



# Technological Pedagogical and Content Knowledge of Pre Service Teachers in Khordha District

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**ABSTRACT:** Effective ICT integration requires teachers to gain proficiency in TPACK. This paper focuses on assessing Technological Pedagogical and Content Knowledge of pre service teachers of Khordha district in Odisha. The purpose of this study was to assess the TPACK level of pre service teachers in teacher training institutions of Khordha district. A TPACK scale was used in this present study. Descriptive survey method was used in this present study. For this study, researcher collected data from 156 sample from 4 teacher training institution. 156 pre service teachers were selected as sample through stratified random sampling. The findings of the study show that the Technological Pedagogical and Content Knowledge have found moderate or average level in the pre service teachers of Khordha district. The study revealed that there are statistically no significant difference in the Technological Pedagogical and Content Knowledge of pre service teachers with respect to stream and degree of education.

**KEYWORDS:** Technological Knowledge, Pedagogical Knowledge, Content Knowledge, TPACK, Pre Service Teacher.

## I. INTRODUCTION

Education is considered as an active and a dynamic process which takes place continuously during one's life by way of various experiences through either in a formal or in an informal. The education system which prevails in the schools and colleges are now attesting a paradigm shift from the conventional chalk and talk teaching methodology to digitalizing the pedagogical approach through the aid of technical gadgets. The development of information technologies had brought many transformation processes in the field of education. drastic changes with the interference of information technologies are reflected well in the teaching-learning process.

Generally speaking, digital technologies give power to the learning environment and student's experience as they provide wide opportunities for qualitative thinking. Digital technologies have

proven to be supportive tools for teaching instruction and learning utilizing directive and nondirective teaching methods and to deepen the student-centered learning environment (SCLE), which gives learners the chance to explore their own needs for knowledge also, they get a chance to find their skills and give meanings to circumstances and contexts based on their prior knowledge and experiences. Due to the widespread use of technology in every aspect of life, successful technology integration has also been critical in teaching and learning practices. Much research has been devoted to the investigation of teachers' technology integration in teaching. One important focus on technology integration research has been to examine pre service teacher's knowledge about technology integration. Therefore, a considerable amount of research has investigated pre service teacher's technology integration by eliciting their knowledge of technology through self-reporting instruments such as surveys, interviews, or reflective journals (e.g., Chai, Koh, & Tsai, 2010; Lai & Calandra, 2007; Mishra & Koehler, 2005; Schmidt, Baran, Thompson, Mishra, Koehler, & Shin, 2009).

The successful integration of technology needs teacher cognition on how to do that effectively. In a technologically advanced teaching-learning environment, a teacher needs more sophisticated pedagogical practices. Teachers who chose to integrate technology into their classrooms face the difficult task of keeping up with rapidly changing technology, and confront a seemingly endless cycle of learning and relearning technology. New technologies bombard teachers from all directions. Facebook, iPhones, iPads, Flickr, blogs, cloud computing, Smart Boards, YouTube, Google Earth, and GPS devices are just some of the most recent examples. Teachers can make any tool an educational technology by re-designing it, or maybe even subverting the original intentions of the designer. In order to do so, teachers need specialised knowledge of their subject matter, pedagogical approaches, and, of course, the technological knowledge. Teachers have to improve themselves



in the fields of technology, pedagogy, and content in order to have a successful professional career (Şahin, 2011). In teaching and learning process, it is important not only how teachers teach (pedagogy) and what they teach (content), but it is also important which materials (technology) they use while teaching (Jones & Moreland, 2004). A teacher who can navigate between these interactions acts as an expert who is different than only a subject matter, pedagogy, or teaching expert (Baran, Chuang, & Thompson, 2011; Mishra & Koehler, 2006). Instead of being treated content knowledge and pedagogical knowledge as separated domains of teacher knowledge bases, they should be considered to have mutual relationships with each other (Shulman, 1987). Therefore, the Technological Pedagogical Content Knowledge (TPACK) framework to explain each aspect which is technology knowledge, content knowledge and pedagogical knowledge (Voogt, Fisser, Roblin, Tondeur, & van Braak, 2013), and the relationships amongst them was developed by Koehler and Mishra (2005) in their study. The TPCK or TPACK framework gives stress on the proper incorporation of effective technology for teaching specific content which requires thorough conceptualization of the relationships between Technology, Pedagogy, and Content.

