

# TECHNO-PEDAGOGICAL COMPETENCY OF TEACHERS IN RELATION TO GENDER, ACADEMIC STREAM AND TEACHING EXPERIENCE

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*Abstract:* Development and innovation of computer technologies have transformed the way education is structured, organized and delivered. It is the teachers' knowledge, skills and competency among others that influence the choices they make about what, when, where, and how to use technologies in teaching learning activities. The present study has been undertaken to investigate the techno-Pedagogical competency of senior secondary school teachers in relation to gender, academic stream and teaching experience. For the very purpose descriptive survey method was used. A sample of 160 senior secondary teachers-Male/Female, Arts/Science working in C.B.S.E. schools was selected. Mean, S.D., t-Test and Three-way ANOVA has been used to analyse the data. Significant differences have been found in techno pedagogical competency of teachers with respect to gender, stream and teaching experience.

*Index Terms* – ICT, Pedagogy, Techno-Pedagogical skills, Techno-Pedagogical competency.

## I. INTRODUCTION

Information and Communication technology has advanced in ways which could not be imagined even a decade back. Changes in technology have facilitated dramatic shifts in communication making it easier to connect people in unprecedented ways and require that today's students have the knowledge, skills and dispositions to engage responsibly and effectively in the increasingly globalized context. The education system is now witnessing a paradigm shift from the traditional chalk and talk teaching methodology to digitizing the pedagogical approach through technical devices. Adopting and adapting educational technologies associated with computers and the internet for use with instruction is often transforming not only how we teach, affording new ways to address old problems but also turning attention to some of the basic issues in teaching focusing the educators on the pedagogy itself, its design and its efficacy (Philip A. Pecornio, 2004).

Techno-pedagogy refers to electronically mediated courses that integrate sound pedagogic principles of teaching and learning with the use of technology tools. It depends on how teachers interpret the uses of tools and how they use technology, pedagogy and content effectively in their day to day classroom teaching. Teachers must understand their role in technologically oriented classrooms (Nabin Thakur). Teacher must be equipped with the skills to integrate technology seamlessly into their instruction in ways that move beyond mere presentation and communication to a place of creation, innovation and problem solving. Fullan states that "the integration of technology and pedagogy to maximize learning must meet four criteria. It must be irresistibly engaging; elegantly efficient (challenging but easy to use); technologically ubiquitous; and steeped in real life problem solving." (Fullan, 2012)

Acquiring techno-pedagogical proficiencies will make teaching and learning a pleasurable experience as it would lessen the pressure on the teachers and enable the students to delve deeper into domain of knowledge. The presence of techno-pedagogical competency in teachers can be examined from various techno-pedagogical skills viz. Proficiency in linguistic abilities; Aptitude to develop teaching learning process; Ability to improve multimedia based Study materials; Capacity to design multi grade instruction; Talent to plan Specific Pedagogy; Development of e-learning module etc.

It is essential that teachers possess positive attitudes and high self-efficacy perceptions in using the technological tools (Milbrath & Kinzie, 2000). Beaudin and Hadden (2004) revealed in their study that techno-pedagogical skill foster the students for further development, attainment of learning outcomes and maintain the context of designing classroom based resources through the use of ICT by the teachers. Therefore, techno-pedagogy method was a necessary component of teacher education. Koehler and Mishra (2005) found in their study that good teaching was not simply adding technology rather the introduction of technology causes the representation of new concepts and requires developing sensitivity to the dynamic, transactional relationship among technology, pedagogy, content and knowledge. Indeed, a teacher is one of the important reasons

contributing to the failure or success of integrating ICT in teaching and learning (Lim & Khine, 2006) Blankenship (1998), Fakeye (2010) and Latio (2009), report that generally only few teachers are actively integrating computers in their classroom teaching. Similarly, Saadiyah Darus and Ho (2008) find that ESL teachers in Malaysia indicate low level of integrating computers in their instructional activities. Lee and Tsai (2010) found that meaningful use of ICT in the classroom requires the teachers to integrate technological affordances with pedagogical approaches for the specific subject matter to be taught. Yurdakul (2011) revealed in his study that pre service teachers need to provide opportunities to get practical knowledge and skills to use current technology during their training process. The technology centers in teaching and learning must be established in higher education institution. Sathiyaraj and Rajasekar (2013) found in their study that the techno-pedagogical competency needs to be improved in order to equip teachers to face the students belong to the digital era and also to face the challenges in the modern classroom. Monsiváis, McAnally and Lavigne (2014) revealed in their study that the integration of ICTs in the classroom depends on the teachers' ability to scaffold the learning environment by using effective ICT-based pedagogies.

