high TPACK, 64.84% average TPACK and 19.36% low TPACK. Thus it is concluded that, majority of the student teachers falls under average TPACK category.
- In the case of technology anxiety, 15.97% of student teachers belong to high technology anxiety, 65.33% average technology anxiety and 18.70% low technology anxiety. Thus it is concluded that, majority of the student teachers falls under average technology anxiety category.
- The study revealed that, there is no significant effect of either gender or type of institution of teacher training institution on TPACK.
- The study revealed that, there is no significant effect of gender of student teachers on technology anxiety but there is significant effect of type of institution on technology anxiety.
- The study shows that, there is no significant relation between TPACK and technology anxiety of student teachers for the total sample.
- The study shows that, there exists a significant positive relation between TPACK and technology anxiety of male student teachers but there is no significant relation between TPACK and technology anxiety of female student teachers.
- The study shows that, there is no significant relation between TPACK and technology anxiety of student teachers belonging to Govt. and private institutions.

14. CONCLUSION AND EDUCATIONAL IMPLICATIONS:

The present study was an attempt to identify the relationship between TPACK and technology anxiety of student teachers belonging to University of Calicut. The present study was conducted keeping in view the growing needs of use of ICT in the teaching learning processes. As we are aware, ICT encompasses varied types of learning gadgets and electronic equipments, which may find application in all fields of teaching and learning. But the general trend shows, comparatively lesser use of ICT devices in teaching-learning. Why is it so? One of the reasons is the lack of training of student teachers. It is observed that, adoption of ICT in teaching learning stands as a theoretical orientation and meager hands own training is organised at these institutions. Even recent policy frameworks have emphasized these drawbacks and in future student teachers would get chances to experiment ICT during their training period.

Whether our teacher educators are endowed with the skills in training the teacher trainees? Those who aspire to employ ICT in teaching learning must have profound knowledge in technology, pedagogy and content. At the same time, teacher should also be acquainted with the ways of interconnecting knowledge of technology and pedagogy, pedagogy and content, technology and content. Apart from that a teacher must be familiar with the technique of interconnecting technology, pedagogy and content i.e. technological pedagogical content knowledge. Technological pedagogical content knowledge (TPACK) has been subjected to researches and primarily many of them focused to develop scales to measure TPACK. Also the research studies centered to examine the knowledge of associated persons in various components of TPACK (Pamuk, et al., 2015& Akman, et al., 2015&Kazu, et al., 2014& Lee, et al., 2014& Liu, 2013). The results revealed that the allied communities lack knowledge in diverse constituents of PACK. In tune with the earlier research findings, the present study divulge that, the teacher trainees are incompetent and in short of knowledge in TPACK components. The results of the study is a serious concern as it has towering impact in the teaching learning irrespective of the level of education. It is identified that research studies with TPACK as a major variable is few in number which widens the scope of opening doors to numerous studies. The relationship of TPACK and personality characteristics, teaching efficiency, etc can also be explored.

The study also explored the anxiety of student teachers while they employ technology in teaching. It is found that anxiety of teacher trainees do impact the use of technology. How can a teacher training college eliminate the fear of using technology? In the present day many of the teacher education colleges has a positive attitude in training their students but it is limited to the traditional electronic gadgets like TV, radio, etc. As we know today children prefer internet as an effective medium of congregating information. Internet is a powerful tool for teaching learning and has wide range of applications. WhatsApp, social networking sites, wikis, blogs, discussion forums, etc. work in a web environment and is highly useful in communicating information. But many teachers fear to use it. One of the possible remedies is to provide intensive training in using web technologies. In such a way the practice of employing web technologies could be improved.

Based on the findings and conclusions, the investigator suggests the following recommendations that would help the associated stakeholders in improving the present educational practices.

- The teacher training must be equipped with latest web technologies and opportunities must be provided to student teachers for hands on experience.
- Student teachers would be provided with both theoretical and practical knowledge in using web technologies.

- Teacher education colleges should provide ample knowledge to their students about the various aspects of TPACK
- The concept of TPACK and its practical orientation should be provided.
- Chalk out strategies to bring down the technology anxiety of student teachers by providing sufficient practical sessions
- Student teachers should be informed about the latest technological device useful for teaching –leaning.
- Teachers should act like the role models by using web technologies during the pre-service coaching.
- Theoretical orientations integrating teaching subject with each of the components of TPACK could be arranged.
- Sessions that select single web technology and integrate it with single subject and teach could be organized.

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