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Computer technology integration and teachers' knowledge and self-efficacy: Barriers and promise

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The purpose of the study is to examine teachers' technology integration level and teachers' technology knowledge level in teaching and learning In addition, to determine whether there is a relationship between teachers' knowledge, self-efficacy and technology integration in teaching and learning in secondary schools of Maldives. Furthermore, to find out if there is a difference in technology integration for science and non-science subject teachers. Study is a correlation study that uses quantitative methods. Sample size of 128 secondary teachers was selected from capital city Male'. Cluster random sampling method was used to randomly select the secondary schools. Data was gathered using survey questioner and data was analyzed using descriptive and inferential statistical techniques. Results revealed that teachers often integrated technology in teaching and learning and teachers had intermediate knowledge regarding how to use technology. Teachers were proficient with basic technology knowledge, however they lack the advance knowledge needed for more complex tasks. A positive correlation was found between technology knowledge, self-efficacy and technology integration. A significant difference was found for technology integration between science subject teachers and non-science subject teachers. These findings could be helpful for school administrators, to encourage teachers to use new technologies in teaching and learning. Findings from this study could be used to conduct future research and to improve current education system.

Keywords: Technology integration, technology knowledge, self-efficacy, teaching and learning, secondary schools.

Introduction

Technology has a great impact on everyday life of different people and plays a major role in the field of education (Lever-Duffy & McDonald 2011). Several countries have spent a lot of money in investing for educational technologies. Such efforts to provide necessary technology is seen as important and useful since technology have proven its advantages as prominent. In many areas of the world teaching and learning has been aligned with

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learning through technology. Instructors and students are involved in computer assisted learning, multimedia visualizations, video and audio conferences and communications through World Wide Web (Cherry, 2014). Educational technologies provide a mean to improve teaching and learning. Such as multimedia instructions could provide a way of delivering complex content which can be understood by the students easily and also can facilitate variety of interactions between students and teachers (Wu et al., 2013).

Even though technology is available for teaching and learning it does not mean it is being integrated in teaching and learning. Many researchers have indicated that technology integration mostly depends on the teacher as he or she plays a vital role in integrating technology in teaching and learning (Archibong, Ogbiji, & Anijaobi-Idem, 2010). The question arise why are the teachers not using technologies for many different areas of teaching and learning. Research findings indicate that factors such as classroom management, availability of technology, teachers' knowledge, skills, belief, attitude, perception, opinion and personality are related to teachers' technology integration in teaching and learning. (Glassett, & Schrum, 2009; Cherry, 2014).

To use technology for teaching and learning purposes it is important for teachers to have the knowledge of technology. To deliver interactive lessons it is essential for teachers to know different types of technology and how to interact with them. Research has shown that teachers' knowledge of technology varies. Even though teachers have basic knowledge regarding how to use technologies, most of the teachers are not proficient enough to use all the different types of technological tools (Lutonsky, 2009). Furthermore, sometimes even though teachers have the necessary knowledge still there are factors that hinder technology integration. Research has shown that among these factors, teachers' confidence played a huge role in deciding whether or not to use technology in classrooms (Chen, 2010). Teachers self-efficacy towards technology integration was found to be a significant factor in determining their technology usage level. Teachers with high self-efficacy towards technology integration used technology more often in teaching and learning.

For these reasons, and for teachers, to keep up with the changes in technology, it is important to integrate technology for teaching and learning. In order to achieve that, it is vital for teachers to have proficiency in technology knowledge and have a high self-efficacy regarding the use of technology for teaching and learning. Hence it is important to conduct research related to teachers' technology integration for teaching and learning and to find out if knowledge and self-efficacy are related to technology integration in the context of Maldives. In a country like Maldives who is at its infant stage in conducting research, it will be extremely valuable to have valid empherical research findings.