The questions that arise are- Are our teachers well equipped or trained for integration of technology in teaching and learning? Have we been able to digitalize the entire process of admission, teaching-learning, assignments and evaluation? To what extent our teachers are efficient in this? In order to understand the present status of use of technology by teachers in teaching-learning, the investigator made an attempt to examine the effect of gender, academic stream and teaching experience on techno-pedagogical competency of senior secondary school teachers.

### 1.1 Operational Definition of terms

Techno-pedagogy is the art of incorporating technology in designing teaching-learning experiences so as to enrich the learning outcomes.

**Techno-pedagogical competency is the ability of teachers to make use of technology effectively in teaching.**

### 2. Objectives of the Study

- 1) The present study purported to realize the following objectives:
- 2) To study the effect of gender on techno-pedagogical competency of teachers.
- 3) To study the effect of academic stream on techno-pedagogical competency of teachers.
- 4) To study the effect of teaching experience on techno-pedagogical competency of teachers.
- 5) To find out the interaction effect of gender and academic stream on techno-pedagogical competency of teachers.
- 6) To find out the interaction effect of academic stream and teaching experience on techno-pedagogical competency of teachers.
- 7) To find out the interaction effect of gender and teaching experience on techno-pedagogical competency of teachers.
- 8) To find out the interaction effect of gender, academic stream and teaching experience on techno-pedagogical competency of teachers.

### 3. Hypotheses

Based upon the above mentioned objectives, the following hypotheses were formulated:

Ho1 There exist no significant difference in techno-pedagogical competency between male and female teachers.

Ho2 There exist no significant difference in techno-pedagogical competency between teachers belonging to Science and Arts group.

Ho3 There exist no significant difference in techno-pedagogical competency between teachers having more and less teaching experience.

Ho4 There exist no significant interaction effect of gender and academic stream on techno-pedagogical competency of teachers.

Ho5 There exist no significant interaction effect of academic stream and teaching experience on techno-pedagogical competency of teachers.

Ho6 There exist no significant interaction effect of gender and teaching experience on techno-pedagogical competency of teachers.

Ho7 There exist no significant interaction effect of gender, academic stream and teaching experience on techno-pedagogical competency of teachers.

## 4. RESEARCH METHODOLOGY

### 4.1 Method

In the present study, descriptive survey method was used.

### 4.2 Population and Sample

Teachers working in C.B.S.E. schools of Haryana constituted the target population of the study. In the present study, multistage random sampling technique was used to select the sample of 160 senior secondary teachers working in C.B.S.E. schools. For this, male and female teachers were divided into four parallel groups- Science group having more teaching experience, Science group having less teaching experience, Arts group having more teaching experience and Arts group having less teaching experience. From each of these groups, 20 teachers were selected randomly i.e. 20 from each combination group. In this way, the distribution of sample (160 teachers) as per the requirement of the 2x2x2 cells of the paradigm is shown as under:

**Table 1 Distribution of Sample (N=160)**

Gender	Teachers of Science Group (80)		Teachers of Arts Group (80)	
	Male (80)	Having more teaching experience (20)	Having less teaching experience (20)	Having more teaching experience (20)
Female (80)	Having more teaching experience (20)	Having less teaching experience (20)	Having more teaching experience (20)	Having less teaching experience (20)

### 4.3 Data and Sources of Data

1. Personal Data Sheet prepared by the Investigator to collect the Personal details of the subjects.
2. Teacher's Techno-Pedagogical Competency Scale developed by Dr. S.Rajasekar and K. Sathiyaraj, (2013) was used to assess the Techno-Pedagogical Competency of Senior Secondary School Teachers.

### 4.4 Statistical Tools

Mean, S.D., t-Test and Three-way ANOVA -2x2x2 factorial design .has been used

## 5. RESULTS AND DISCUSSION

### 5.1 Results of Descriptive Statics of Study Variables

In order to study the nature of data, descriptive statistics i.e. the measure of central tendency and dispersion-Mean, Standard Deviation were used. To study the main effects and interaction effects of independent variables i.e. gender, academic stream and teaching experience on the dependent variable i.e. techno-pedagogical competency, three way ANOVA was used. For further investigations' t-test was employed, wherever F-value was found to be significant. These statistical techniques were computed using SPSS . The obtained results are given in the tables.

