# Factors Affecting Teachers' Perceived Proficiency in Using ICT in the Classroom

Prema Basargekar & Chandan Singhavi
K. J. Somaiya Institute of Management Studies and Research, India

## Abstract

Effective implementation of Information and Communication Technologies (ICT) plays an important role in school education, especially in a developing country like India, to improve the quality of education. School teachers' lack of confidence and motivation for using ICT is one of the major barriers of its implementation in schools. These barriers can be either non-manipulative (i.e. which cannot be changed) or manipulative (i.e. which can be changed with the help of school/government policies). This paper studies the impact of non-manipulative and manipulative teachers' factors on their perceived proficiency in using ICT in the classrooms. It uses the primary data of 515 school teachers from the Maharashtra region of India teaching at high-school level ($8^{th}$ grade to $12^{th}$ grade). The study concludes that both non-manipulative as well as manipulative teachers' factors are important in affecting teachers' perception regarding their own proficiency in using ICT in the classrooms. The study also provides some suggestions to improve the perception by changing some manipulative factors.


**Keywords**: ICT; manipulative and non-manipulative teachers' factors; teachers' perceived confidence.

## Introduction

One of the major challenges in school education in a developing country like India is to bring better quality and standardization. Information and Communication Technologies (ICT) can be a very valuable tool to tackle this problem. ICT not only helps in the teaching and learning process, it also helps in assessment and evaluation, as well as in promoting inclusive education (Tikam, 2013). ICT can provide better access to educational resources, improve the quality of learning, improve teachers' productivity and can act as an effective tool to bridge the digital divide between various socio-economic strata. It also enhances students' participation which improves their success rate (Naji, 2017). Success or failure of ICT implementation depends on how teachers perceive themselves to be proficient in using ICT in the classroom. Teachers' perception related to their proficiency is influenced both by non-manipulative teachers' factors (demographic characteristics of the teachers) and manipulative teachers' factors (such as language of delivery, school board, training facilities, etc.) This paper studies the influence of non-manipulative as well as manipulative teachers' factors in forming their perception relating to their proficiency in using ICT in the classroom. It uses the primary data of 515 teachers teaching at high school level ($8^{th}$ grade to $12^{th}$ grade) from Mumbai Metropolitan Region, Maharashtra, India.

## Literature Review

ICT stands for a diverse set of technological tools and resources used to communicate and to create, disseminate, store and manage information. Existing research has proven a positive relationship between the active and positive role of the teachers and the successful implementation of ICT in the classrooms (Granger et al., 2002). Afshari et al. (2009) made a distinction between non-manipulative and manipulative teacher factors. Non-manipulative factors are those such as a teacher's age, work experience, gender, etc. which cannot be influenced by the external environment or by the school. Manipulative factors are those such as the school board, the language of delivery, teachers' training programs, infrastructure, etc. which can be influenced by the external environment or by school management. This classification is also adopted by other researchers such as Drent and Meelissen (2008).

Many authors have made an attempt to see the effect of personal attributes of the teachers on successful implementation of ICT. Buaneng-Andoh (2012) stated that personal characteristics like gender, age, educational qualifications and teaching experience of the teachers play an important role in effective implementation of ICT in the classrooms.

Gender is one of the attributes which affects the attitude towards computers. The discussion on 'gender' as an attribute affecting teachers' factor is important as it might have a long-term impact on implementation of ICT in the classrooms. It can also throw some light on policy implication at the school as well as at the governmental level. Volman et al. (2005) reported that girls show a lower attitude to learning ICT based skills from secondary school onwards which later is reflected in lower self-confidence in using computers. Jamieson-Proctor, Burnett, Finger and Watson (2006) found that female teachers are less likely to use ICT in classrooms compared to their male counterparts on account of a lower level of confidence.

Teaching/working experience of teachers is another attribute which may influence implementation of ICT in the classrooms. The existing research shows that there are mixed results to be found in the relationship between teacher's work experience and their use of ICT in the classrooms. For example, Hernandez-Ramos (2005) stated that teachers' understanding

of the use of technology for education as well as overall work experience will have a positive impact in building a positive attitude towards ICT. Lau and Sim (2008) also demonstrated that experienced teachers are more willing to use technology in the classroom. At the same time Wachiuri (2015) found that there is no correlation between teacher's work experience and their use of ICT in the classrooms. Baek, Jong, and Kim (2008) found the opposing relationship between work experience and ICT use in the classroom. They argued that more experienced teachers are in fact reluctant to use technology in the classrooms as compared to non-experienced and young teachers. Afshari et al. (2009) also pointed out that teachers with fewer years of experience are likely to use computers more than teachers with more years of experience. These two opposing views might also imply different policy perspectives with respect to selection of schools, teachers for implementation of ICT in the schools as well as for development of course material for teachers' training program in ICT.

Teachers' experience of working with computers is found to have a positive relationship with their use of ICT in the classrooms (Lou and Sim, 2008; Hernandez-Ramos, 2005). The authors further state that exposure to technology and knowledge of software application is vitally important for successful implementation of ICT. Gilakjani (2013) mentioned that computer self-efficacy or teachers' judgment related to their own proficiency in computers plays an important role in their using ICT in the classroom.

