



## A STUDY OF TECHNOLOGICAL PEDAGOGICAL CONTENT KNOWLEDGE OF SCIENCE TEACHERS AT THE HIGHER SECONDARY STAGE

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### Abstract

*This study aimed to gather knowledge about the Technological Pedagogical Content Knowledge of Science Teachers at the Higher Secondary stage in the Covid Era. A descriptive survey method has been used to collect data from the sample comprised of 202 higher secondary stage Science teachers from the Cuttack district by employing random and incidental sampling techniques. The researcher used Likert Scale to collect data from 202 higher secondary-stage Science teachers by adopting the Likert scale. The objectives of the study were, 1) to study the Technological Pedagogical Content Knowledge of Science Teachers at Higher Secondary stage, 2) to find out the Technological Pedagogical Content Knowledge of science teachers at the higher secondary stage concerning their teaching experiences, and 3) to investigate the differences in higher secondary stage science teachers' Technological Pedagogical Content Knowledge regarding the type of institution. To draw out the result, two statistical techniques were used percentage and t-test. The researcher found that there is no significant difference in the TPACK means scores of novice and experienced teachers and government and private higher secondary school teachers.*

**Keywords:** Teaching experiences, TPACK, Science Teachers, Covid Era...



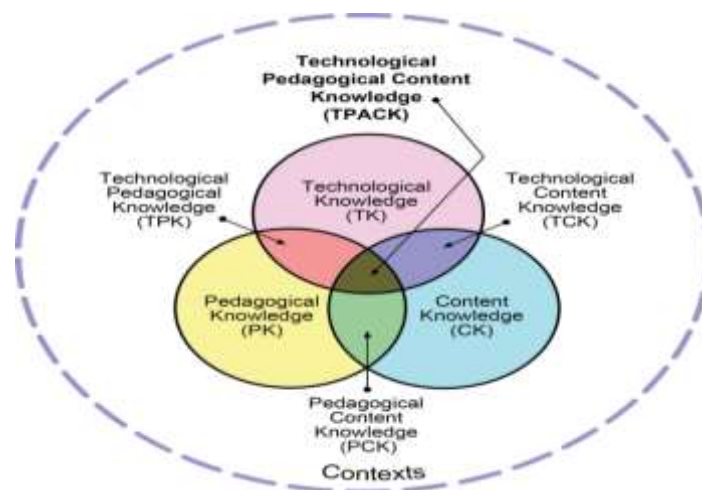
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### Introduction:

It takes a long time for society to transform but the Covid-19 has brought about a drastic change in every sector of society. The impact of the Covid-19 scenario has also affected the education sector as well. As a result, the education system has drastically shifted from face-to-face or offline mode to online mode overnight. Both teachers and learners were found to adapt to the new way of teaching and learning which was conducted online with the help of ICT. Before this, everyone used technology in their daily lives. However, because the

teaching and learning process has a stronger impact on the learner, everyone had to learn it differently. To do so, teachers need to have technological, pedagogical as well as content knowledge (TPACK) which would help them throughout the process. Here the researcher has come into two categories Novice teachers and experienced teachers. The researcher has compared the technological pedagogical content knowledge of higher secondary stage novices & experienced, and teachers of government and private science institutions in the present scenario.

As the number of contractual teachers increases rapidly, they should be well trained in technology to be technologically savvy to meet the standard of new-generation learners (Cheng 2012). Teacher education institutions should not only display and provide the latest technology to teachers but also taught them how to use them to draw out the best possible learning outcome from the prospective teachers (Okojje & Olinzock, 2006). Since the mid-20<sup>th</sup> century classroom situation in terms of the use of technology has changed and moved towards ICT (Okojje & Olinzock, 2006; Means 2010). Bell (2001) have stated that preparing technology-proficient teachers is a very hard task nowadays due to teachers' unwillingness to learn new technology as well as its application Dore (2001).



Source: <http://tpack.org/>

Mishra and Kohler (2006) have proposed a significant modification to the model of the existing PCK(Pedagogical Content Knowledge) structure and added technology to it which implies Technological Pedagogical Content Knowledge (TPACK). Mishra and Kohler(2005)

have suggested a framework by extending the PCK model which has content knowledge, pedagogical knowledge, technological knowledge and technological pedagogical content knowledge.

