Effect of Problems of Mathematics Teachers in Using ICT on their Purposes to its Use

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Abstract

The problems of mathematics teachers to using ICT in mathematics teaching represent the infrastructure and resources, skills and training, and policy-related problems. The aim of the study was to find the effect of the problems of using ICT on the purposes of its usage in mathematics teaching among mathematics teachers of secondary level. 342 mathematics teachers from secondary schools of Kathmandu, Kailali, and Kanchanpur were selected purposively and data was analyzed by Structural Equation Modeling (SEM). The finding indicates that the mathematics teachers of Nepal were facing several problems related to infrastructure and resources, skills and training, and policy. The problems of using ICT in mathematics teaching have no effect on the purpose of using ICT in mathematics teaching however the purposes of using ICT in teaching and learning and documentation and internet surfing had significant contribution to determine alternative dimensions.

Keywords*: ICT, purposes, problems, mathematics teaching, secondary level, Nepal*

Introduction

ICT represent those digital resources supportive for mathematics learning and problems of using digital resources indicating the obstacles or challenges of mathematics teachers during the integrating of digital resources in their instructional practices. Purpose of mathematics teachers representing the aims of teachers to use digital resources in institutions for different activities like teaching and learning, documentation, and internet surfing. Several applications have developed for mathematical learning (Larkin, 2013). The technology implemented classroom has a positive impact on mathematics achievement (Crompton & Burke, 2015; Etcuban & Pantinople, 2018), the insight of students and teachers' (Skillen, 2015; Celik & Karayaman, 2018), motivate learners towards self-learning (Drigas & Pappas, 2015) and enhance learning habits (Supandi et al., 2018). Hence technology should be integrated into instructional practices and concern bodies should focus to manage such resources in institutions. Technology has positive effect (Dixit, 2009) on mathematics learning, increase learners participation (Mainali & Heck, 2017), effective for erudition setting (Dhakal & Pant, 2016) visualize the mathematical concepts (Ozmantar et al., 2009), and generate ideas, processes and solve the mathematical problems (Sivakova et al., 2017). Based on the effectiveness of those resources, the purpose of the mathematics teachers to use ICT was demanded to study.

Several web-based digital resources developed based on the mathematics curriculum of mathematics which has constructive impression (Zermeno & Gutierrez, 2018), learning (Loong, 2003), and motivation (Kartika, 2018) towards content learning of mathematics. Additionally, such properties are likely for meaningful learning (Portela, 2007), recognize fundamental ideas (Kong et al., 2005), and update novel ideas (Geomez-Zermeno & Franco-Gutierrez, 2018). These literatures suggesting that mathematics teachers should have free for using digital resources, policies and skills, and training. Moreover, teachers should use digital resources in their regular pedagogical practices for effective learning.

The use of technology enhances the knowledge, understanding, and achievement of the learners (Lalian, 2019) however, mathematics teachers have several problems like time management, lack of tools and regularities of students (Singha et al., 2012), negative attitude of students (Boruah, 2018) and ICT supports to manage the problems of mathematics learning (Bhattacharjee & Deb, 2016). Hence this study tries to find the status of problems of mathematics teachers in using ICT in the teaching under the dimensions of infrastructure and resources and training and policy in the Nepalese context. Additionally, the study also found the effect of problems of mathematics teachers in using technology in their purposes of using those resources in instructional practices where the purposes have categories as teaching and learning, documentation, and internet surfing.

In the context of Nepal, Information Technology Policy 2000 was the first IT-related policy which focused on the integration of computer education in the school curriculum (GoN, 2000). Next, School Sector Reform Plan (SSRP) 2009-2015 emphasized ICT

assisted teaching/learning activities and allocate few budgets for ICT resource management (MoE, 2009) in schools, and ICT in Education Master Plan 2013-2017 also focused on infrastructures, human resources and digital contents (MoE, 2013). School Sector Development Plan 2016-2023 focused on the implication of ICT-based teaching-learning practice (MoE, 2016). The aims of all of these policies are to implement digital technologies in classroom practices effectively. The ICT-related content also integrated into the curriculum of Mathematics Education related streams in university educations. So, the concern of this research was to study the status of mathematics teachers' problems in using ICT in mathematics teaching, and its effect on the purpose of using ICT in mathematics teaching.