Manipulative teachers' factors relate to school environment such as the type of school board, language of delivery, teachers' training program facilities and the type of subjects taught by the teachers. These factors can be controlled or changed by designing and implementing effective policies at the school and the governmental level.

In most of the developing countries such as India, Bangladesh, and Sri Lanka, there are two types of Educational Boards which govern the school system. The Education Board is a controlling authority of an education system or a unit of it. The State sponsored school system is governed by Secondary School Certificate (SSC). Private school education is governed by different boards such as the Central Board of Secondary Education (CBSE), Indian Certificate for Secondary Education (ICSE) and International Baccalaureate (IB). Education boards have a very important role in designing the school curriculum and other school administration, which in turn has an impact on ICT implementation at the school level. State sponsored schools which are governed by the SSC board mainly cater to mass education and mostly use regional language as the medium of delivery. Private schools governed by other boards mainly cater to a better socio-economic class and use English as a language of delivery.

Language of delivery can also act as one of the factor affecting use of ICT. In many developing countries like India and Bangladesh many schools are using regional languages as a language of delivery. English being the dominant language of computer software, it also supports ICT and ICT supported tools. ICT is integrated in the school syllabus in two ways. Firstly, it is used as one of the compulsory subject which is taught at higher grades such as $9^{th}$ grade onwards. Secondly it is used as an effective tool to teach various subjects such as mathematics, social sciences or languages. ICT will become truly effective only if it is used as a tool to teach other subjects and not as a separate tool. For this purpose, it is most essential that electronic content is available in regional languages in which the majority of the children are learning. Lack of appropriate ICT content in the regional languages is one of the challenges of the use of ICT (Khan, Hasan and Clement, 2012).

Many studies such as Bingimlas (2009), Unwin (2005), Galanouli, Murphy and Gardner (2004) have pointed out the importance of teachers' training programs for integrating ICT successfully in the school education. Teachers' training programs not only help in building technology literacy, but also motivate teachers to use ICT in the classrooms (Hennessy, Harrison and Wamakote, 2010; Abuhmaid, 2011). Lack of in-service training is cited as one of the major barriers for integrating ICT in the classroom by many studies (Gotkas and Yildirim, 2009; Ali, Haolader and Muhammad, 2013). Kay (2006) analyzed the gender differences in pre-service teachers before and after a training program (laptop program). The authors conclude that though there were significant differences in the attitude before the program, they were mitigated after the program.

The existing research showed that personal characteristics of the teachers have a significant impact on the successful implementation of ICT in the classroom. It also pointed out that external environment like teachers' training programs; government policy; infrastructural availability can bring out positive changes. It is observed that comparatively less study is done in the context of developing economies like India. Developing countries can use ICT as one of the tools to bridge the digital divide between urban and rural schools or between private and public schools. In fact, there is a risk of widening this divide if the positive actions are not taken on time. It is in this context that this study is related to identifying teachers' factors affective their perceived proficiency in implementing ICT in the classroom.

## Objectives

The main objective of the study was to ascertain the impact of non-manipulative and manipulative teacher factors on teachers' perception related to their proficiency in using ICT in the classrooms. The specific objectives were as follows:

- To discover the impact of non-manipulative teacher factors such as age, gender, work/ teaching experience, experience of working with computers, on teachers' perception of their proficiency in using ICT in the classroom.
- To explore the impact of manipulative teacher factors such as school board, language of delivery, teachers' training programs facilities and the subjects taught on teachers' perception related to their proficiency in using ICT in the classroom.

## Methodology

The study used the primary data of 515 teachers teaching $5^{th}$ to $10^{th}$ grade. They were surveyed from Mumbai Metropolitan region, Maharashtra, India. They represent different schools from different boards such as SSC board, CBSC board, ICSE board or IB board. They came from schools providing education using different languages of delivery such as English medium schools or Regional medium schools.

Teachers' perception related to their proficiency in using ICT in the classroom was investigated using a Likert scale of 16 parameters.

Table 1: Teachers' perception related to their proficiency.

| | |
|---|---|
| 1 | I can use power point in my class |
| 2 | I can use email to communicate with other teachers and students |
| 3 | I can create a document in Microsoft word |
| 4 | I can print a document in Microsoft word |
| 5 | I can use formula in spreadsheet |
| 6 | I can teach my students creating newsletter using desktop publishing |
| 7 | I can select appropriate software to use in my teaching |
| 8 | I can design technology enhanced learning activities for my students |
| 9 | I can teach my students to use appropriate software to use in their projects |
| 10 | I can teach my students how can they make their own webpages |
| 11 | I can use internet in my class to meet certain learning goals |
| 12 | Computers help students to understand concepts clearly |
| 13 | I can teach students to use graphics software to create pictures |
| 14 | I can teach students use scanners to capture graphics, photos and/or text |
| 15 | I can teach students import clipart into text |
| 16 | I can teach my students browsing WWW |

'1' represents the lowest rank and '5' represents the highest rank. The mean of these 16 parameters is taken as an index of teachers' perceived proficiency in using ICT in the classroom. An ANOVA test is used to see whether the difference across the categories is statistically significant or not.