### 1.1 THE TPACK FRAMEWORK:-

The TPACK framework was first introduced by Punya Mishra and Matthew J. Koehler in 2006. Technological Pedagogical Content Knowledge (TPACK) is a framework to understand and describe the kinds of knowledge needed by a teacher for effective pedagogical practice in a technology enhanced learning environment. The idea of pedagogical content knowledge (PCK) was first described by Lee Shulman (Shulman 1986) and TPACK builds on those core ideas through the inclusion of technology. Technological Pedagogical Content Knowledge (TPCK) was introduced to the educational research field as a theoretical framework for understanding teacher knowledge required for effective technology integration (Mishra & Koe-hler, 2006). The TPCK framework acronym was renamed TPACK (pronounced “tee-pack”) for the purpose of making it easier to remember and to form a more integrated whole for the three kinds of knowledge addressed: technology, pedagogy, and content (Thompson & Mishra, 2007–2008). The TPACK framework emphasises the blended relationships which exists between the knowledge of content, pedagogy and technology. In the present educational scenario, the TPACK

framework can act as an effective organizing frame for the professional development of teachers in educational technology.

The TPACK is a theoretical framework for understanding teacher knowledge required for an effective technology integration process (Mishra & Koehler, 2006). It describes “how teacher’s understanding of technologies and pedagogical content interact with one another to produce effective teaching with technology” (Koehler & Mishra, 2008, p. 12). The TPACK includes the knowledge of how to make concepts understandable by using technology, knowledge of how to use technology with pedagogical knowledge in order to meet the needs of students, knowledge of the difficulties in learning concepts and how to eliminate these difficulties by using technology, knowledge of students’ epistemological beliefs and background knowledge and how to increase their epistemological beliefs level by using technology (Koehler & Mishra, 2008). The TPACK represents a “thoughtful interweaving of all three key sources of knowledge; technology, pedagogy, and content” (Mishra & Koehler, 2006, p. 14). As Koehler and Mishra (2008) argue that “at the heart of good teaching with technology are three components: content, pedagogy, and technology and relationships between them” (p. 11). According to Baran, Chuang, and Thompson (2011), the TPACK “acts as a useful framework for thinking about what knowledge teachers must have to integrate technology into teaching and how they might develop this knowledge” (p. 371).

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

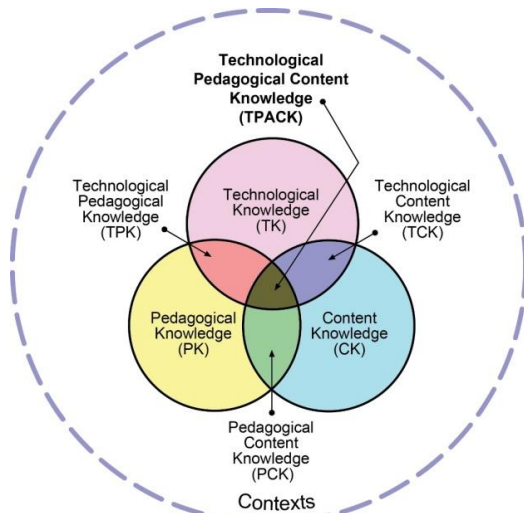
### 1.2 COMPONENTS OF TPACK FRAMEWORK:-

The term TPCK became very popular in the year 2006 after Mishra & Koehler (2006) introduced their framework. Koehler & Mishra conceptualized TPACK framework in terms of seven knowledge components. They are

