IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

A STUDY ON TECHNOLOGICAL PEDAGOGICAL AND CONTENT KNOWLEDGE (TPACK) OF PROSPECTIVE ELEMENTARY TEACHERS

Dr. Honngam Konyak[1]
Assistant Professor
Mokokchung College of Teacher Education, Yimyu
Mokokchung, Nagaland, India

Abstract: The purpose of this study was to find out the prospective elementary teachers' Technological Pedagogical Content and Knowledge (TPACK) in relation to gender, academic level, age and stream of study. A sample of 150 prospective teachers was selected through simple random sampling. The tool used for the study was Teachers' Technological Pedagogical and Content Knowledge Scale (TTPACKS) developed by Hemant Lata and Leena Sharma (2017). Mean, SD, t-test and ANOVA were used to analysed the data. The findings of the study revealed Prospective Elementary Teachers' Technological Pedagogical Content and Knowledge (TPACK) to be above average and no significant difference was found on the basis of gender, academic level, age and stream of study among the prospective elementary teachers.

***Keywords*- Academic level, Age, DIETs, Gender, Prospective elementary teachers, Stream, TPACK.**

1. INTRODUCTION

The 21st century is an age of technology which has brought about tremendous changes in all aspects of the society. The field of education has not been an exception to this change. Technology today has become an important need and an integral part of the society. In recent years, educational institutions are integrating technology into their curriculum and much emphasis is given on online and digital education, blended learning, use of digital repositories for teaching and learning, e-content creation, online assessment and examinations and professional development of teachers through SWAYAM and DIKSHA. National Education Policy (NEP) 2020 emphasizes on transforming our entire nation into a digitally empowered society and use of technological interventions to serve as aids to teachers and for the purposes of improving teaching-learning and evaluation processes, teacher preparation and professional development, enhancing educational access and in educational planning, management, assessment and administration (43, 104). The role of transforming our nation into a digitally empowered nation puts great emphasis on the role of our educational system and the teachers. Therefore, the use of technology both by the teachers and the learners in the educational system has become a necessity. However, the effective integration of technology to leverage its potentials for teaching-learning at all levels from school to higher education (NEP 2020, 107) in the educational system is a big challenge for both the teachers and the learners. Teachers are especially required to be adept with all the knowledge, skills and competencies of integrating technology as they will be transferring these competencies in the learners as well as catering to the diverse needs of the learners of this dynamic and complex society. It is important for the teachers to have knowledge of content, pedagogy and context (TPACK framework) in using new and emerging technologies as the use of new technologies can have implications for the nature of content-area learning, as well as the pedagogical approaches they can select (Harris, Mishra & Koehler, 395).

TPACK framework is built upon Shulman's construct of Pedagogical Content Knowledge (PCK) to include technology knowledge as situated within content and pedagogical knowledge (Schmidt et al. 123-124). The framework requires teachers to have pedagogical knowledge about the methods, processes and practices of teaching and learning; technological knowledge of using varied and new technologies; content knowledge about the subject matter to be taught or learnt; and the knowledge of how these elements are interconnected and how they interact with each other within context knowledge so that they can be successfully integrated with the use of technology for effective teaching and learning (Harris, Mishra & Koehler, 397-401; Schmidt et al. 124-125). As Harris, Mishra and Koehler (2009) emphasized, 'teachers' understanding of and demonstration of Technological Pedagogical and Content Knowledge (TPACK) framework can enable 'connections among technologies, curriculum content, and specific pedagogical approaches within contextual knowledge' for 'effective discipline-based teaching with educational technologies' (395-397).

Teachers are considered as the shapers of our nation (NEP 2020, 56). And therefore, understanding of the prospective teachers' TPACK is important as they are going to be the future educators who will be molding the future generation (Santos & Castro, 2). Research indicated potential impact of measuring teaching knowledge of teachers using TPACK framework on the type of training and professional development for both pre-service and in-service teachers (Denise et al., 2009). Thus, the need arose for this study to know the Technological Pedagogical and Content Knowledge (TPACK) of prospective teachers who will be in the educational system in the future thereby, impacting the lives of the future generation.