## Results

The data analysis is done in two parts: Descriptive analysis and inferential analysis. The descriptive analysis provides the profile of the surveyed teachers and their own perception related to computer proficiency. The inferential analysis shows the relationship between different manipulative and non-manipulative factors and teachers' perception related to proficiency in using ICT in the classroom.

### Descriptive Analysis

The basic profile of the surveyed teachers is given in Table 2.

Table 2: Profile of the surveyed teachers.

| Sr. No | Particulars | Categories | Number | Percent |
|---|---|---|---|---|
| 1 | Gender | Male | 128 | 25 |
| | | Female | 387 | 75 |
| | | Total | 515 | 100 |
| 2 | Age category | 21 years to 30 years | 93 | 18 |
| | | 30 years to 45 years | 269 | 52 |
| | | 46 years and above | 113 | 22 |
| | | Non reporting | 40 | 8 |
| | | Total | 515 | 100 |
| 3 | Language of delivery | English | 369 | 72 |
| | | Regional | 146 | 28 |

| | | | | |
|---|---|---|---|---|
| | | Total | 515 | 100 |
| 4 | Work experience | 1 year to 5 years | 124 | 24 |
| | | 6 years to 15 years | 166 | 32 |
| | | 16 years and above | 203 | 39 |
| | | Non reporting | 22 | 4 |
| | | Total | 515 | 100 |
| 5 | Experience to work with computers | 1 year to 5 years | 263 | 41 |
| | | 6 years and above | 183 | 36 |
| | | Non reporting | 69 | 13 |
| | | Total | 515 | 100 |
| 6 | Subjects taught | Technical | 217 | 42 |
| | | Non-technical | 208 | 40 |
| | | Technical + Non-technical | 90 | 17 |
| | | Total | 515 | 100 |

The table reveals that nearly 75 percent of the surveyed teachers are female. More than 50 percent belong to the age group of 30 to 45 years. Most of them are teaching in English medium schools. Around 39 percent of the surveyed teachers have work experience more than 16 years. Forty-one percent have experience in working with the computer for at least 1 to 5 years. There is a good mix of teachers teaching technical and non-technical subjects.

**Perception Related to Computer Proficiency Score**

The surveyed teachers were asked to provide their perception related to their proficiency in using ICT in the classroom. The Likert scale was used to measure it ranging from 1 scoring the lowest to 5 scoring for highest perceived proficiency. 15 parameters were used to cover various uses of ICT in the classroom ranging from simple using power point presentation in the class to helping students to make their web pages. The scale used to measure perceived proficiency of the teachers is taken from Papanastasiou and Angeli (2008). It is modified to suit Indian context. The details of the same are given in Table 3.

Table 3: Details of the perception related to Proficiency in ICT score.

| Sr. no | Parameters of proficiency in ICT | Number | Mean | Std. Dev | Minimum | Maximum |
|---|---|---|---|---|---|---|
| 1 | I can use power point in my class | 508 | 3.95 | 1.04 | 1.00 | 5.00 |
| 2 | I can use email to communicate with other teachers and students | 503 | 3.86 | 1.07 | 1.00 | 5.00 |
| 3 | I can create a document in Microsoft word | 508 | 4.06 | .98 | 1.00 | 5.00 |
| 4 | I can print a document in Microsoft word | 509 | 4.05 | 1.05 | 1.00 | 5.00 |
| 5 | I can use formula in spreadsheet | 499 | 3.89 | 1.11 | 1.00 | 5.00 |
| 6 | I can teach my students creating newsletter using desktop publishing | 492 | 3.61 | 1.14 | 1.00 | 5.00 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 7 | I can select appropriate software to use in my teaching | 499 | 3.75 | 1.09 | 1.00 | 5.00 |
| 8 | I can design technology enhanced learning activities for my students | 499 | 3.60 | 1.15 | 1.00 | 5.00 |
| 9 | I can teach my students to use appropriate software to use in their projects | 500 | 3.71 | 1.09 | 1.00 | 5.00 |
| 10 | I can teach my students how can they make their own webpages | 500 | 3.26 | 1.24 | 1.00 | 5.00 |
| 11 | I can use internet in my class to meet certain learning goals | 500 | 3.76 | 1.18 | 1.00 | 5.00 |
| 12 | I can teach students to use graphics software to create pictures | 498 | 3.45 | 1.28 | 1.00 | 5.00 |
| 13 | I can teach students use scanners to capture graphics, photos and/or text | 495 | 3.50 | 1.19 | 1.00 | 5.00 |
| 14 | I can teach students import clipart into text | 499 | 3.70 | 1.19 | 1.00 | 5.00 |
| 15 | I can teach my students browsing WWW | 503 | 3.93 | 1.05 | 1.00 | 5.00 |
| | Overall Proficiency score | 515 | 3.74 | 0.95 | .00 | 5.00 |

The overall score of perception related to proficiency in ICT is 3.74 out of maximum 5. It ranges from minimum zero to maximum 5. The data shows that it ranges widely across different parameters of proficiency. It is found to be higher in using computers for routine functions like creating a word doc (4.06), printing a document (4.05) and using power point presentation in a classroom (3.95). It is lower in more technical use of computers such as helping students to make their own web pages (3.26), teaching with the help of graphic software (3.45) and using the scanners to capture graphics, text, etc. (3.50).

