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Implementing ICT at School Level: Factors Affecting Teachers' Perceived Proficiency

Dr. Chandan Singhavi and Dr. Prema Basargekar

K J Somaiya Institute of Management, Mumbai, India
chandans@somaiya.edu
prema@somaiya.edu

Abstract.

Implementation of Information and Communication Technology (ICT) at the school level has become a need of the hour during the pandemic period. The factor which plays important aspect for adopting ICT in the schools is lack of readiness of the teachers for adopting ICT in the classrooms. This is very closely related to the teachers' perceived proficiency for usage of ICT effectively in the classroom. The present study tries to identify the factors like access to ICT, ICT material etc. affecting the perceived proficiency of teachers related to using ICT. The perceived proficiency is affected by number of factors such as school culture, school leadership, access to ICT resources, availability of digital content as well as support received from colleagues and the administration. These factors also impact the perception about ICT as an effective tool of teaching learning activity.

The study uses the primary data collection of 515 school teachers located in Maharashtra. It uses SmartPLS3 software for theory building to see the relationship between exogenous variable affecting perception about ICT and perceived proficiency of the teachers to use ICT in the teaching learning process. The study concludes that positive perception about ICT as a teaching learning tool positively and significantly impacts teachers' perceived proficiency to use ICT. Similarly, many of the factors such as availability of computer equipment and resources and ICT related digital content contributes perceived proficiency positively. The paper also provides few policy measures for effective implementation of ICT at school level.

Keywords: ICT, School education, Teachers' perceived proficiency, E-learning

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1 Introduction

The World Bank estimation says, school closures due to Coronavirus – COVID19 impacted more than 1.5 billion students accounting for 87.5 percent of the learners from 180 countries[1]. In India more than 250 million students suffered due to closure of the schools. Along with risk of higher school drop-outs, decline in confidence and self-esteem of the children and declining effectiveness of teaching and learning process, it also puts a major threat to future skill building and manpower development. This proves that use of Information and Communication Technology (ICT) is no more a luxury or a supplementary tool for the schools and it is now become the most vital instrument to bring the continuum of education. Implementing ICT has many challenges such as access to computer equipment and internet, availability of educational content in digital platform and the readiness of the schools, parents and children to adapt the new pedagogies. One of the major challenges is readiness of the teachers to use ICT in their classrooms which is impacted by their perceived proficiency and perception of using ICT for teaching and learning. This paper tries to find out the impact of various school level factors such as school leadership and administrative support, access to ICT resources, access to ICT teaching-learning material and support from colleagues help in creating a positive perception about the efficacy of using ICT in the classroom and that in turn impacts perceived proficiency of teachers' in using ICT positively.

2 Objective

The objective of the study is to assess the impact of various school level factors on perception about ICT as an effective teaching-learning tool which acts as a mediator variable in creating a positive perceived proficiency to implement ICT effectively in the classroom.

3 Review of literature

Importance of ICT in school education in making education more learners centric, more inclusive and more democratic is well proven in the existing literature. One of the major challenges in its successful implementation is the attitude and perceptions of the teachers about its effectiveness and their own perceived proficiency in implementing ICT in the classroom. Various factors such as school leadership, school culture, role of ICT coordinator, training facilities made available to the teachers play an important role in it.

This review of literature covers the impact of four important characteristics at school level which impact perception and perceived proficiency of teachers' in implementing ICT in the classroom. They are School leadership and administrative support, Access to ICT equipment and infrastructure, Availability of ICT teaching learning material and

[1] https://edtechhub.org/wp-content/uploads/2020/04/education-during-covid-19-crisis.pdf

, Support of the colleagues. The literature shows that these four factors have an impact on the teachers' perception about the efficacy of ICT as a teaching-learning tool as well as on their perceived proficiency in using ICT in the classroom.