- (a) Content Knowledge (CK),
- (b) Pedagogical Knowledge (PK),



- (c) Technological Knowledge (TK),
- (d) Pedagogical Content Knowledge (PCK),
- (e) Technological Content Knowledge (TCK),
- (f) Technological Pedagogical Knowledge (TPK), and
- (g) Technological Pedagogical Content Knowledge (TPACK)



COMPONENTS OF TPACK FRAMEWORK  
(From: <http://www.tpack.org/>)

## II. REVIEW OF RELATED LITERATURE

Naaz & Khan (2018) found that, both male and female differs in Technological Knowledge, but overall TPACK of pre-service teachers have no difference on the basis of gender. Similarly there exists no significant difference in Technological Pedagogical Content Knowledge of pre-service teachers among different streams (science and arts). Jeyaraj & Ramnath (2018) found that, there is a significant difference in TPACK of B.Ed. student teachers with respect to degree, access of e-content and technology usage frequency in teaching learning process. Omoso & Odindo (2020) found the results that the pre-service teachers were unsure about their technological knowledge (TK) and the specific technologies that are best suited for teaching and learning in their subject domains (TCK). The results further show that the pre-service teachers who pursue arts-based subjects reported low TK and technological content knowledge (TCK) compared to those pursuing science-based subjects. Hosseini & Anand (2013) conducted study on 236 pre service and in-service teachers to measures the Technological Pedagogical Content Knowledge (TPACK). The findings showed that participants have low Technological Pedagogical Knowledge

(TPK) and high Pedagogical knowledge (PK). The study indicated that there was no effect of gender on TPACK and its components but teaching experience and participant's field of study were significantly influenced their TPACK. Bakar et al. (2017) conducted a study on Mathematics Teachers Self-efficacy of Technology Integration and Technological Pedagogical Content Knowledge. The results of correlation for all sub-constructs in the TPACK instrument with only one sub-constructs that were TPACK show there was a strong relationship with mathematics teacher self-efficacy of technology integration. The rest of the sub-constructs (TK, PK, CK, PCK, TCK and TPK) show a moderate relationship with mathematics teacher self-efficacy of technology integration. The result of the study is Mathematics teachers self-efficacy of technology integration had a strong relationship with the TPACK construct that involved interaction of all knowledge. Bhuyan and Tripathy (2019) conducted a study on "Techno Pedagogical Skills of Batchelor of Education Students of Odisha" and they found that B.Ed students have positive and high techno-pedagogical skills in terms of learning, implementing instructional strategy and evaluation. Further, there is no significant difference found between male and female B.Ed students in techno- pedagogical skills and there is no significant difference found between male-arts and female-arts B.Ed students in their techno pedagogical skills but there is significant difference found between male-science and female science B.Ed students in their techno pedagogical skills.

## III. RATIONALE OF THE STUDY

In the modern era a teacher without the knowledge of educational technology can not be recognized as a trained teacher. So Technological Pedagogical and Content Knowledge (TPACK) is a framework to understand and describe the kinds of knowledge needed by a teacher for effective pedagogical practice in a technology enhanced learning environment. Different studies had been conducted on TPACK at national and international level. However There were less studies conducted related to pre service teacher in Odisha state. Bhuyan & Tripathy (2019) in their study they found that B.Ed students in Odisha have positive and high techno-pedagogical skills in terms of learning, implementing instructional strategy and evaluation. Further, there is no significant difference found between male and female B.Ed. students in techno-pedagogical skills and there is no significant difference found between male-arts and female-arts B.Ed. students in their techno pedagogical skills but there is significant difference found between male



science and female science B.Ed students in their techno pedagogical skills. After analysis all of studies related to TPACK, it was found that TPACK is very important for every teachers for better teaching learning process. However there were less studies conducted on TPACK related to pre service teachers of Odisha state with respect to degree and stream of education.