Purpose of this study was to examine teachers' technology knowledge and technology integration in teaching and learning in secondary schools of Maldives. In addition, to determine whether there is a relationship between teachers' knowledge, self-efficacy and technology integration in teaching and learning in secondary schools of Maldives. Furthermore, to find out if there is a difference in technology integration for science and non-science subject teachers.

Literature Review

Technology integration

In this study technology integration is the use or utilization of hardware, software or web based tools in any aspect related to teaching and learning in order to improve teaching and learning process. Rader and McCoy (2011) indicated instructors utilized the Internet to deliver and enhance classroom instruction using multiple modalities such as videos, simulations, tutorials, and instructional games. Study conducted by Mouza, Cavalier, & Nadolny, (2008) found that majority of teachers utilized technology for tasks such as word processing, drill and practice, and research on the Internet. However, they also observed that only some teachers implemented computers for more complex activities such as communication through blogs, multimedia presentations, and real-world problem solving. When technology is widely available, teaching is becoming more student-centered, more constructivist, and more flexible. Lessons are more project-oriented and inquiry-based and technology is used to explore, create, and communicate knowledge (Norris & Soloway, 2004; Roschelle, Penuel, & Abrahamson, 2004; Pritchett, 2012).

However there are several factors associated with teachers' technology integration and many studies are done to explore teachers' technology integration. Cherry, (2014) did a study regarding technology adoption in teaching and learning. Researcher's intention was to get a better understanding of the factors related to technology adoption so that it may help to increase the levels of technology adoption in the teaching and learning process. Results showed that teachers had adopted technology for teaching and learning. However, technology adoption levels differed significantly by subject area. Business teachers' adopted technology at significantly higher levels than other subject area teachers, especially higher than math and science teachers. Technology adoption was significantly associated with the technology anxiety, barriers to technology integration, technology availability and training sources. Several research findings have indicated that factors such as teacher's skills, beliefs, attitudes, perceptions, opinions, personality and knowledge are among many other factors that affect the choices teachers make about what, when, and how to teach using technologies (Glassett, & Schrum, 2009).

Technology knowledge

For this study technology knowledge is considered as the knowledge about how to perform different tasks using technology. Having the required skills to use technology is considered as having technology knowledge. It is important that teachers have the required technology knowledge and skills to use different types of technologies. Basics skills are critical for teachers, who want to integrate technology into their teaching (Topper 2004).

Lutonsky (2009) investigated how pre-service college computer training, in-service training, gender, and years of teaching experience influence teachers' computer skills. Results indicated that teachers who had training had better skills compared to teachers who did not have training. Study also revealed that teachers wanted to learn more technologies through in-service training. In addition to that, the study indicated that training and technology access were helpful in aiding participants to learn computer skills. Most of the research has shown that teachers have basic skills such as using MS word or PowerPoint. But their skill level is less when it comes to using advanced

technologies. Kandasamy and Shah (2013) conducted a study to investigate knowledge level, attitude and the use of ICT by ESL teachers in Malaysia. This study also investigated obstacles faced by ESL teachers in using ICT. Overall it was indicated from the study that the level of teachers' knowledge regarding ICT was moderate, as they were only good at using certain applications that are often used in teaching and learning. Applications such as word processing, spread sheet, PowerPoint and e-mailing. These results were also similar to findings from Erdogan (2010) that showed respondents were highly knowledgeable only on certain applications such as word processing and internet browsing (Kandasamy, & Shah, 2013).

Self-efficacy and technology integration

Self-efficacy was first introduced by Bandura (1977). Bandura has defined self-efficacy as a person's belief about themselves in their ability to perform tasks. Bandura noted that it is not to do with the skill possessed by the person but how the person feels about and what the person does with that skill. According to Bandura, it is people's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances. Self-efficacy belief determines how people feel, think and behave. With all the factors being considered, most important role of technology integration belongs to teachers. It is them who use technology with the students. Their decision to integrate technology and how they integrate technology for teaching and learning will affect student' leaning (Nespor, 1987; Bitner & Bitner, 2002; Archibong, Ogbiji, &Anijaobi-Idem, 2010).