Methodology

A survey design was used to collect the data in the research. Total 342 mathematics teachers of secondary level from Kathmandu, Kailali, and Kanchanpur districts were participated in this survey. The study was carried out among the schools having computer facilities and the list of the total number of teachers with these resources were not available in concerned bodies of the government like the District Education Office and Department of Education hence purposive sampling technique was followed for sampling. The data were collected by visiting the schools with the permission of the principal.

Tools and Techniques

The self-constructed tool was employed in the research. The tool containing 19 items related to the problems of using ICT in mathematics teaching under three categories as infrastructure and resources, Skills and training, and policy. The items were measured in a five-point rating scale as strongly disagree to strongly agree. Additionally, the use of ICT for different purposes was measured in 23 items under three categories as documentation, teaching and learning, and internet surfing. Which were also measured in always to never however the mean score of respective dimensions was measured in the research. The validity of the tool was ensured by Cronbach's Alpha which is 0.97.

Data Analysis Techniques

Structural Equation Modeling (SEM) was used to analyze the data. Data validation, cleaning, and outlier were checked before analysis. The SEM was fitted based on the different dimensions under the problems of using ICT in mathematics teaching and the purpose of using ICT resources in institutions.

Results

In Figure 1 it can be seen that the level of the problem found to be high in measured items, however, the lack of sufficient budget for ICT (Mean=4.04), lack of skills and training (Mean=4.03), lack of ICT integration in the curriculum (Mean=4.04) and lack of time to use ICT in the classroom (Mean=4.04) found to be higher as compared to other problems. The mean score of the language-related problems (Mean=3.43) found to be lower in comparison to the others.