#### IV. STATEMENT OF THE PROBLEM

TPACK is a useful frame for thinking about what knowledge teachers must have to integrate into teaching and how they might develop this knowledge. Using TPACK as a framework for measuring teaching knowledge could potentially have an impact on the type of training and professional development experiences that are designed for both pre-service and in-service teachers. So in this study investigator try to measure the TPACK of pre service teacher in Khordha district. So the study entitled as “**TECHNOLOGICAL PEDAGOGICAL AND CONTENT KNOWLEDGE OF PRE SERVICE TEACHERS IN KHORDHA DISTRICT**”.

#### V. OBJECTIVE OF THE STUDY

- To study the Technological pedagogical and content knowledge of Pre Service Teachers.
- To study the Technological Pedagogical and Content Knowledge of Pre Service Teachers with respect to different streams (Arts and Science ).
- To study the Technological Pedagogical and Content Knowledge of Pre Service Teachers with respect to degree (Under Graduate and Post Graduate).

#### VI. HYPOTHESIS OF THE STUDY

- Ho1:- Technological Pedagogical and Content Knowledge of Pre Service Teachers is high.
- Ho2:- There is no significant difference in the Technological Pedagogical and Content Knowledge of Pre Service Teachers with respect to Stream (Arts and Science).
- Ho3:- There is no significant difference in the Technological Pedagogical and Content Knowledge of Pre Service Teachers with respect to Degree (UG and PG).

#### VII. DESIGN OF THE STUDY

##### 7.1 METHOD

The researcher used descriptive survey design for the present study. The present study was undertaken to study the Technological Pedagogical and Content Knowledge of pre-service teachers of Khordha district so the descriptive survey research method was adopted.

##### 7.2 POPULATION

In this present study the population comprises of four teacher education institutions in Khordha district of Odisha. The population comprises of 260 Pre Service teachers of four teacher education institution of Khordha District. To collect the pertinent data needed for the study, the researcher was considered the student- teachers those who are pursuing B.Ed course in these teacher education institutions i.e. (i) BJB Autonomous College, (ii) Rajdhani college, Bhubaneswar, (iii) RIE, Bhubaneswar, (iv) Rama Devi Women’s University, Bhubaneswar.

##### 7.3 SAMPLE

The investigator select 156 Pre service teachers from 4 teacher education institution of Khordha district through stratified random sampling.

SL NO	NAME OF THE INSTITUTION	SAMPLE				TOTAL
		ARTS		SCIENCE		
		UG	PG	UG	PG	
1	BJB AUTONOMOUS COLLEGE	10	10	10	9	39
2	RAJADHANI COLLEGE, BBSR	10	9	10	10	39



3	RIE, BHUBANESWAR	10	10	10	10	40
4	RAMA DEVI WOMEN'S UNIVERSITY	9	10	9	10	38
TOTAL		39	39	39	39	156

#### 7.4 TOOLS AND TECHNIQUES

In this present study the investigator collected the data from respondents by using a self made Technological Pedagogical and Content Knowledge scale which was developed by researcher with the consultation of expert for assessing TPACK of pre service teacher of Odisha. The total number of items of the scale is 34. There is no time limit for administering the Technological Pedagogical content knowledge scale.

#### 7.5 PROCEDURE OF DATA COLLECTION

The investigator visited the selected teacher education institutions to collect the data. Self developed TPACK scale was employed to collect the data from respondents.

#### 7.5. TECHNIQUES OF DATA ANALYSIS

In this study both descriptive statistics such as 'Mean, SD' & inferential statistics such as 't – test' was used to test the hypotheses.

### VIII. DATA ANALYSIS AND INTERPRETATION

**8.1 OBJECTIVE 1:** To study the Technological Pedagogical and Content Knowledge of pre service teachers.

**HYPOTHESIS 1:** Technological Pedagogical and Content knowledge of pre service teachers is high. To test the first hypothesis the following procedure is adopted. The mean and standard deviation on TPACK of the entire group was calculated.

