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A Study on TPACK of Science Teachers at the Higher Secondary Level in Chengalpattu District

Dr. R. Suhirtha Rani
Assistant Professor, School of Education
Vels Institute of Science, Technology & Advanced Studies (VISTAS), Pallavaram, Chennai, Tamilnadu
julietsuhirtharani@gmail.com

Abstract: *Technology has become an essential component of modern education. In science education, effective teaching requires not only subject knowledge and pedagogical skills but also the ability to integrate technology meaningfully into classroom instruction. Technological Pedagogical Content Knowledge (TPACK) refers to the understanding teachers need to combine technology, pedagogy, and subject content effectively for improved teaching and learning outcomes.*
Science teachers at the higher secondary stage play a vital role in developing scientific thinking, problem-solving ability, and practical knowledge among students. Therefore, it is important to examine their level of TPACK and identify factors influencing its development and implementation in classrooms.
This study aimed to analyze the Technological Pedagogical Content Knowledge (TPACK) of science teachers at the higher secondary stage. A descriptive survey method was employed for collecting data from higher secondary stage science teachers from the Chengalpattu district.

Keywords: Teaching experiences, TPACK, Science Teachers.

I. INTRODUCTION

Meaning of TPACK

Technological Pedagogical Content Knowledge (TPACK) is a framework developed by Mishra and Koehler (2006) that explains the relationship between technology, pedagogy, and content knowledge in teaching.
The framework consists of:

- **Content Knowledge (CK)** – Knowledge of the subject matter.
- **Pedagogical Knowledge (PK) –** Knowledge of teaching methods and strategies.
- **Technological Knowledge (TK) –** Knowledge of technological tools and resources.
- **Pedagogical Content Knowledge (PCK) –** Knowledge of how to teach specific subject content.
- **Technological Content Knowledge (TCK) –** Understanding how technology relates to subject content.
- **Technological Pedagogical Knowledge (TPK) –** Understanding how teaching changes with technology.
- **Technological Pedagogical Content Knowledge (TPACK)** – Integration of all three domains for effective teaching.

Need and Significance of the Study

The rapid advancement of digital technologies has transformed educational practices. Science teachers are expected to use smart classrooms, simulations, virtual laboratories, multimedia presentations, and online learning platforms to enhance student learning.
The study is significant because:

- It helps identify the technological competencies of science teachers.
- It reveals the extent of technology integration in science classrooms.
- It supports educational institutions in planning teacher training programmes.
- It contributes to improving the quality of science education at the higher secondary level.

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Objectives of the Study

- To examine the Technological Pedagogical Content Knowledge (TPACK) of science teachers at the higher secondary stage.
- To analyze the TPACK of science teachers based on their teaching experience.
- To identify differences in TPACK with respect to the type of institution.

Hypotheses of the Study

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

II. METHODOLOGY

The study employed a descriptive and exploratory survey design.

- **Population:** Science teachers working at the higher secondary stage in Chengalpattu district.
- **Institutions:** Government and private institutions affiliated with the Council of Higher Secondary Education, Tamil Nadu.
- **Sample:** A sample of 202 teachers selected using the simple random sampling technique.
- **Statistical Techniques Used:** Percentage analysis and t-test.

Analysis of the Study

Hypotheses 1: There is no significant difference in the technological pedagogical content knowledge mean scores of novice and experienced science teachers.

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

Teaching Experience	No. of Teachers	Mean	SD	Calculated t-value	Table t-value	df	Level of Significance
Novice Teachers	128	135	15.38	1.33	1.96	200	0.05
Experienced Teachers	74	132	15.24				

Interpretation

The obtained t-value (1.34) was lower than the table value (1.97) at the 0.05 level of significance. Therefore, no significant difference was observed between novice and experienced science teachers with regard to technological pedagogical content knowledge.

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

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

Type of Institution	No. of Teachers	Mean	SD	Calculated t-value	Table t-value	df	Level of Significance
Government	143	134	14.10	0.98	1.97	200	0.05
Private	59	136	12.78				

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Interpretation

The obtained t-value (0.98) was lower than the table value (1.97). Hence, no significant difference was found between government and private higher secondary science teachers with respect to technological pedagogical content knowledge.

III. RESULTS AND DISCUSSION

The study found that:

- Teachers, in general, had sufficient technological pedagogical content knowledge.
- No significant difference was observed between novice and experienced teachers.
- No significant difference existed between teachers working in government and private schools.
- Teachers highly agreed that TPACK enhances classroom instruction and learning outcomes.

Recommendations

The researcher recommended:

- Providing more in-service training programs for technology-integrated teaching.
- Offering improved technical support to teachers.
- Ensuring adequate salary and motivation for private school teachers.
- Encouraging teachers through higher authorities to integrate technology, pedagogy, and content knowledge effectively.

IV. CONCLUSION

The integration of technology, pedagogy, and content knowledge is vital for effective teaching in the contemporary educational setting. The study concludes that higher secondary science teachers possess satisfactory levels of TPACK regardless of their teaching experience or the type of institution in which they work.

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