**Inferential Analysis**

ANOVA was used to discover the impact of non-manipulative and manipulative factors on teachers' perceived proficiency in using ICT in the classroom.

**Impact of Non-manipulative Factors**

A number of non-manipulative factors such as gender, age group, teaching/ working experience, experience to work with the computers, and the type of subjects taught by the teacher were considered for further analysis.

**Impact of Gender on Teachers' Perceived Proficiency in Using ICT**

The surveyed teachers were classified into male and female s to examine the impact of gender on their perceived proficiency in using ICT in the classroom.

$H_1$: The difference in gender of teachers affects their perceived proficiency in using ICT in the classroom.

Table 4: Perceived proficiency in using ICT as per the gender.

| Sr. No | Gender | Number | Mean | S.D | Minimum | Maximum |
|---|---|---|---|---|---|---|
| 1 | Male | 128 | 3.58 | 1.12 | .00 | 5.00 |
| 2 | Female | 387 | 3.82 | .88 | .00 | 5.00 |
| Total | Total | 515 | 3.76 | .95 | .00 | 5.00 |

The mean of perceived proficiency in using ICT of female teachers is higher than that of male teachers. It is found that the difference across the categories of the gender is statistically significant as $p < 0.05$. This finding is different from that reported in the existing literature.

**Impact of Age Group on Perceived Proficiency in Using ICT**

The surveyed teachers were classified into 3 categories as per the age group 21 years to 30 years, 31 years to 45 years and 46 years and above.

$H_2$: The difference in age-group of teachers affects their perceived proficiency in using ICT in the classroom.

Table 5: Perceived proficiency in using ICT as per the age group.

| Sr. No | Age Group | Number | Mean | S.D | Minimum | Maximum |
|---|---|---|---|---|---|---|
| 1 | 21 years to 30 years | 93 | 3.97 | .83 | 1.00 | 5.00 |
| 2 | 30 years to 45 years | 269 | 3.71 | .93 | .00 | 5.00 |
| | 46 years and above | 113 | 3.69 | 1.04 | .00 | 5.00 |
| Total | Total | 475 | 3.76 | .94 | .00 | 5.00 |

The mean of perceived proficiency score is highest for the age group of 21 years to 30 years and lowest for the last group of 46 years and above. The difference across the groups is found out to be statistically significant as $p < 0.05$. This finding confirms some of the earlier studies by stating that younger teachers are relatively more confident and enthusiastic to use ICT in the classroom.

**Impact of Work/Teaching Experience on Perceived Proficiency in Using ICT**

In order to see whether work experience has any impact on the perceived proficiency or not, the surveyed teachers were classified into three groups such as working experience up to 1 to 5 years, 6 to 15 years and 26 and above.

$H_3$: The difference in working/ teaching experience of the teachers affects their perceived proficiency in using ICT in the classroom.

Table 6: Perceived proficiency in using ICT as per the working/teaching experience.

| Sr. No | Teaching/Working experience | Number | Mean | S.D | Minimum | Maximum |
|---|---|---|---|---|---|---|
| 1 | 1 year to 5 years | 124 | 3.96 | .81 | 1.00 | 5.00 |
| 2 | 6 years to 15 years | 166 | 3.74 | .94 | .00 | 5.00 |
| 3 | 16 years and above | 203 | 3.69 | 1.00 | .00 | 5.00 |
| Total | Total | 493 | 3.77 | .94 | .00 | 5.00 |

The mean of perceived proficiency in using ICT is higher in the first category of 1 to 5 years of work experience and lowest in the third category of work experience of 16 years and above. The difference across the three categories is statistically significant ($p < 0.05$). This finding goes in tandem with our earlier finding of perceived proficiency with the age group of the surveyed teachers.

**Impact of Experience to Work with Computers on Perceived Proficiency in Using ICT**

The surveyed teachers were classified into three groups such as working experience up to 1 to 5 years, 6 to 15 years and 26 and above.

$H_4$: The difference in teacher's experience to work with computers affects their perceived proficiency in using ICT in the classroom.

Table 7: Perceived proficiency in using ICT as per the experience to work with computers.

| Sr. No | Experience to work with computers | Number | Mean | S.D | Minimum | Maximum |
|---|---|---|---|---|---|---|
| 1 | 1 year to 5 years | 69 | 3.76 | .98 | .00 | 5.00 |
| 2 | 6 years to 15 years | 263 | 3.67 | .93 | .00 | 5.00 |
| | 16 years and above | 183 | 3.90 | .95 | .00 | 5.00 |
| Total | Total | 515 | 3.76 | .95 | .00 | 5.00 |

It can be seen that with rising years of experience to work with the computers the mean of perceived proficiency in using ICT is also rising. The difference across the categories is statistically significant ($p < 0.05$).