**Table 2 Mean and S.D.'s of Sub Samples of 2x2x2 Design for Techno-Pedagogical Competency of Teachers**

		Science Group (B1)	Arts Group (B2)
<b>Male (A1)</b>	More Teaching Experience (C1)	N=20 Mean=146.05 S.D.=6.484	N=20 Mean=141.15 S.D.=3.705
	Less Teaching Experience (C2)	N=20 Mean=155.15 S.D.=5.062	N=20 Mean=145.1 S.D.=5.476
<b>Female (A2)</b>	More Teaching Experience (C1)	N=20 Mean=138.3 S.D.=4.243	N=20 Mean=121.8 S.D.=3.627
	Less Teaching Experience (C2)	N=20 Mean=146.4 S.D.=3.852	N=20 Mean=128.8 S.D.=4.118

The summary of ANOVA (2x2x2) has been presented in Table 3 which has been analyzed in terms of main effects and interaction effects.

Table 3 Summary of 3 Way ANOVA (2x2x2 Factorial Design) for Techno-Pedagogical Competency of Teachers

Source of variance	Sum of Squares	df	Mean Squares	'F' Ratio
A (Gender)	6799.06	1	6799.06	296.38**
B (Academic Stream)	6014.76	1	6014.76	262.2**
C (Teaching Experience)	1981.06	1	1981.06	86.36**
AxB Interaction	916.81	1	916.81	39.97**
BxC Interaction	10.51	1	10.51	0.46 (NS)
AxC Interaction	97.66	1	97.66	4.26*
AxBxC Interaction	40.98	1	40.98	1.79 (NS)
Errors	3487.25	7		
		152	22.94	
<b>Total</b>	<b>19348.09</b>	<b>159</b>		

- =Significant at 0.05 level; \*\* = Significant at 0.01 level; NS= Not Significant

## 5.2 Main effects of Gender, Academic Stream and Teaching Experience on Techno-Pedagogical Competency

From table 3, it is evident that the main effect of gender ( $F = 296.38$ ,  $df=1, 152$ ) is highly significant at 0.01 level. This means that gender has a significant independent effect upon techno-pedagogical competency of teachers. Therefore, null hypotheses H01 is rejected. It may therefore be concluded that there is significant difference in techno-pedagogical competency between male and female teachers.

From table 3, it can be further seen that F value of 262.2,  $df(1, 152)$  is highly significant at 0.01 level for the main effect of academic stream on techno-pedagogical competency of teachers. This means that academic stream has a significant independent effect upon techno-pedagogical competency of teachers. Therefore, null hypotheses H02 is rejected. It may therefore be said that there is significant difference in techno-pedagogical competency between teachers belonging to Science and Arts group.

From the results, it is also evident that F value of 86.36 with  $df(1, 152)$  is highly significant at 0.01 level for the main effect of teaching experience on techno-pedagogical competency of teachers. This means that techno-pedagogical competency of teachers is significantly affected by their teaching experience. Therefore, null hypotheses H03 is rejected. It may therefore be concluded that there is significant difference in techno-pedagogical competency between more experienced and less experienced teachers.

In order to investigate further, the 't' values were computed and have been given in Table 4.

Table 4 't' Values for the Techno-pedagogical Competency Scores with respect to Gender, Academic Stream and Teaching Experience

Group	N	Mean	S.D.	't' value
Male	80	146.862	7.356	9.252**
Female	80	133.825	10.136	
Science	80	146.48	7.790	8.44**
Arts	80	134.21	10.294	
More Teaching Experience	80	136.82	10.230	-4.245**
Less Teaching Experience	80	143.86	10.602	

\*\* Significant at 0.01 level of Significance

Table 4 reveals that 't' value between Male and female groups ( $t=9.252$ ) is significant at 0.01 level. In the context of mean scores, it was found that mean scores of techno-pedagogical competency of male group was higher than that of female group. This shows that male teachers have more techno-pedagogical competency than female teachers. This result has been found to be supported by the findings of Von Braak (2001), Enoch and Soker (2006), Koochang (2004) and Jai Parkash and Sushila Rani Hooda (2017) who reported that male teachers were found to have more techno-pedagogical competency than female teachers.