**Table: 1**

Showing the mean and standard deviation of the pre service teachers on TPACK

Sample (N)	Score Limits	Overall Mean(M)	Overall SD
156	Highest possible score is 170 Possible lowest score is 34	135.583	10.4356

**Table: 2**

Showing the classification of the total sample with regards their knowledge on TPACK

Scores	Size(N)	%	Verbal Description
Below 125.1474	23	14.7435	Low level
Between 125.1474 to 146.0186	112	71.7948	Moderate level
Above 146.0186	21	13.4615	High level
Total	156	100%	

**INTERPRETATION:** The calculated mean and standard deviation on TPACK scores from table 1 are 135.583 and 10.4356 respectively. Based on the computed mean and standard deviation the entire group was categorized into high (above M+ 1SD), moderate (between M+1SD to M- 1SD) and low (below M-1SD).

Result from table 2 are indicating that the pre service teachers whose scores are less than (M-1SD

= 135.583-10.4356) 125.1474 were considered as having low level of knowledge on TPACK and their number is 23 i.e., 14.7435 percent. The respondents whose scores are between (M+1SD to M+1SD) i.e., 125.1474 to 146.0186 were considered as having moderate level of knowledge on TPACK and their number is 112 i.e., 71.7948 percent. The respondents whose scores are higher than (M+1SD= 135.583+10.4356) 146.0186 were



consider as having high level of knowledge on TPACK. Their number is 21 i.e., 13.4615 percent. Therefore, more than half of the pre service teachers i.e., 112 number of pre service teachers (71.7948%) are having a moderate level of knowledge on TPACK.

Hence, the formulated hypothesis is rejected.

**8.2 OBJECTIVE 2:** To study the Technological Pedagogical and Content Knowledge of pre service teachers with respect to stream i.e., Arts and Science.

**HYPOTHESIS 2:** There is no significant difference between in the Technological Pedagogical and Content Knowledge of pre service teachers with respect to stream i.e., Arts and Science.

To test this hypothesis, the following procedure is adopted. The t-test was employed to find out the statistical difference between the arts and science stream pre service teachers on TPACK.

**Table: 3**

This table is showing t-test score and df of the pre service teachers on Technological Pedagogical and Content Knowledge with respect to stream i.e., Arts and Science.

STREAM	SAMPLE (N)	MEAN (M)	STANDARD DEVIATION (SD)	t- value	Df
ARTS	78	134.73	10.261	1.02346	154
SCIENCE	78	136.44	10.605		

**INTERPRETATION:**

From the table 3 it is revealed that the calculated t-value of arts and science pre service teachers is 1.02346 with table value 1.98 at 0.05 level of significance. It indicates that the calculated t-value (1.02346) is smaller than the table value (1.98). So, the Null hypothesis is accepted. It can be concluded that there is no significant difference on the Technological Pedagogical and Content Knowledge of pre service teachers with respect to stream i.e., Arts and Science.

Hence, the formulated hypothesis is accepted.

**8.3 OBJECTIVE 3:** To study the Technological Pedagogical and Content Knowledge of pre service teachers with respect to degree i.e., under graduate and post graduate.

**HYPOTHESIS 3:** There is no significance difference between in the Technological Pedagogical and Content Knowledge of pre service teacher with respect to degree i.e., under graduate and post graduate.

To test this hypothesis, the following procedure is adopted. The test was employed to find out the statistical difference between the under graduate and post graduate pre service teachers on TPACK.

**Table: 4**

This table is showing t-test score and df of pre service teachers on Technological Pedagogical and Content knowledge with respect to educational qualification i.e., under graduate and post graduate.