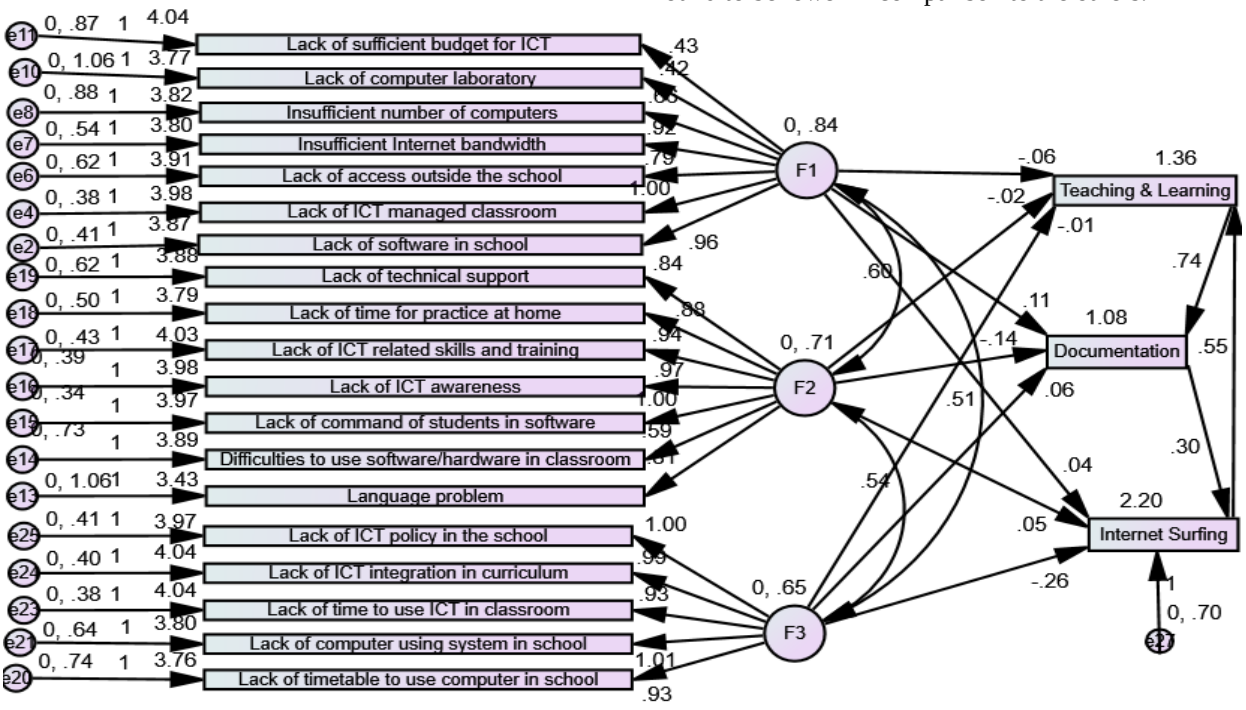

Figure 1 Unstandardized regression width of ICT related problems on their usage

SEM Analysis

On the basis of the number of variables and participants the sample size is large (MacCallum et al., 1996) so the significant value of the chi-square is considered in the model (Bentler & Bonett, 1980). Table 1 showing the model fit indices and showing that the root mean square error of approximation (RMSEA) value 0.08 indicates that the model is moderate fit (MacCallum et al., 1996). After the declaration overall fit indices, construct and indicator reliability, as well as convergent and divergent validity, were evaluated. Goodness-of-fit statistic (GFI) and the adjusted goodness-of-fit statistic (AGFI) found to be less than 0.90 hence the GIF and AGFI are poorly fitted in the model (Hooper et al., 2008). Normed-fit index (NFI) found to be 0.86 indicating that the model is a poor fit however the Comparative Fit Index (CFI) and Incremental Fit Index (IFI) found to be 0.90 hence the model is a good fit (Bentler & Bonett, 1980; Hu & Bentler, 1999; Xia & Yang, 2019). Modification indices were employed because of the poorest fit indices in maximum items.