It has been further observed from Table 4 that 't' value between Science and Arts academic stream ( $t= 8.44$ ) is significant at 0.01 level. When the results were compared in the context of mean scores, it was found that mean score of techno-pedagogical competency of Science teachers was higher than that of Arts group teachers. This shows that science teachers have more techno-pedagogical competency than arts teachers. This significant difference may be due to the fact that science stream teachers are more technical as they are taught by adopting practical approach of direct experiences i.e. learning by doing. Since they learn by doing experiments, they are more skilled, competent and efficient in use of technology and pedagogy in science teaching. This result has been found to be supported by the findings of Bans Sezer (2015) who reported that teachers teaching science were found to have higher techno-pedagogical competency than their counterparts in respective groups.



Table 4 also indicates that ‘t’ value between teachers having more and less teaching experience ( $t=-4.245$ ) is significant at 0.01 level. In the context of mean scores, it was found that less experienced teachers have higher techno-pedagogical competency than more experienced teachers. This may be attributed to the fact that when a teacher gets more experience, he becomes reluctant to change and resists adoption of new technologies in teaching.

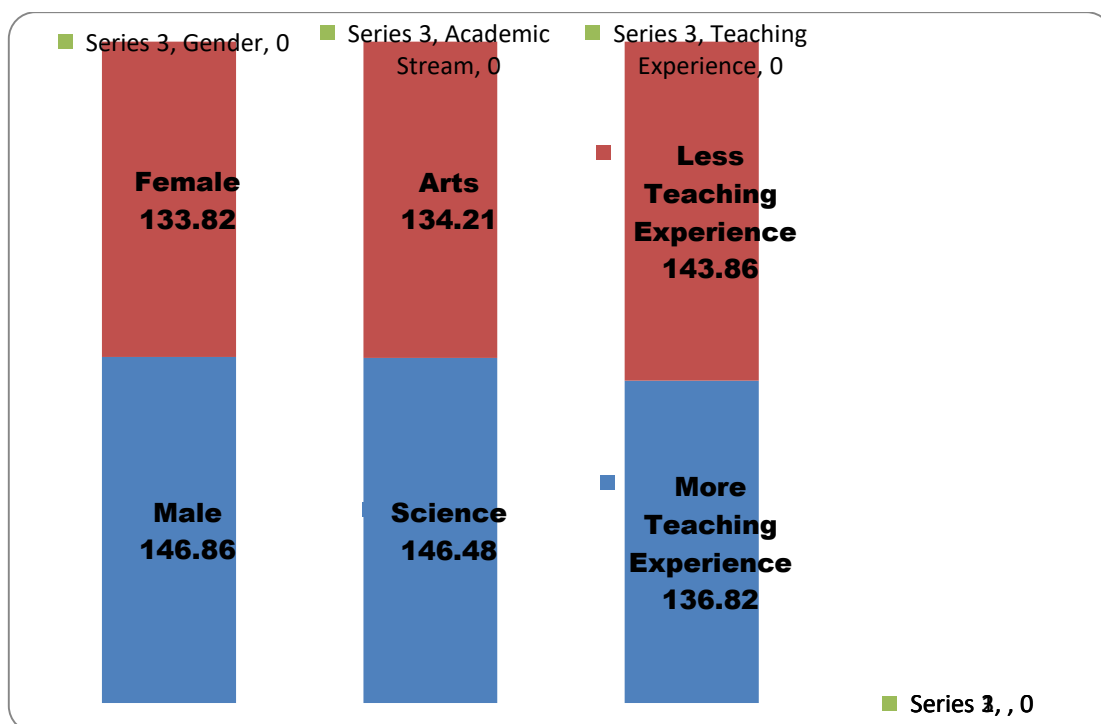


Fig.1: Mean Scores Corresponding to Main Effects on Techno-Pedagogical Competency of Teachers

### 5.3 Two Factor Interaction Effect

#### 5.3.1 AXB (Gender X Academic stream)

The F (AB) value for the interaction between gender and Academic stream (Table 3) is 39.97 with df (1,152) which is significant at 0.01 level leading to the inference that both the variables interact with each other. Therefore, null hypotheses H04 is rejected. This result indicates that there is a significant interaction effect of gender and academic stream on techno-pedagogical competency of secondary school teachers. The interaction between gender and academic stream on techno-pedagogical competency is presented in the form of Line graph in Figure 2