3.1 School leadership and administrative support:

School leadership plays an important role in creating mission and vision supporting ICT integration in the school, creating encouraging environment and providing administrative support for implementing ICT at the classroom level. Integration of ICT in school's mission and vision enables long-term sustenance [25,17] which in turn encourages professional development of the teachers required for successful implementation of ICT. School leaders' own competency and attitude towards ICT influences school culture and day to day policies [2, 20]. Porten et al. [32] also state that school principals play an important role in not only designing mission and vision but also in providing required support in terms of provision of budget and designing educational policies to articulate mission in action. Along with that the school leaders also have to create shared vision with teachers and staff to implement ICT, motivate them and build collaborative culture which is necessary for integrating ICT in the classroom [24, 33]. Teacher's attitudes are positively affected by the support provided by administration towards the use of computers. [14]. Buabeng-Andoh and Yidana [16] and Albugarni and Ahmed [3] found that lack of good school leadership and administrative support can lead to teacher centric education and lack of confidence amongst teachers for fully integrating ICT in curriculum.

Sharija and Watters [36] mention the role of school leadership in successful implementation of ICT in a very clear way. They mention that the school leaders have to go beyond the change maker and have to adopt the role of learning leader by demonstrating the use of ICT, persuading old and reluctant teachers to adopt ICT and building communication between teachers and ICT technology specialists. Eickelmann [15] summarizes the role of school leadership by stating that strong school leadership having a sound understanding of the potential of ICT as an effective teaching- learning tool and able to link ICT integration in regular classrooms by involving all the teachers and associating it with pedagogical aims of the school will make ICT sustainable in the long-run.

3.2 Access to ICT equipment and infrastructure:

Researchers have also studied the impact of access of ICT resources to the teachers such as computers, internet, software, suitable classrooms and the degree of accessibility on building their perception related to ICT as an effective tool and building the confidence to use it in the classroom. Aramide and Ladipo [6] found that accessibility to ICT resources and location of ICT resource (i.e. whether it is in the classroom, computer lab, building, etc.) can impact the use of ICT and teachers' perception towards it. Teachers perceived access to ICT resources, perceived administrative support and their perceived confidence can lead to higher use of ICT in the classroom [8,9]. Thunman

and Persson [40] mention that unequal access of ICT resources at different schools such as public and private or independent schools can potentially cause significant differences in learning abilities for the children.

3.3 Availability of ICT teaching learning material:

Many authors have concluded that sheer provision of hardware and software will not increase the readiness of teachers to integrate ICT in the classroom. Availability of ICT teaching material and access to it is a key factor for ICT integration. Usage of ICT material positively affects teaching learning process. Inability of teacher for searching right content on internet is limiting factor for ICT adoption in the class[1] . Ekberg and Gao [16] also mention lack of digital content and time consuming process to find the right kind of content as major challenges in adoption of ICT at the school level. The lack of time available to master the software or adopting the ICT in the teaching learning process are the barrier for teachers to adopt ICT in the classroom [17,4].

Onofrei [31] observes that many schools are using ICT at basic levels such as for finding information on internet, organizing activities and so on. But very few schools are using ICT by taking collaborative approach and making use of digital processing materials and various specialized software which will improve the learning outcomes. It is very important to build techno-pedagogical literacy of the teachers. Slabeycius and Polčin [38] describe the EDULAB project from Slovania of how it systematically created 30,000 projects by using digital technologies to teach mathematics and physics. Interface easiness and website interface displays are also important in making the learning process enjoyable and enriching [34].

3.4 Support of the colleagues:

ICT requires higher level of collaborations amongst teachers. The platform for teachers to share technology practices and experience is likely to help in increasing perceived proficiency of teachers. If schools provide opportunities to the teachers to observe the teachers who use technology effectively will help other teachers to try and adopt ICT in the classroom [18]. Ming et al [27] report about the project ‘e-CPDelT Model 2020’ which will act as a catalyst to serve as a nucleus to all teachers of research, materials, pedagogical skills and will be a support system to bring out attitudinal change in teachers.