**Impact of the Type of Subjects Taught on the Perceived Proficiency in Using ICT**

It is believed that some of the subjects like mathematics, science and computers (technical subjects) might be more easily learnt with the help of technology as compared to other subjects such as languages, social sciences, etc. (non-technical subjects). In order to find out whether the perceived proficiency differs due to the type of the subjects taught or not, the surveyed teachers were classified into three groups such as those who teach technical subjects, those who teach non-technical subjects and those who teach both type of subjects.

$H_5$: The difference in the type of subjects taught by the teachers affects their perceived proficiency in using ICT in the classroom.

Table 8: Perceived proficiency in using ICT as per the subjects taught.

| Sr. No | Subjects taught | Number | Mean | S.D | Minimum | Maximum |
|---|---|---|---|---|---|---|
| 1 | Technical | 217 | 3.72 | 1.02 | .00 | 5.00 |
| 2 | Non- technical | 208 | 3.73 | .95 | .00 | 5.00 |
| 3 | Both | 90 | 3.95 | .73 | 2.00 | 5.00 |
| Total | Total | 515 | 3.76 | .95 | .00 | 5.00 |

It is seen that the mean of perceived proficiency in using ICT in the classroom amongst the teachers teaching technical subjects (like mathematics, science and computer) is not so

different than the teachers teaching non-technical subjects (like languages, social sciences, etc.). Also the mean of perceived proficiency of teachers taking both technical as well as non-technical subjects is higher than other two categories. The difference across the categories is not statistically significant ($p > 0.05$).

**Impact of Manipulative Factors on Perceived Proficiency of Teachers in Using ICT in the Classroom**

Manipulative factors included in this study are related to school environment such as type of school board, language of delivery and the teachers' training program facilities.

**Impact of Type of School Board on Teachers' Perceived Proficiency in Using ICT**

The surveyed teachers belong to four different types of boards. They are as follows:

a. Secondary School Certificate (SSC board) – These schools are also popularly known as state board school run with the help of state government grant
b. Central Board of Secondary Education – CBSE
c. Indian Certificate for Secondary Education (ICSE)
d. International Baccalaureate (IB)

There is a significant difference between the SSC board schools and other board schools. Most of the other board schools are privately run. They have better amenities and they mainly cater to higher socio-economic strata in the society as compared with SSC board school. They all are English medium schools. Most of the SSC board schools are catering to mass education and many of them are regional medium schools. In order to find out whether the type of board has any impact on teachers' perceived proficiency in using ICT, they were classified into two groups: SSC board and other boards. This classification also reflects the difference between state board schools and private schools.

$H_{06}$: The difference in the type of school board will not have any impact on perceived proficiency in using ICT in the classroom.

$H_6$: The difference in the type of school board in which teachers are working affects their perceived proficiency in using ICT in the classroom.

Table 9: Perceived proficiency in using ICT as per the school board.

| Sr. No | School Board | Number | Mean | S.D | Minimum | Maximum |
|---|---|---|---|---|---|---|
| 1 | SSC | 353 | 3.65 | .96166 | .00 | 5.00 |
| 2 | Other Boards | 159 | 4.03 | .88175 | .00 | 5.00 |
| 3 | Total | 512 | 3.77 | .95261 | .00 | 5.00 |

The mean of perceived proficiency in using ICT is lower for teachers working in SSC board than that of other boards. This difference is found out to be statistically significant ($P < 0.05$). As mentioned earlier, most of the SSC board schools cater to the mass education where the infrastructural resources are relatively less as compared to other board schools.

## Impact of Language of Delivery on Teachers' Perceived Proficiency in Using ICT

Language of delivery can have a strong impact on the teachers' perceived proficiency in ICT. In order to see that the surveyed teachers were classified into two groups such as those who are working in regional medium schools and in English medium schools.

$H_7$: The difference in language of delivery of the school affects teachers' perceived proficiency in using ICT in the classroom.

Table 10: Perceived proficiency in using ICT as per the language of delivery.

| Sr. No | Language of delivery | Number | Mean | S.D | Minimum | Maximum |
|---|---|---|---|---|---|---|
| 1 | English | 369 | 3.88 | .86 | .00 | 5.00 |
| 2 | Regional | 146 | 3.47 | 1.09 | 1.00 | 5.00 |
| Total | Total | 515 | 3.76 | .95 | .00 | 5.00 |

The data analysis reveals that the mean of perceived proficiency in using ICT for teachers working in English medium schools is significantly higher than that of teachers working in regional medium schools. This difference across the two categories is statistically significant as $p < 0.05$.