2. REVIEW OF RELATED LITERATURE

Kalaimani and Stephen (2022) conducted a survey on Technological Pedagogical Content Knowledge of High School Teachers in Chennai using self-developed tool on TPACK; the findings indicated moderate level of TPACK and no significant difference based on gender and stream of subjects among the High school teachers. **Santos and Castro (2021)** conducted a mixed method research study on Technological Pedagogical Content Knowledge (TPACK) in action: Application of learning in the classroom by pre-service teachers (PST). The findings found the pre-service teachers to have strong knowledge in the seven elements of TPACK. **Koyuncuoglu (2021)** investigated Graduate Students' Technological Pedagogical and Content Knowledge (TPACK) and found their TPACK competence to be moderate; whereas, the technological knowledge and technological content of males was higher than females, females had higher level of pedagogical knowledge than males. The study also found that doctoral students had higher TPACK competencies than the master's level students; and whereas Natural Sciences students' had higher technological knowledge, Educational Sciences students had higher pedagogical knowledge.

Putri, Hidayat and Purwianingsih (2019) analysed the TPACK competence of biology teachers in classification of living things learning using Content Representations (CoRes) involving five biology teachers from senior high school level, Grade X and found all the teachers to be on the pre TPACK category as the teachers still faced difficulties in integrating content knowledge, pedagogy and technology.

Guru and Beura (2019) studied the Techno-Pedagogical competence of higher secondary school teachers in relation to students' academic achievement in science using the Techno-pedagogical Competency Scale developed by Rajasekar S and Sathiyaraj K (2013). The findings of the study showed moderate level of pedagogical competency among the teachers and no significant difference between male and female teachers; however urban teachers have higher techno-pedagogical competency as compared to rural and teachers' techno-pedagogical competency and student achievement in science was found to be positively correlated. **Jeyaraj and Ramnath (2018)** studied the Technological Pedagogical and Content Knowledge of B.Ed Student Teachers in Puducherry region with the TPACK scale by Ismail Sahin (2011). The result of the study showed moderate level of TPACK among the student teachers and those with post-graduate degree had higher TPACK than those with Graduates; it was also found that student teachers who accessed the e-content and used technology frequently had higher TPACK than others who did not do so.

A descriptive study on Techno-Pedagogical Educational Competencies or Pre-service Elementary School and Preschool Teachers conducted by **Ozdemir (2016)** on 995 pre-service elementary and preschool teachers found the means of third and fourth year pre-service teachers TPACK to be high and that their pre-service education had positive effects on their TPACK; the study recommended on providing opportunities to the teachers for using technology and to consider use of technology as one of the criterion of their assessment. **Schmitdt et al (2009)** conducted a pilot study on 124 pre-service teachers in developing an instrument for assessing TPACK for pre-service teachers. Data was analysed by employing Cronbach alpha statistics on the TPACK knowledge domains and each domain was analysed through factor analysis. Results indicated the

instrument to be valid and reliable for longitudinal studies to assess pre-service teachers' development of TPACK.

3. OBJECTIVES OF THE STUDY

i) To study the level of Technological Pedagogical Content and Knowledge of prospective elementary teachers.
ii) To study the Technological Pedagogical Content and Knowledge of prospective elementary teachers based on gender, academic level, age and Stream of study.

4. HYPOTHESES OF THE STUDY

i) There is no significant difference in the Technological Pedagogical Content and Knowledge between male and female prospective elementary teachers.
ii) There is no significant difference in the Technological Pedagogical Content and Knowledge between First year and Second year prospective elementary teachers.
iii) There is no significant difference in the Technological Pedagogical Content and Knowledge among the prospective elementary teachers with respect to age.
iv) There is no significant difference in the Technological Pedagogical Content and Knowledge among the prospective elementary teachers with respect to their stream of study.