Table 1 *Result of model fit indices*

CMIN	*DF*	*CMIN/DF*	*GFI*	*AGFI*	*NFI*	*IFI*	*CFI*	*RMSEA*
580.90	*194*	*2.99*	*0.86*	*0.82*	*0.86*	*0.90*	*0.90*	*0.08*

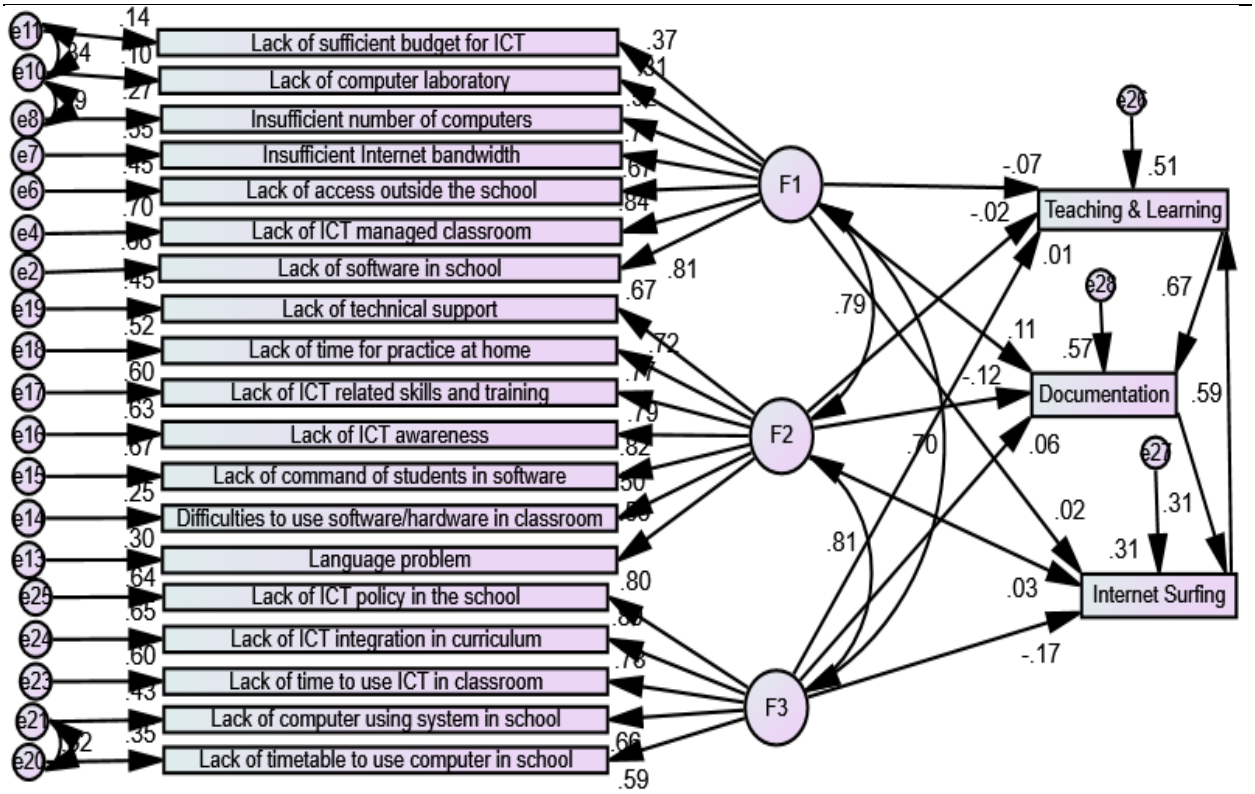

Figure 2 Standardized Regression width of ICT related problems on their usage.

Table 2 showed the result of multiple regression of the effect of mathematics teachers' problems in using ICT in the use of ICT in their teaching-learning activities. The result indicates that the latent variables infrastructure and resources-related problems (F1), skills and training-related problems (F2), and policy-related problems (F3) found to be significant with their respective items at a 99% confidence interval. The three dimensions of problems F1, F2 and F3 are not significant predictors to the purpose of using ICT in mathematics teaching. However, the use of ICT in teaching and learning, documentation, and internet surfing are significant predictors to each other. Figure 2 showed that 51%, 57%, and 31% of the variance was explained by the model in teaching and learning, documentation, and internet surfing respectively. The lack of software in school (Beta=0.84, p<0.01) and insufficient Internet bandwidth (Beta=0.74, p<0.01) were found to be the main significant predictors to the infrastructure and resources related problems to use ICT with reference to lack of command of students in software. Lack of ICT awareness (Beta=0.79, p<0.01), lack of ICT-related skills and training (Beta=0.77, p<0.01) were the main significant predictors to

determine the skills and training-related problems with reference to lack of command of students in software. Lack of ICT integration in the curriculum (Beta=0.80, p<0.01) and lack of time to use ICT in the classroom (Beta=0.78, p<0.01) are the main significant predictors to determine the policy-related problems with reference to lack of ICT policy in the school.

Additionally, the result indicates that the variables infrastructure and resources related problems (F1), skills and training related problems (F2), and policy-related problems (F3) have no significant effect on the purpose of using ICT in teaching and learning, documentation, and internet surfing. However, documentation, teaching and learning, and internet surfing found to be significant predictors of teaching and learning (Beta=0.67, p<0.01), internet surfing (Beta=0.59, p<0.01), and documentation (Beta=0.31, p<0.01) respectively.

Table 2 *Multiple regression of the effect problems in using ICT on their use in mathematics teaching (n=342)*