## Impact of Teachers' Training Programs on Teachers' Perceived Proficiency in Using ICT

Teachers' training programs play an important role in building computer skills and in creating positive attitude towards using ICT in the classroom. The surveyed teachers were asked about the type of training taken by them to improve their proficiency. It is as follows:

Table 11: The list of training modules to improve proficiency of teachers in using ICT.

| Sr. No | List of the modules |
|---|---|
| 1 | Introductory course on internet use |
| 2 | Introductory course on general application (Basic word, spreadsheet, presentation) |
| 3 | Advanced course on applications (advanced word processing, relational databases, visual learning environment etc.) |
| 4 | Advanced course on internet use (creating website/home page, video conferencing etc...) |
| 5 | Equipment specific training (interactive white board software, laptop, etc..) |
| 6 | Courses on pedagogical use of ICT in teaching and learning |
| 7 | Subjects specific training on learning applications (tutorials, simulations, etc…) |
| 8 | Courses on multimedia (using digital video, audio equipment) |
| 9 | Participating in online communities (e.g. mailing list, twitter, blogs etc..) for professional discussion with other teachers |
| 10 | ICT training provided by school staff |
| 11 | Personal learning about ICT in your own time |
| 12 | Other training related to ICT |
| 13 | How to use ICT to support assessment of learning |
| 14 | Planning and implementing e-learning in your class or school |

The list covers a variety of training modules ranging from a basic introductory course such as using internet to advanced courses such as use of multi-media, simulations, etc. The teachers were classified based on the number of modules they had covered in the overall training programs such as: training facility not accessed, 1 to 4 modules, 5 to 10 modules, and above 10 modules.

$H_8$: The number of Teachers' training program attended by teachers affects their perceived proficiency in using ICT in the classroom.

Table 12: Perceived Proficiency in using ICT as per teachers' training program facility in terms of number of modules covered in the training programs.

| Sr. No | Category of training modules | Number | Mean | S.D | Minimum | Maximum |
|---|---|---|---|---|---|---|
| 1 | 0 | 36 | 3.50 | .87 | 1.00 | 5.00 |
| 2 | 1-4 | 88 | 3.60 | .91 | 1.00 | 5.00 |
| 3 | 5-10 | 156 | 3.86 | .99 | .00 | 5.00 |
| 4 | Above 11 | 60 | 3.88 | .88 | 1.00 | 5.00 |
| | Total | 340 | 3.76 | .95 | .00 | 5.00 |

The data analysis shows that the mean of perceived proficiency in using ICT in the classroom is rising as per the rising number of modules covered in the training program. The difference across all the categories is statistically significant ($p < 0.05$). It can thus be concluded that teacher training programs have an impact on perceived proficiency in using ICT in the classroom.

**Summary of Findings**

Table 13 gives the summary of inferential analysis about acceptance or rejection of hypotheses.

Table 13: Acceptance and rejection of hypotheses.

| Sr. no | Hypotheses | Between the groups and within the groups |
|---|---|---|
| 1 | Gender | Null hypothesis is rejected and alternative hypotheses are accepted |
| 2 | Age group | Null hypothesis is rejected and alternative hypotheses are accepted |
| 3 | Teaching/working experience | Null hypothesis is rejected and alternative hypotheses are accepted |
| 4 | Experience to work with computers | Null hypothesis is rejected and alternative hypotheses are accepted |
| 5 | Subjects taught | Null hypothesis is accepted and alternative hypotheses are rejected |
| 6 | School board | Null hypothesis is rejected and alternative hypotheses are accepted |
| 7 | Language of delivery | Null hypothesis is rejected and alternative hypotheses are accepted |
| 8 | Null hypothesis is rejected and alternative hypotheses are accepted | Null hypothesis is rejected and alternative hypotheses are accepted |

## Discussion

Our study showed that both non-manipulative and manipulative factors play an important role in developing teachers perceived proficiency in using ICT in the classroom. In non-manipulative factors, gender, age group, work experience and experience to work with the computers are found out to be significant factors.

Our study reflected that female teachers have higher level of perceived proficiency in using ICT in the classroom than their male counterparts. This is in contradiction to the existing research. The existing literature states that female teachers are less proficient in using ICT in the classroom. This might be due to two facts. Firstly, the proportion of female teachers is significantly high at school level as it is considered to be an appropriate (safe, respectable, etc.) job for educated females in the Indian context.

Secondly, all the state board schools (SSC) have a compulsory component of teacher training programs in ICT where most of our surveyed female teachers are working. This finding may have a positive implication for school management and policy makers. Implementation of ICT may not face a gender barrier of as the proportion of female teachers is larger than that of male teachers.

Age group and working/teaching experience has a negative relation with the perceived proficiency in using ICT in the classroom. The existing research also shows that younger teachers and teachers with less number of years of experience are more enthusiastic to use technology in the classroom. This may be due to various reasons. Firstly, teachers from higher age-groups and having longer experience may feel threatened due to new technologies such as ICT and using computers in the classrooms. The feeling of getting easily replaced by the technology might have created a negative attitude in using it. Secondly adopting ICT also means changing pedagogy and moving towards encouraging self-learning process rather than teaching and instructing in the classroom.

Experience to work with the computers has a positive relationship with perceived proficiency in using ICT in the classroom.