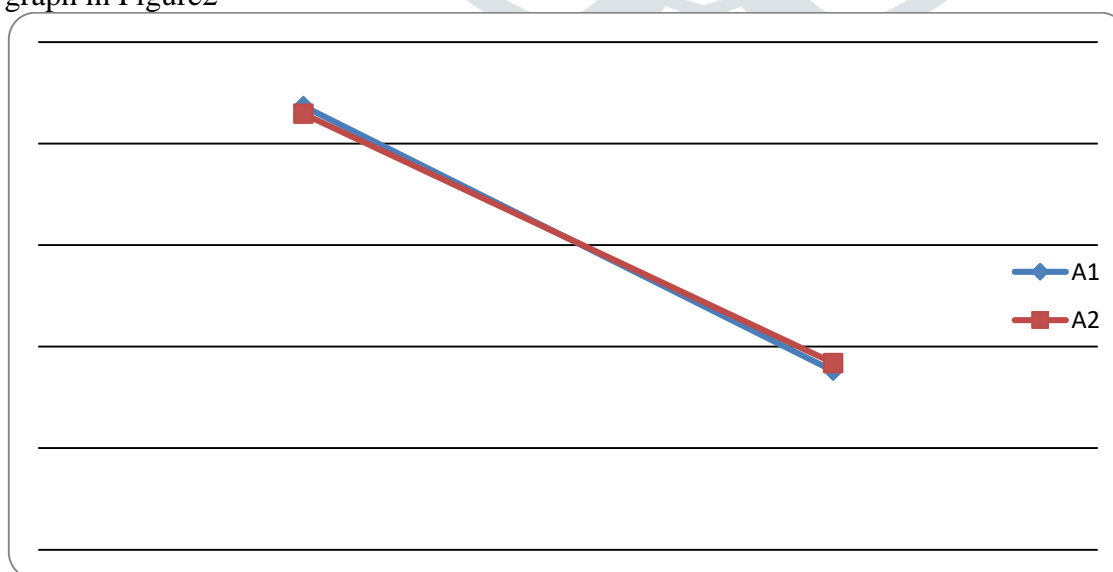


Fig. 2: The Interaction Effect between Gender and Academic Stream on Techno-pedagogical Competency

### 5.3.2 BxC (Academic stream x Teaching Experience)

The F (Bc) value for the interaction between Academic stream and Teaching Experience (Table 3) is 0.46 with df (1,152) which is not significant at any level leading to the inference that both the variables do not interact with each other. Therefore, null hypothesis H<sub>06</sub> is accepted. This result indicates that there is no significant interaction effect of Academic stream and Teaching Experience on techno-pedagogical competency of secondary school teachers.

### 5.3.3 AXC (Gender x Teaching Experience)

The F (AC) value for the interaction between gender and teaching experience (Table 3) is 4.26 with df (1,152) which is significant at 0.01 level leading to the inference that both the variables interact with each other. Therefore, null hypothesis H<sub>06</sub> is rejected. This result indicates that there is a significant interaction effect of gender and teaching experience on techno-pedagogical competency of secondary school teachers. The interaction between Gender and Teaching Experience on techno-pedagogical competency is presented in the form of Line graph in Figure 3