3.5 Relationship between perception toward ICT as an effective teaching-learning tool and perceived proficiency of teachers:

The existing research throws a light on teachers’ perception about ICT and their perceived proficiency. It shows that there is a positive relationship between teachers’ attitude towards ICT and its successful implementation in the classroom. Lack of acceptance and enthusiasm of teachers to use ICT is cited as one of the principle reason for low penetration of ICT in education [28,35].

Building teachers' proficiency for using ICT in the classroom requires multidimensional approach such as bringing attitudinal changes, changing organizational culture and providing scope for professional development for building competencies [37]. Mynaríková and Novotný [29] support this argument and state that efforts should be made to reduce the distrust of the teachers on ICT as a useful technology and reduce the level of anxiety to use it.

Buabeng-Andoh [7] found that teachers' competence and perception related to efficacy of ICT as a tool positively gets affected by their access to the instructional material which is learner centric. Amenyedzi et al [5] report that willpower of the teachers to learn ICT tools and appropriate training programs to help them reflect on existing education practices and encourage them to adopt new technologies will go a long way to develop positive perceptions about ICT.

To sum up the existing literature speaks about the factors affecting the teachers' attitude towards implementation of ICT. It also proves how teachers' attitude plays an important role in its effective utilization of ICT in the classroom. The present study focuses on bridging two gaps in the existing literature – i) this type of study is not made in the Indian context – specifically covering its diverse range under school education system of various boards and different languages of delivery ii) the path analysis between the school related factors affecting teachers' perceptions which in turn affect their perceived proficiency of using ICT in the classroom is not attempted.

4 Research methodology

The study uses the primary data collection method. The 515 respondents surveyed for the study were teachers teaching to grade 5^{th} to 10^{th} grades. The schools selected for the survey were located in Mumbai Metropolitan region, Suburban region of Mumbai and Navi Mumbai, Maharashtra, India. The study used stratified random sampling. The teachers selected were from different schools belong to different board of education, government & private school and medium of instruction as English and Regional (Marathi). The adoption of ICT, ICT enabled curriculum, ICT policies of these boards are different.

The questionnaire was designed with the help of three pretested questionnaires from the existing literature. First questionnaire used was taken from the questionnaire used by the survey which was funded by European Commission and the questionnaire was administered in 31 countries. The second questionnaire used for the study was designed by 'Professional Development Service by Teacher (PDST)', Dublin, Ireland. The third questionnaire was about the factors affecting teachers teaching with technology (SFA-T3) Copyright of Charoula Angeli, Department of Education, University of Cyprus ETC. These three questionnaires were used to prepare the teacher's questionnaire for the study. The face and content validity were administered on the scale. The Cronbach Alpha of the scale is found to **0.967**.

The sample characteristics showed that there were 76 percent female and 24 percent male respondents. They belonged to the age group between 21 to 50 years. The regional

language (Marathi) schools were affiliated to only state board. The 72 percent teachers surveyed were from English medium school and only 28% were from regional (Marathi) medium school. 39 percent teachers were having more than 15 years of experience.

The study tries to find the relation of endogenous factors and perception of the teachers for the using ICT in the classroom and their perceived proficiency in using ICT in the classroom.

Objective 1: Measurement Model: Development of Model Fit to see the relationship between of factors related to ICT adoption and Perception of teachers related to ICT as a Teaching Learning tool and their perceived proficiency in using it in the classroom.

Objective 2: Structural Model Assessment: to measure the effect of factors related to ICT adoption on perceived proficiency and perception of teachers towards usage of ICT.