It might be perceived that ICT can be used more effectively for teaching technical subjects like mathematics or science rather than non-technical subjects like languages or social sciences. Our study showed that the type of subject category taught by the teachers has no relationship with perceived proficiency in using ICT in the classroom. This indicates that teachers perceive that both technical as well as non-technical both the subjects can be effectively taught with the help of ICT.

Manipulative factors cover type of school board, language of delivery and teachers training program facilities. The study shows that teachers working in State education board (SSC) has relatively lower perceived proficiency in using ICT in the classroom as compared to the teacher working in other boards (CBSC, ICSE and IB). State education board schools are also public grant schools or popularly known as public schools. Most of the other board schools are private schools. These schools also reflect the socio-economic status of the children admitted in these schools. Most of the children from weaker socio-economic background attend public schools which are free, whereas children from better socio-economic background attend private schools.

Our study showed that perceived proficiency of teachers in private schools is higher than that of public schools. This indicates that socio-economic context of the school and availability of infrastructure has an impact on teachers' perceived proficiency in using ICT in the classroom. The study finds that the language of delivery has a very strong impact on perceived proficiency in using ICT in the classroom. The teachers working in the regional medium schools were found to have substantially low perceived proficiency in using ICT in the classroom as compared to English medium schools. This result goes in tandem with the existing literature which states that due to inadequate support of software and e-content in regional languages, the integration of ICT in regional language schools is lesser than in English medium schools. This is a major challenge for a developing country like India as majority of the children attending regional medium schools and public schools are also coming from weaker section of the society. ICT can encourage inclusive education in a true sense only if it can enable education in regional languages.

The study further confirms that teachers' training programs have a positive impact on teachers' perceived proficiency on using ICT.

## Recommendations

The study provides the following suggestions:

- The existing research unanimously agrees that teachers play a vital role in successful implementation of ICT in the school. Therefore, the importance of building the proficiency of teachers to use ICT cannot be overstated. The school management and policy makers can consider the non-manipulative and non-manipulative factors to improve the teachers' proficiency in using ICT in the classroom.

- Non-manipulative teachers' factors are related to their demographic characteristics. It is found that age group and working experience of the teachers have a negative relation with the perceived proficiency. Hence, it is suggested that special teachers' training programs can be organized for more experienced and mature teachers. Teachers having more number of years of experience and belonging to higher age-group often face a fear of getting replaced by new technologies like ICT. The training should also be oriented in removing these fears and building a positive attitude for using ICT in the classrooms. Training in building technical competencies should also be complemented with training in changing the mind-set.

- Manipulative factors are under control of the school management. As it is found that the teachers from the SSC board school have lower perceived proficiency in using ICT, it is recommended that the state government and school managements of these schools should take active efforts to build teachers proficiency. Compulsory teachers training programs is one such positive move which is recently taken by many state governments. Along with that it is also necessary to provide the supporting environment to the teachers in terms of infrastructure, incentives and time availability. Attaran, Alias and Siraj (2012) pointed out that effective implementation of ICT in schools requires creation of learning culture which requires top management's support, investment in technology such as internet, portal development, computer equipment and other required machinery, common mission and values among all the stakeholders and strong course material in electronic format.

- It is seen in our study that teachers from regional medium school have significantly lower perceived proficiency in ICT as compared to the teachers from English medium school. This can be on account of inadequate resources such as appropriate software and e-content in regional language. Attention must be given to build-up these resources in the regional language. It may have a long-term impact of increasing or mitigating the digital gap in the country. Development of e-content in regional languages is essential if ICT is to be used for bridging the digital divide between public and private schools.

- This study as well as the existing research has shown that teachers' training programs are important to build-up their capabilities and attitudes. These training programs need to be appropriately designed and conducted based on the proficiency level, age group, work experience and the subjects taught by the teachers. As use of ICT will lead to more self-study oriented learning, the teaching pedagogy also needs to be changed. The teachers need to mould themselves as facilitators rather than as instructors. The training programs should also focus on changing their mind-sets and building a positive attitude towards using ICT in the classrooms.

## Conclusion

This study focused on finding out the impact of non-manipulative and manipulative teachers' factors on their perceived proficiency in using ICT in the classrooms. It has a special reference to a developing country like India where there is a huge variation in the standard and quality of school education due to divergent socio-economic backgrounds of population. The study finds that teachers' perceptions are affected by non-manipulative as well as manipulative factors. It further recommends that intervention in terms of creation of e-content in regional languages and encouraging teachers training program in ICT will go a long way in improving their perceived proficiency in using ICT in the classrooms.

## References

Abuhmaid, A. (2011). ICT training courses for teacher professional development in Jordan. *The Turkish Online Journal of Educational Technology*, *10*(4), 195–210.

Afshari, M., Bakar, K., Luan, W. S., Samah, B. A., & Fooi, F. S. (2009). Factors affecting teachers' use of information and communication technology. *International Journal of Instruction*, *2*(1), 77–104.

Ali, G., Haolader, F., & Muhammad, K. (2013). The role of ICT to make teaching-learning effective in higher institutions of learning in Uganda. *International Journal of Innovative Research in Science, Engineering and Technology*, *2*(8), 4061–4072.