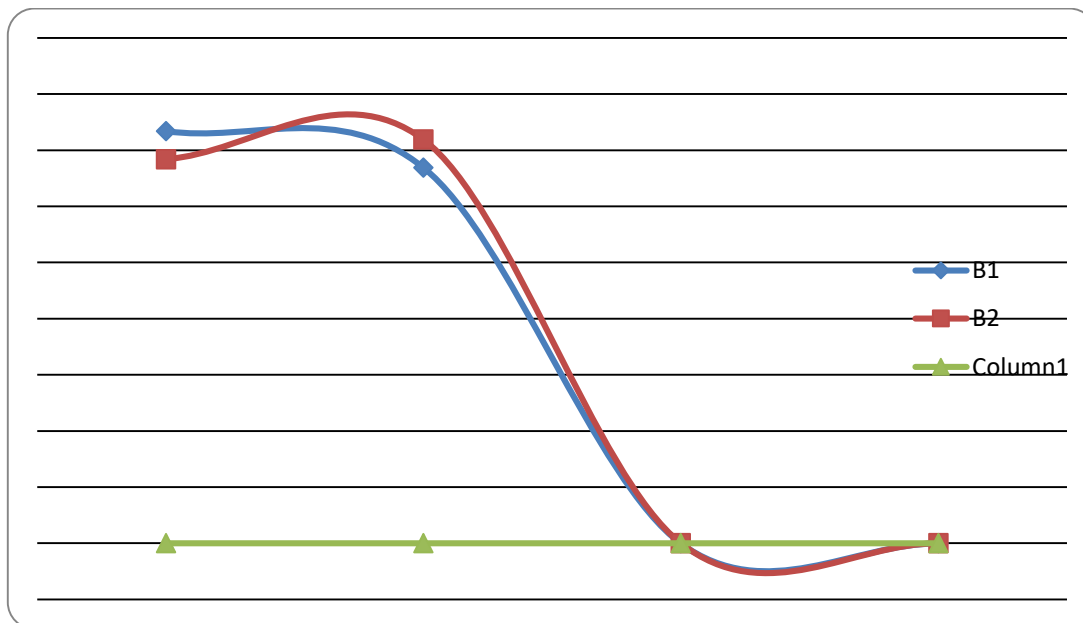


Fig. 3: The Interaction Effect between Gender and teaching experience on Techno-pedagogical Competency

### 5.3.4 Three Factor Interaction Effect

#### A X B X C (Gender X Academic Stream X Teaching Experience)

The F<sub>ABC</sub> value vide Table 2 for the triple interaction of gender, academic stream and teaching experience is 1.79 (with df 1, 152), which is not significant at any level leading to the inference that three variables do not interact with each other. Therefore null hypothesis H<sub>07</sub> is retained. This result indicates that there is no significant interaction effect to gender, academic stream and teaching experience on techno pedagogical competency of teachers working in Senior Secondary Schools.

### 5.3.5 Findings

The major findings of the study were:

- Significant difference was found in techno pedagogical competency of male and female teachers. It was revealed that male teachers had more techno pedagogical competency than the female teachers.
- There was found a significant difference in techno pedagogical competency between teachers belonging to Science and Arts group. This revealed that Science group teachers had better techno pedagogical competency than Arts group teachers.

- Significant difference was found in techno pedagogical competency of teachers having more teaching experience and less teaching experience. This showed that less experienced teachers had better techno pedagogical competency than more experience teachers.
- There was a significant interaction effect of gender and academic stream on techno pedagogical competency of teachers working in Senior Secondary Schools.
- There was no significant interaction effect of academic stream and teaching experience on techno pedagogical competency of Senior Secondary School teachers.
- There was a significant interaction effect of gender and teaching experience on techno pedagogical competency of Senior Secondary School teachers.
- There was no significant interaction effect of gender, academic stream and teaching experience on techno pedagogical competency of Senior Secondary School teachers.

## 6. IMPLICATIONS FOR PRACTICE AND FUTURE RESEARCH

With the aim of achieving Vision 2020, the ability to successfully integrate computers in the classroom environment play a crucial role in the development of a group of technologically literate workforce that is competent in the borderless knowledge based world (Melor Md. Yunus, 2007). Hence, Teachers' active integration of technology tools in classroom instruction will not only enhance the learning environment but will also assist students to be familiar with using technology in other aspects of their lives. The result of this study has implications on policy makers, school authorities and teacher training programmes/departments. Teachers' techno-pedagogical competency and use of technologies in classroom need to be taken into consideration in policy making, course designing and implementation of ICT integration in schools. Teachers need to have high level of techno-pedagogical competency to ensure positive attitudes towards the use of ICTs in the classrooms for teaching and learning purposes. The teachers need pedagogical training on how to effectively use computers both during the lesson and also in the preparation of lessons with confidence rather than just training in the computer skills. Future research should replicate this study to other types of senior secondary schools such as Urban Govt. schools, Rural Govt. senior secondary schools, boarding schools and Secondary schools considering the present study is limited to urban senior secondary public schools. Furthermore, in view of present study only utilizes the survey method, future studies may possibly consider using a mixed approach of combining quantitative data from questionnaires and qualitative data such as observations and interviews to enhance the understanding of issues and problems related to using ICTs for teaching and learning. In addition to techno-pedagogical competency, other factors that can be looked into include the physical aspects of the school, teachers' additional responsibilities, attitudes towards technology use, educational changes and organizational behaviour.

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