5. DELIMITATION OF THE STUDY

The study was confined to Prospective Teachers studying two years Diploma in Elementary Education (D.El.Ed.) course in the District Institute of Educational Training (DIETs) in Nagaland state only.

6. METHODOLOGY OF THE STUDY

6.1.Research Design

Descriptive survey method was adopted to study the Technological Pedagogical and Content Knowledge of Prospective Elementary Teachers of DIETs in Nagaland state.

6.2.Population and Sample

The population consisted of the prospective teachers studying in the District Institute of Education and Training (DIET) in the academic year 2022-2024 and 2023-2025 in Nagaland. Out of the 8 DIETs in Nagaland, 2 Diets were selected randomly through simple random sampling technique. The sample consisted of 150 prospective teachers out of which 50 were male teachers and 100 were female teachers.

6.3.Tools and techniques

The tool employed to collect the data was Teachers' Technological Pedagogical and Content Knowledge Scale (TTPACKS) developed by Hemant Lata and Leena Sharma (2017). The tool consisted of 55 items based on 7 dimensions of TPACK. The analysis of the data was done with the help of appropriate statistical technique such as Percentage, Mean and Standard Deviation, T-test and ANOVA.

7. RESULTS AND INTERPRETATIONS

Objective 1: To study the level of Technological Pedagogical and Content Knowledge of prospective elementary teachers.

TABLE-1

Frequency and Percentage distribution of overall TTPACK level of prospective elementary teachers.

Sl. No	Frequency	Percentage	TPACK Raw Score Range	Z-Score Range	Grade	Level of TTPACKS
1	19	12.7%	232 to 269	+1.26 to + 2.00	B	High
2	66	44%	195 to 231	+0.51 to +1.25	C	Above Average
3	53	35%	144 to 194	-0.50 to +0.50	D	Average
4	12	8%	107 to 143	-1.25 to -0.51	E	Below Average
Total	**150**	**100**				

Table 1 showed the TTPACK scores of prospective elementary teachers of DIETS. It can be observed that out of 150 respondents, only 19 respondents i.e. 12% of the respondents scored in the high range (232-269), 66 respondents i.e. 44% scored in the above average range (195-231), 35% of the respondents scored in the average level (144-194) and only 8 respondents scored below average (107-143). This implied that the majority of the prospective elementary teachers have an Above Average level of Technological Pedagogical and Content Knowledge.

Objective 2: To study the Technological Pedagogical Content and Knowledge of prospective elementary teachers based on gender, academic level, age and Stream of study.

To find out the significant difference, the data has been analysed and interpreted using descriptive statistics such as mean, and standard deviation. The hypothesis is tested by employing the "t" test and F test.

H_{01}: There is no significant difference in the Technological Pedagogical Content and Knowledge between male and female prospective elementary teachers.

Table 2
Result of t-test in respect of Technological Pedagogical Content Knowledge between female and male prospective elementary teachers.

Gender	N	Mean	Std. Deviation	df	t	S/NS
Female	100	197.26	34.283	148	0.368	NS*
Male	50	194.84	39.741			

**At 0.05 level of significance*

From Table 2, it can be observed that the calculated t value (0.368), for the significance of the difference between the means of male and female prospective elementary teachers studying in DIETs on Technological Pedagogical and Content Knowledge is less than the table value (1.96) for df=148 at 0.05 level of significance. Hence, the null hypothesis that there is no significant difference between means of male and female prospective elementary teachers on Technological Pedagogical and Content Knowledge cannot be rejected. Hence, the null hypothesis is accepted.

H_{02}: There is no significant difference in the Technological Pedagogical Content and Knowledge between First year and Second year prospective elementary teachers.

Table 3
Result of t-test in respect of Technological Pedagogical Content Knowledge between first year and second year prospective elementary teachers.