EDUCATIONAL QUALIFICATION	SAMPLE (N)	MEAN (M)	STANDARD DEVIATION (SD)	t-value	Df
UNDER GRADUATE	78	137.17	9.3287	1.9132	154
POST GRADUATE	78	134	11.275		

**INTERPRETATION:**

From the table 4 it is revealed that the calculated t-value of under graduate and post graduate pre service teachers is 1.9132 with table value 1.98 at 0.05 level of significance. It indicates that the calculated t-value (1.9132) is smaller than the table value (1.98). So, the Null hypothesis is accepted. It can be concluded that there is no significant difference in the Technological Pedagogical and Content Knowledge of pre service teachers with

respect to educational qualification i.e., under graduate degree and post graduate degree.

Hence, the formulated hypothesis is accepted.

**IX. MAJOR FINDINGS**

The major findings of the study are:

The present study revealed that the Technological pedagogical and content knowledge among B.Ed students of Khordha district are moderate. It may be due to technology and internet are a part of our



life now. This findings are matched from studies of Jeyaraj & Ramnath(2018), Kumar(2017), Bas & Senturk(2018), Keçeci and Zengin (2017) because in their studies pre service teachers have moderate level of TPACK knowledge.

The study also revealed that there exist no significant difference in Technological pedagogical and content knowledge between students of Arts stream and students of Science stream. The findings of the study was different from the findings of the studies of Jeyaraj & Ramnath (2018), Bas & Senturk(2018), Omoso & Odindo(2020) Beri and Sharma(2019). Because in their studies they found that there is a significant difference between students of Arts stream and students of Science stream on TPACK. But some studies like Naaz and Khan (2018), Berber and Erdem(2015) found that there is no significant difference between students of Arts stream and students of Science stream.

The rest of the study also found that there is no significant difference in Technological pedagogical Content knowledge of pre-service teachers of Khordha district with respect to their educational qualification degree that is under graduate and post graduate. The findings of this study are similar with the findings of Naaz and Khan(2018), Kumar (2017), Berber and Erdem (2015) that there is no significant difference with respect to degree on TPACK. There are some studies which are opposed to the study findings of Bas & Senturk(2018), Omoso & Odindo(2020). In this study researcher found that the mean score of under graduate pre service teachers are higher than the post graduate pre service teachers.

#### **X. EDUCATIONAL IMPLICATIONS OF THE STUDY**

- Integration of technology, content and pedagogy knowledge helps the pre service teachers to teach and learn effectively in the present scenario.
- TPACK helps the pre service teachers to enhance their knowledge and skills which upgrade their professional development.
- Technology enhanced class room climate promotes confidence among student and encourage to learn..
- Findings of the present study is an evident that proper training may lead the TPACK level of pre service teachers from moderate to high level.
- This study will help to policy maker and Teacher Educators to take care of this area

and more emphasis should be given to development of technological and pedagogical skills and competencies of B.Ed students.

#### **XI. SUGGESTIONS FOR FURTHER RESEARCH**

- The present study was conducted on four institutes of Khordha district in Odisha, which can be extended considering population at another place.
- It was evaluating TPACK of 156 B.Ed. students, which can be extended to large numbers of sample for more comprehensiveness result and better generalization.
- It was conducted on B.Ed. student, further elementary teacher students, BA.B.Ed, B.Sc. B.Ed students, vocational, differently able students can also be considered as sample for future research.

#### **XII. CONCLUSION**

This research was carried out with a aim of assessing technological pedagogical and content knowledge (TPACK) competencies of pre service teachers of Khordha district in Odisha (India). In line with this aim the levels of TPACK competencies were studied in terms of stream of education and degree of educational qualification. Findings of the study revealed that the pre service teachers in the sample group of the study have average or moderate level of Technological pedagogical and content knowledge in general. According to the findings of the study, based on stream of education and degree of educational qualification of pre service teachers, there is no significant difference on TPACK. The study throws light into the fact that the mean of science pre service teachers is slightly higher than the arts pre service teachers, and the mean of under graduate pre service teachers is higher than the mean of post graduate pre service teachers.

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