Attaram, M., Alias, N., & Siraj, S. (2012). Learning culture in a smart school: A case study. *Procedia-Social and Behavioural Sciences*, *64*, 417–423. https://doi.org/10.1016/j.sbspro.2012.11.049

Baek, Y.G., Jong, J., & Kim, B. (2008). What makes teachers use of technology in the classroom? Exploring the factors affecting facilitation of technology with a Korean sample. *Computers and Education, 50*(8), 224–234. https://doi.org/10.1016/j.compedu.2006.05.002

Bingimlas, K. A. (2009). Barriers to the successful integration of ICT in teaching and learning environments: A review of the literature. *Eurasia Journal of Mathematics, Science & Technology Education*, *5*(3).

Buaneng-Andoh, C. (2012). Factors influencing teachers' adoption and integration of information and communication technology into teaching: A review of the literature. *International Journal of Education and Development using Information and Communication Technology, 8*(1), 136–155.

Drent, M., & Meelissen, M. (2008). Which factors obstruct or stimulate teacher educators to use ICT innovatively? *Computers & Education*, *51*(1), 187–199. https://doi.org/10.1016/j.compedu.2007.05.001

Galanouli, D., Murphy, C., & Gardner, J. (2004). Teachers' perceptions of the effectiveness of ICT-competence training. *Computers & Education*, *43*(1), 63–79. https://doi.org/10.1016/j.compedu.2003.12.005

Gilakjani, A. (2013). Factors contributing to teachers' use of computer technology in the classroom. *Universal Journal of Educational Research, 1*(3), 262–267.

Goktas, Y., Yildirim, S., & Yildirim, Z. (2009). Main barriers and possible enablers of ICTs integration into pre-service teacher education programs. *Educational Technology & Society*, *12*(1), 193–204.

Granger, C. A., Morbey, M. L., Lotherington, H., Owston, R. D., & Wideman, H. H. (2002). Factors contributing to teachers' successful implementation of IT. *Journal of Computer Assisted Learning*, *18*(4), 480–488. https://doi.org/10.1046/j.0266-4909.2002.00259.doc.x

Hennessy, S., Harrison, D., & Wamakote, L. (2010). Teacher factors influencing classroom use of ICT in Sub-Saharan Africa**,** *Itupale Online Journal of African Studies,* 2, 39–54. http://www.a-id.org/pdf/teacher-factors-influencing-classroom-use-of-ict.pdf

Hernandez-Ramos, P. (2005). If not here, where? Understanding teachers use of technology in Silicon Valley Schools. *Journal of Research on Technology in Education, 3*(1), 39–64. https://doi.org/10.1080/15391523.2005.10782449

Jamieson-Proctor, R., Burnett, P., Finger, G., & Watson, G. (2006). ICT integration and teachers' confidence in using ICT for teaching and learning in Queensland state schools. *Australian Journal of Educational Technology*, *22*(4), 511–530. https://doi.org/10.14742/ajet.1283

Kay, R. (2006). Addressing gender differences in computer ability, attitudes and use: The laptop effect. *Journal of Educational Computing Research*, *34*(2), 187–211. https://doi.org/10.2190/9BLQ-883Y-XQMA-FCAH

Khan, S, Hasan, M., & Clement, C. (2012). Barriers to the introduction of ICT into education in developing countries: The example of Bangladesh. *International Journal of Instruction, 5*(2), 61–80.

Lau, B., & Sim, C. (2008). Exploring the extent of ICT adoption among secondary school teachers in Malaysia. *International Journal of Computing and ICT Research*, *2*(2), 19–36.

Naji, S. (2017). The impact of ICT on schools. *IOSR Journal of Business & Management*, 19, 83–85. https://doi.org/10.9790/487X-1901078385

Papanastasiou, E. C., & Angeli, C. (2008). Evaluating the use of ICT in education: Psychometric properties of the survey of factors affecting teachers teaching with technology (SFA-T3 ). *Educational Technology & Society*, 11 (1), 69–86.

Tikam, M. V. (2013). Impact of ICT on education. *International Journal of Information Communication Technologies and Human Development (IJICTHD)*, *5*(4), 1–9. https://doi.org/10.4018/ijicthd.2013100101

Unwin, T. (2005). Towards a framework for the use of ICT in teacher training in Africa. *Open Learning: The Journal of Open, Distance and e-Learning*, *20*(2), 113–129. https://doi.org/10.1080/02680510500094124

Volman, M., Van Eck, E., Heemskerk, I., & Kuiper, E. (2005). New technologies, new differences. Gender and ethnic differences in pupils' use of ICT in primary and secondary education. *Computers & Education*, *45*, 35–55. https://doi.org/10.1016/S0360-1315(04)00072-7

Wachiuri, R. N. (2015). Effects of teachers' experience and training on implementation of information communication technology in public secondary schools in Nyeri, Central District, Kenya, *IOSR Journal of Humanities and Social Science*, *20*(3), 26–38.

**Corresponding author:** Prema Basargekar
**Email:** prema@somaiya.edu