### **Literature Review:**

Technological Pedagogical Content Knowledge is more or less a theoretical framework which has major components like technology, pedagogy and content knowledge which tends to improve the effectiveness of teachers as well as learners' teaching-learning style. It also improved the teaching methodology, and pedagogical practice along with the use of technological knowledge (Sousa, Tercariol, Christino, 2017). On the other hand, the implementation of these Technological Pedagogical Content Knowledge domains is very restricted in the classroom context (Barac, Preatridge & Main, 2017). Guler & Celik (2018) found a correlation between the content knowledge and Pedagogical content knowledge scores of prospective teachers. Kim.S.W. & Lee.Y (2018) in TPACK-P educational programme pre-service teachers faced difficulties when it comes to learning programmes according to learner's needs. Pre-service teachers look upon content, pedagogical and technological part while planning a lesson while in-service teachers did not do it so carefully (Ekşi, & Yakışık, (2016).). There is a critical relationship found between the pre-service teachers and the needs in the classroom context (Junie, Fletcher, Zutto & Russob, 2015). Pre-service teachers who have constructivist and student-centred approaches have a high level of content knowledge, pedagogical knowledge& pedagogical content knowledge than teachers who believed in the traditional method of teaching(Kim, 2018). Novice teachers who are more open towards adopting and incorporating technology into pedagogical practices need to have the opportunity to explore it (Turgut, 2017). Prospective Science teachers' self-efficiency level is higher in the teaching-learning process (Sensoy& Yildirim (2018). Srisawasdi(2012) has found that future Physics teachers are more likely to use and implement TPACK in the teaching-learning process which has a positive impact on learners' achievement levels. On the other hand, Salton & Arslan (2017) found a significant difference between the pre-service teachers' candidates and in-service teachers candidate's self-perception about technological pedagogical content knowledge. In-service teacher candidates' self-perception about technological pedagogical content knowledge is affected by their gender, occupation, level of education, level of teaching, and computer and internet use (Hardisky, 2018). According to Baran, Chuang, and Tompson (2011), technological pedagogical content knowledge should be developed and adopted by both in-service teachers.

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### **Objectives of the study:**

This study was directed towards achieving the following objectives:

1. To study the Technological Pedagogical Content Knowledge of Science Teachers at Higher Secondary stage.
2. To study the Technological Pedagogical Content Knowledge of science teachers at the higher secondary stage regarding their teaching experiences.
3. To investigate the differences in higher secondary stage science teachers' Technological Pedagogical Content Knowledge regarding the type of institution.

### **Hypotheses of the Study:**

1. There is no significant difference in the technological pedagogical content knowledge mean scores of novice and experienced science teachers at the higher secondary stage.
2. There is no significant difference in the technological pedagogical content knowledge mean scores of government and private higher secondary stage science teachers.

### **Methodology:**

This study was conducted using a descriptive and exploratory survey design. The population depicted for the study comprises the higher secondary stage science teachers of the Cuttack district. Here, the higher secondary stage denotes both government and private institutions affiliated with the Council of higher secondary education, Odisha. 740 higher secondary stage science teachers are taken as the population among which 202 teachers were selected as the sample of the study.

### **Sample of the study:**

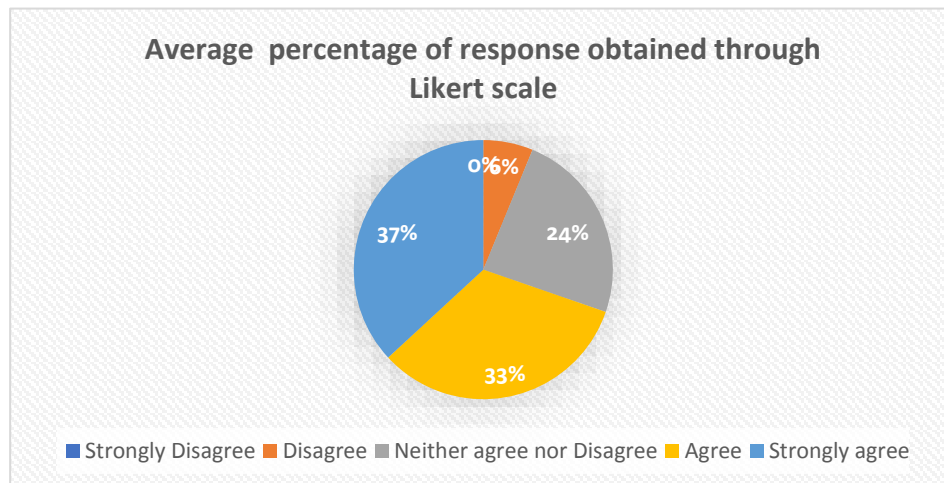
The respondents are (n=202) permanent faculty of selected higher secondary schools through a simple random sampling method. The collected data has been analyzed by statistical techniques like t-tests and percentage tables.