Variables			B	β
Internet Surfing	<-	F2	0.04	0.03
Documentation	<-	F3	0.07	0.06
Teaching & Learning	<-	F3	0.01	0.01
Documentation	<-	F1	0.12	0.11
Internet Surfing	<-	F1	0.02	0.02
Teaching & Learning	<-	F1	-0.07	-0.07
Documentation	<-	F2	-0.15	-0.13
Internet Surfing	<-	F3	-0.20	-0.17
Teaching & Learning	<-	F2	-0.03	-0.02
Lack of software in school	<-	F1	0.95	0.81**
Lack of ICT managed classroom	<-	F1 (Reference)	1.00	0.84
Lack of access outside the school	<-	F1	0.78	0.67**
Insufficient Internet bandwidth	<-	F1	0.90	0.74**
Insufficient number of computers	<-	F1	0.63	0.52**
Lack of computer laboratory	<-	F1	0.37	0.31**
Lack of sufficient budget for ICT	<-	F1	0.41	0.37**
Language problem	<-	F2	0.80	0.55**
Difficulties to use software/hardware in classroom	<-	F2	0.59	0.50**
Lack of command of students in software	<-	F2 (Reference)	1.00	0.82
Lack of ICT awareness	<-	F2	0.97	0.79**
Lack of ICT related skills and training	<-	F2	0.94	0.77**
Lack of time for practice at home	<-	F2	0.88	0.72**
Lack of technical support	<-	F2	0.84	0.67**
Lack of timetable to use computer in school	<-	F3	0.82	0.59**
Lack of computer using system in school	<-	F3	0.91	0.66**
Lack of time to use ICT in classroom	<-	F3	0.91	0.78**
Lack of ICT integration in curriculum	<-	F3	0.99	0.80**
Lack of ICT policy in the school	<-	F3 (Reference)	1.00	0.80
Documentation	<-	Teaching & Learning	0.74	0.67**
Teaching & Learning	<-	Internet Surfing	0.55	0.59**
Internet Surfing	<-	Documentation	0.30	0.31**

***significant at 99% confidence interval*

Discussion

The level of mathematics teachers in using ICT in mathematics teaching found to be high in almost all items indicating that the related stakeholders should focus on managing digital resources in the institution. The result also indicating that the investment in digital resources in educational institutions is not sufficient and awareness and training programs also not sufficient for mathematics teachers. Furthermore, the appropriate policies for the integration of ICT in classroom practice of mathematics were insufficient with respect to the perception of mathematics teachers of secondary level however the data was collected from January to June 2016. Similar problems of using ICT in mathematics teaching as lack of knowledge, skills, training financial support, ICT integration in curriculum, time, equipment with teachers and students (Gera & Verma, 2014) in India, administrative support, infrastructure, (Agyei & Voogt, 2011) in Ghana, communication, policy (Hennessy & Dunham, 2001) in the US, technical support, the confidence of teachers, knowledge of subject-related software and hardware (Oldfield, 2010) in Europe, lack of planning of teachers (Hudson & Porter, 2010) in Australia. The ICT was poorly used in mathematics in European countries (European Commission, 2011). SEM result showed that lack of software in school and insufficient Internet bandwidth was found to be main significant predictors to the infrastructure and resources related problems to use ICT in mathematics teaching indicating that subject related software or application and internet connectivity should be managed in the educational institution to reduce the infrastructure and resources related problems. Lack of ICT awareness and skills and training are the main determinant factors to determine the skills and training related problems and lack of ICT integration in the curriculum and lack of time to use ICT in the classroom were main predictors to determine the policy-related problems hence concern body of the government should focus and sensitive to manage such issues. Moreover, the use of ICT for the purpose of documentation, teaching and learning, and internet surfing found to be a significant predictor of teaching and learning, internet surfing and documentation respectively so every mathematics teacher should be encouraged to the proper use of ICT in the instructional practice of mathematics.

Conclusion

The mathematics teachers of Nepal were facing several problems related to infrastructure and resources, skills and training, and policy. The problems of using ICT in mathematics teaching have no effect on the purpose of using ICT in mathematics teaching however the purposes of using ICT in teaching and learning and documentation and internet surfing had significant contribution to determine alternative dimensions. The result of the study will be supportive to the mathematics teachers, school principals, policymakers, financial investigator, researchers, and other concerned bodies of governmental and non-governmental units however the study was carried out in only three districts of Nepal before five years hence the finding of the research may not generalize in other settings. The study was based on survey design by taking mathematics teachers of secondary schools from only three districts of Nepal hence further study can be carried out by taking the large sample from different teaching levels with taking teachers of diverse subject areas.

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