4.1 Hypothesis

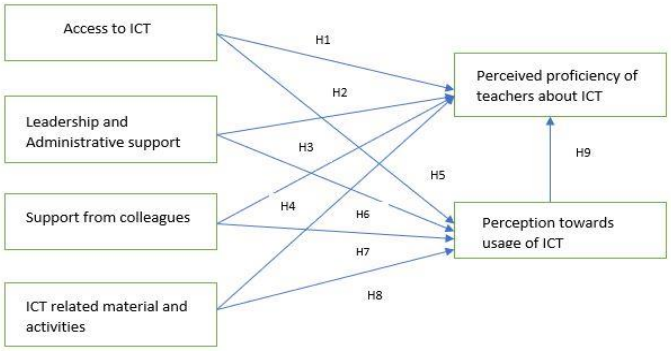
- H1: Access to ICT will positively influence the perceived proficiency of teachers about ICT.
- H2: Administrative support for ICT will positively influence the perceived proficiency of teachers about ICT.
- H3: Support from Colleagues for ICT will positively influence the perceived proficiency of teachers about ICT.
- H4: ICT material and activities used will positively influence the perceived proficiency of teachers about ICT.
- H5: Access to ICT will positively influence the perception of teachers for adoption of ICT in the classroom
- H6: Administrative support for ICT will positively influence the perception of teachers for adoption of ICT in the classroom
- H7: Support from Colleagues for ICT will positively influence the perception of teachers for adoption of ICT in the classroom
- H8: ICT material and activities used will positively influence the perception of teachers for adoption of ICT in the classroom
- H9: Perception of teachers for adoption of ICT in the classroom influence positively the perceived proficiency of teachers about ICT.

5 Data Findings

5.1 PLS-SEM Model Assessment

Each latent variable in the model has 10 to 15 items. The model tries to find a complex relationship by using Partial Least Square structural equation model based on Principal Component Analysis. The study uses PLS-SEM model for theory building and complex structural model [23].

Fig. 1. The Conceptual Framework of the Study is**:**



5.2 Measurement Model Assessment

The assessment of outer model of structural relation was done first with the composite reliability (assesses internal consistency), Outer loadings (Assesses indicator reliability) and average variance extracted (assesses convergent reliability).

Composite reliability coefficient assesses the internal consistency reliability. Composite reliability takes into consideration different outer loadings of indicator variables [23].

Table 1. Reliability and Validity

Construct	CR #1	AVE #2	Access to ICT	Admin support	ICT material activities	Perceived proficiency	Perception towards ICT	Support colleagues
Access to ICT	0.893	0.626	**0.791**					
Admin support	0.937	0.679	0.441	**0.824**				
ICT material activities	0.930	0.595	0.535	0.388	**0.771**			
Perceived proficiency	0.957	0.648	0.381	0.423	0.386	**0.805**		
Perception towards ICT	0.953	0.718	0.388	0.507	0.372	0.692	**0.847**	
Support colleagues	0.951	0.796	0.205	0.510	0.282	0.383	0.451	**0.892**

The diagonal values represents square root of Average Variance Extracted and the off diagonal bold values are the correlations between the latent variables

CR #1 Composite reliability

AVE #2 Average Variance extracted

The above table shows composite reliability is found greater than 0.7 [22]. The average variance extracted (AVE) is greater than 0.5 [22].

The table also shows the square root of Average Variance Extracted (AVE) for all latent variable is higher than inter construct correlation [19]. It explains the discriminant validity.

The individual loading for all indicators were found higher than their respective cross loadings. This provides additional evidence of discriminant validity. The reliability of indicators was explained by outer loadings. The outer loadings ranged from 0.672 to 0.924. All the values of outer loadings were higher than the prescribed value 0.6 [30]. Some items had low values of outer loadings and hence those items were dropped. This resulted in improvement of composite reliability and validity of those latent variables.

5.3 Structural Model Assessment

The inner model was assessed to test the relationship between the variables. The path coefficients were attempted using Boot Strapping technique with 395 cases and 5000 samples for non-return model.

The R^2 value for proficiency of teachers for ICT was found 0.507 and the R^2 value for perception of teachers for ICT was found 0.351.