Academic level	N	Mean	Std. Deviation	df	t	S/NS
First Year	65	195.51	37.217	148	0.278	NS*
Second year	85	197.18	35.387			

**At 0.05 level of significance*

From Table 3, it can be observed that the calculated t value (0.278), for the significance of the difference between the means of first and second year prospective elementary teachers on Technological Pedagogical and Content Knowledge is less than the table value (1.96) for df=148 at 0.05 level of significance. Hence, the null hypothesis that there is no significant difference between means of first and second year prospective elementary teachers on Technological Pedagogical and Content Knowledge cannot be rejected. Hence, the null hypothesis is accepted.

H_{02}: There is no significant difference in the Technological Pedagogical Content and Knowledge among the prospective elementary teachers with respect to age.

Table 4
Result of the F-test for the significant difference in the Technological Pedagogical and Content Knowledge among prospective elementary teachers with respect to age.

Source of Variance	Sum of Squares	df	Mean Square	F	S/NS
Between Groups	4728.014	3	1576.005	1.216	NS*
Within Groups	189209.159	146	1295.953		
Total	193937.173	149			

**At 0.05 level of significance*

Table 4 showed that the calculated value of F (1.216) for df=3 and 146 is less than the critical F value (2.410) and is therefore, statistically not significant at 0.05 level of significance. Hence we cannot reject the null hypothesis that, there is no significant difference among the means of different groups on the basis of their age on Technological Pedagogical and Content Knowledge. Therefore, null hypothesis is accepted at this degree of confidence.

H_{04}: There is no significant difference in the Technological Pedagogical Content and Knowledge among the prospective elementary teachers with respect to their stream of study.

Table 5
Result of the f-test for the significant difference in the Technological Pedagogical and Content Knowledge among prospective elementary teachers with respect to stream of subject.

Source of Variance	Sum of Squares	df	Mean Square	F	S/NS
Between Groups	6226.303	3	2075.434	1.614	NS*
Within Groups	187710.871	146	1285.691		
Total	193937.173	149			

**At 0.05 level of significance*

From table 5, it can be observed that the calculated value of F (1.614) for df=3 and 146 is less than the critical F value (2.410) and is therefore statistically not significant at 0.05 level of significance. Hence we cannot reject the null hypothesis that, there is no significant difference among the means of different groups on the basis of their stream of study on Technological Pedagogical and Content Knowledge. Therefore null hypothesis is accepted at this degree of confidence.

8. DISCUSSION

The present study showed that the majority of the prospective teachers have an Above Average level of Technological Pedagogical and Content Knowledge which is contradictory to the studies which found moderate level of teachers' Technological Pedagogical and Content Knowledge (Guru & Beura, 2019; Jeyaraj & Ramnath, 2018; Kalaimani & Stephen, 2022 & Koyuncuoglu, 2021) and that of Ozdemir (2016) which found to be Pre-service Elementary School and Preschool teachers' TPACK to be high. This may be due to the emphasis given on the use of technology, access to smartphone and e-content, digitalization, especially during and after the COVID-19 pandemic where educational institutions had to adapt to the situation of conducting online and blended learning.

The study also revealed that there was no significant difference in the Technological Pedagogical and Content Knowledge of male and female prospective teachers studying D.El.Ed. in the DIETs which is consistent with the study of Kalaimani & Stephen (2022) and Guru & Beura (2019). This showed that regardless of gender, prospective teachers may be equally motivated to integrate technology in the teaching and learning process. It was also revealed that there is no significant difference on Technological Pedagogical and Content Knowledge first and second year prospective teachers studying D.El.Ed. in the DIETs. Further, no significant difference was found among of different groups on the basis of their age on Technological Pedagogical and Content Knowledge as well as based on their stream of study consistent to

the study of Kalaimani & Stephen (2022). This may be because those prospective teachers are introduced to constructivist learning, pedagogical strategies, assessment tools and techniques with the integration of technology and Enhancing Professional Capacities Courses on ICT, Self-Understanding, Drama and Art in education and Reading and reflecting on texts in the two years Elementary teacher training Institutes that they study in.