### **Analysis of the Study:**

In this section, the researcher has analyzed and interpreted the data collected by administering the tool.

**Objective 1:** To study the Technological Pedagogical Content Knowledge of Science Teachers at Higher Secondary stage.

To evaluate the aforementioned objective, the researcher has presented the collected data using the Likert scale.



The average response rates are 0% 6.21% 24.09% 32.84% and 36.87% for strongly agree, disagree, neither agree nor disagree, agree and strongly agree respectively. About their TPACK the average of strongly disagree is 0% whereas the average of strongly agree is maximum which is 36.87%

**Objective 2:** To study the Technological Pedagogical Content Knowledge of science teachers at the higher secondary stage regarding their teaching experiences.

**Hypothesis 1-** To analyse hypothesis-1 “There is no significant difference in the technological pedagogical content knowledge mean scores of novice and experienced science teachers at higher secondary stage” the researcher has represented in a table from the data collected through the tool. The table is prepared by data collected through 5 points Likert scale.

**Table 1: Significant difference in the TPACK of Novice and Experienced Science Teachers**

Teaching Experience	Number of Teachers (N)	Mean	SD	Calculated t-value	Table t-value	df	Level of significance
Novice Teachers	128	135	15.39	1.34	1.97	200	0.05
Experienced Teachers	74	132	15.26				

Here, the calculated t-value (1.34) is less than the table t-value at 0.05 label of significance (1.97). Here hypothesis 1 is accepted that “There is no significant difference in the technological pedagogical content knowledge mean scores of novice and experienced science teachers at higher secondary stage” based on the data gathered using the Likert scale.

**Objective 3:** To investigate the differences in higher secondary stage science teachers’ Technological Pedagogical Content Knowledge regarding the type of institution.

**Hypothesis 2** - To analyse hypothesis-2 “There is no significant difference in the technological pedagogical content knowledge mean scores of government and private higher secondary stage science teachers” the researcher has represented a table which is prepared by data collected through 5 points Likert scale.

**Table 2: Significant difference in the TPACK of Government and Private Higher Secondary Stage Science Teachers**

Type of Institution	Number of Teachers (N)	Mean	SD	Calculated t-value	Table t-value	df	Level of significance
<b>Government</b>	143	134	14.12	0.98	1.97	200	0.05
<b>Private</b>	59	136	12.79				

Here, the calculated t-value (0.98) is less than the table t-value at a 0.05 level of significance (1.97). Here hypothesis-3 is accepted that “There is no significant difference in the technological pedagogical content knowledge mean scores of government and private higher secondary stage science teachers.” according to the data collected through the Likert scale.

Here, the calculated t-value (0.98) is less than the table t-value at a 0.05 level of significance (1.97). Here hypothesis-2 is accepted that “There is no significant difference in the technological pedagogical content knowledge mean scores of government and private higher secondary stage science teachers.” according to the data collected through the Likert scale.

**Results and Discussions:**

The study revealed that all the respondents have more or less technological pedagogical content knowledge whereas, 5.47% of higher secondary stage science teachers disagree about their technological pedagogical content knowledge. Again, 28.45% of higher secondary stage science teachers neither agree nor disagree about their technological pedagogical content knowledge. On the other hand, 32.32 % of higher secondary stage science teachers agreed that they have technological pedagogical content knowledge, whereas 33.74% of high secondary stage science teachers strongly agreed that they have an adequate amount of technological pedagogical content knowledge. After analysis of the gathered data it was found by the researcher that mean scores of novice and experienced science teachers at higher secondary stage regarding technological pedagogical content knowledge remains the same

that is there is so significant difference among them regarding technological pedagogical content knowledge. Lastly, after analysing the last objective it was found by the investigator that there were no significant differences in the technological pedagogical content knowledge mean scores of government and private higher secondary stage science teachers.

### **Recommendations:**

The researcher made some recommendations as, more in-service training for technology-integrated learning should be provided to both the government and private school teachers to enhance their skill in off integration of technological knowledge, pedagogical knowledge and content knowledge. Again it was recommended that adequate salaries should be provided to the private school teachers to keep them motivated and encouraged to better engage in the classroom to enhance learning outcomes. Furthermore, Government school teachers should be provided adequate technical support to draw out the best of them. Another recommendation was that the need of the teachers should be addressed properly so that they can serve the learners in a better way and they should be encouraged and motivated by the higher authority to walk on the integration of technological pedagogical and content knowledge.

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