Table 2. Structural Relation

Hypothesis	Paths	Path Coefficient	P-Values	Decisions
H1	ACCESS -> PERCEIVED_PROF	0.079	0.050	Accepted
H5	ACCESS -> PERCEPTION	0.158	0.003	Accepted
H2	ADMIN_SUPP -> PERCEIVED_PROF	0.019	0.740	Not Accepted
H6	ADMIN_SUPP -> PERCEPTION	0.266	0.001	Accepted
H4	ICT_MAT_ACT -> PERCEIVED_PROF	0.101	0.020	Accepted
H8	ICT_MAT_ACT -> PERCEPTION	0.113	0.015	Accepted
H3	SUPP_COLL -> PERCEIVED_PROF	0.065	0.183	Not Accepted
H7	SUPP_COLL -> PERCEPTION	0.251	0.000	Accepted
H9	PERCEPTION -> PERCEIVED_PROF	0.585	0.000	Accepted

5.4 Findings:

The above table shows that Support from colleagues and administrative support do not influence perceived proficiency of teachers. H2 and H3 are not accepted as p-values is greater than 0.05. Access to ICT equipment and ICT materials and activities used in class influence the perceived proficiency of teachers. H1 and H4 are accepted as p-values is less than 0.05. Access, Admin support, ICT materials and activities used in class and support from colleagues' influence perception of teachers towards ICT. H5,

H6, H7 and H8 are accepted as p-value is less than 0.05. Perception of teachers towards ICT influences the perceived proficiency of teachers. H9 also accepted as p-value is less than 0.05.

Table 3. Effect Size

Paths	Effect Size (Cohen's f^2)
ACCESS -> PERCEIVED_PROF	**0.008**
ACCESS -> PERCEPTION	0.025
ADMIN_SUPP -> PERCEIVED_PROF	**0.000**
ADMIN_SUPP -> PERCEPTION	0.067
ICT_MAT_ACT -> PERCEIVED_PROF	**0.014**
ICT_MAT_ACT -> PERCEPTION	**0.013**
SUPP_COLL -> PERCEIVED_PROF	**0.006**
SUPP_COLL -> PERCEPTION	0.070
PERCEPTION -> PERCEIVED_PROF	**0.450**

Cohen's f^2 for all paths in the model to study effect size was attempted [13]. The stated values for f^2 are 0.02, 0.15, 0.35 Low, medium and large effect size [11]. It can be seen from above table the effect size of perception on perceived proficiency is large.

The blindfold technique helps to emphasize more the predictive relevance of structural model by using Stone-Geisser's Q^2 technique with omission distance 7. The Q^2 for perception of teachers towards ICT is 0.233 and The Q^2 for perceived proficiency of teachers is 0.298. These values are greater than zero. It indicates all endogenous variables are relevant in the model.

6 Conclusions

The study concludes that access to ICT equipment and resources contributes positively to the perception of the teachers related to efficacy of ICT as a teaching learning tool as well as their perceived proficiency in implementing it the classroom. Administrative support helps in improving the perception of the teachers towards ICT but may not help in improving their perceived proficiency to implement ICT in the classroom. Availability of ICT material and course content improves the perception of the teachers towards the ICT as well as their perceived proficiency in using the same. Support from the colleagues and experts in implementing ICT in the classroom improve the perception but may not improve the perceived proficiency of the teachers in implementing ICT in the classroom. Finally, positive perception of the teachers about efficacy of ICT as a teaching learning tool helps build their perceived proficiency in using it in the classroom.

7 Implications and suggestions

- Timely and easy access to ICT equipment, resources and ICT material like digital content, activities, etc. to the teachers are of paramount importance for effective implementation of ICT in the schools. Many regional language schools do not have quality and adequate digital content to deliver. It may become a major hindrance in integrating e-learning in the mass education.
- The study shows that self-confidence of the teachers and their positive perception about ICT is important for building their perceived proficiency. It requires two interventions. Firstly teacher should be trained in soft-skills and communication skills along with the technical training in how to teach using ICT. Secondly the subject specific training is required to be given to the respective teachers so as to make ICT fully integrated in the course structure and make the teachers confident of its delivery in their own areas of expertise.
- Administrative support and support from the colleagues mainly play a supportive role in building positive perception related towards efficacy about ICT. But it cannot be ignored. Frequent training sessions of the administrative staff and organizing experts interactions with regular interventions will go a long way in building school culture positive for implementing ICT.

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