9. CONCLUSION

The present study found prospective teachers' Technological Pedagogical and Content Knowledge to be above average. But none of them were found to have extremely high or TPACK. Further, it also found no significant difference on the basis of gender, academic level, age and stream of study among the prospective teachers. The implications of such findings cannot be ignored. Understanding the relationship between technology, content, pedagogy and context is very essential for teachers and learners as it will enable them to use technology appropriately and effectively in the teaching and learning process. It will also enable them to be more creative, develop self-directed learning skills, up-date their knowledge, skills and competencies. Further studies can be conducted on in-service as well as pre-service teachers at different levels of education; comparative study between Pre-service and In-service teachers; and studies with reference to other variables such as Information technology, ICT and digital competence to see if there are any significant relationship between them or not. Teacher training institutes need to adopt strategies to enhance the TPACK of the teachers as the TPACK framework can assist teachers in their professional development in the era of rapid technological development (Lee et al., 2022). Both faculty of Elementary Teacher Training Institutes as well as student Teachers of the Institutes should be provided opportunities to continuously develop their professional skills and competencies through various offline and online training programmes, seminars and workshops.

REFERENCES

[1] Guru, N., & Beura, M.K. (2019). Techno-pedagogical competency of higher secondary school teachers in relation to students' academic achievement in science. *International Journal of Applied Research,* 5 (12), 362-370. https://www.allresearchjournal.com/archives/2019/vol5issue12/PartF/5-10-60-608.pdf

[2] Harris, J., Mishra, P., & Koehler, M. (2009). Teachers' technological Pedagogical content Knowledge and learning activity types: Curriculum –based technology integration reframed. *Journal of Research on Technology in Education*, 41(4), 393-416. https://www.researchgate.net/publication/272786975

[3] Jeyaraj, I., and Ramnath, R .A (2018).Study on Technological Pedagogical and Content Knowledge of B.Ed. Student-teachers in Puducherry Region. *World Wide Journal of Multidisciplinary Research and Development,* 4(1): 306-308. https://wwjmrd.com/archive/2018/1/743/a-study-on-technological-pedagogical-and-content-knowledge-of-b-ed-student-teachers-in-puducherry-region

[4] Kalaimani, K., & Stephen, L.G. (2022). A study on technological pedagogical content knowledge of high school teachers in Chennai. *Journal of Positive school Psychology*, 6(2), 6303-6308. https://journalppw.com/index.php/jpsp/article/view/7386

[5] Koyuncuoglu, O. (2021). An investigation of graduate students' Technological Pedagogical and Content Knowledge (TPACK). *International Journal of Education in Mathematics, Science, and Technology* (IJEMST), 9(2), 299-313. https://doi.org/10.46328/ijemst.1446

[6] Ozdemir, M. (2016). An Examination of the Techno-Pedagogical Education Competencies (TPACK) of Pre-service Elementary School and Preschool Teachers. *Journal of Education and Training Studies,* 4(10), 70-78. https://files.eric.ed.gov/fulltext/EJ1111352.pdf

[7] Putri, A.R.A., Hidayat, T., & Purwianingsih. (2019). Analysis of technological pedagogical content knowledge (TPACK) of biology teachers in classification of living things learning. Journal of Physics: Conference Series, 1521 (2020), 1-7. https://iopscience.iop.org/article/10.1088/1742-6596/1521/4/042033/pdf

[8] Santos, J.M., & Castro, R.D.R. (2021). Technological Pedagogical content knowledge (TPACK) in action: Application of learning in the classroom by pre-service teachers (PST). Social Science & Humanities Open, 3(1), 1-8. https://www.sciencedirect.com/science/article/pii/S2590291121000061

[9] Schmitdt, D.A., Baran, E., Thompson, A.D., Misra, P., Kohler M.J., & Shin, T.S. (2009). TPACK – The Development and Validation of an Assessment Instrument for Pre-service Teachers. *Journal of research and technology education*, 42 (2), 123-149. https://files.eric.ed.gov/fulltext/EJ868626.pdf