A study was conducted by Anderson and Maninger (2007) to examine the factors related to technology related abilities, beliefs and intentions. Data collected through pre and post surveys showed significant increase in perceived abilities, self-efficacy beliefs, value beliefs and intentions to use instructional technology in their future classrooms. Predictors of pre service teachers' purpose for using instructional technology were their self-efficacy beliefs, gender, and value beliefs. Study suggested using these results to support and improve pre service teachers' instructional educational technology course work at the same time make efforts to build their self-efficacy belief and intentions. Height (2011) did a study to find out whether a significant correlation exists between teacher self-efficacy and technology adoption within teachers. Findings showed significant strong positive correlation between computer self-efficacy and integration of technology into classroom instruction. Findings also suggested that teachers as a group tend to feel confident in their use of technology. During qualitative phase it was revealed that teachers felt confident they could produce the desired results when incorporating technology in lesson delivery. This supported the findings of the quantitative phase of the study, which revealed that the teachers have a high level of computer self-efficacy. Since studies prove that there is a connection between teachers self-efficacy to use technology and technology integration it is important further explore this relationship. If teachers are expected to be effective users of technologies it is essential that they have high self-efficacy perceptions in using them.

Bandura's (1986) theory of self-efficacy- Bandura defines self-efficacy as "the beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments". Teacher self-efficacy is partly determined by the individual's judgment of his or her current abilities and whether these abilities meet the demands of a particular teaching task (Tschannen-Moran, Woolfok-Hoy, & Hoy, 1998). According to

self-efficacy theory, self-efficacy's impact on human functioning takes place through four psychological processes: cognitive, motivational, affective, and selection. Selection processes are influenced by self-efficacy, in other words, the activities and environments that people choose depend on their beliefs of their capabilities to handle the challenges associated with them. Higher self-efficacy beliefs may lead to more challenging undertakings. Because many teachers may find technology integration challenging, their self-efficacy towards technology might impact how they integrate technology in teaching and learning. If they feel that they are not prepared do so, they may select not to incorporate it in their teaching environments.

Research Questions

1 What is the level of technology integration by teachers in teaching and learning?
2 What is the knowledge level of teachers regarding technology integration in teaching and learning?

Hypotheses

1 There is no significant relationship between teachers' knowledge towards technology and technology integration in teaching and learning. .
2 There is no significant relationship between teachers' self-efficacy towards technology and technology integration in teaching and learning.
3 There is no significant difference between teachers' technology integration in teaching and learning for science and non-science subject teachers.

Methodology

Research Design

Study was a correlation study that used quantitative methods to examine the teachers' technology integration in teaching and learning in secondary schools of Maldives. Quantitative approaches used in the study involved the use of questionnaires to collect data from teachers. Technology integration by teachers for teaching and learning was used as criterion (dependent) variable to see if any relationship exists between teachers' knowledge and self-efficacy towards technology. Knowledge and self-efficacy towards technology integration was used as independent variables.

Population & Sample

Population of the study consisted of 669 teachers working in 18 secondary schools of capital MALE' of Maldives. Among them are 295 male teachers and 375 female teachers (Ministry of Education, 2014). From the population, sample size was determined using Table for Determining minimum returned sample size for a given population size for continuous data and categorical data (Barlette, Kotrlik, & Higgins, 2001). A minimum sample size of 128 was obtained. Cluster random sampling method was used to select the sample for the study. Using cluster random sampling method from the 18 secondary schools, 6 schools were randomly selected and questionnaires were distributed to secondary teachers working in those schools. Cluster random sampling has advantages

such as easier to implement in schools, less time consuming and it can be useful when it is impossible to select individuals by simple random sampling method (Fraenkel, Wallen, & Hyun, 2012).

Instrument

Instrument developed for this study was constructed by referring the Computer Technology Integration Survey (CTIS) developed by Wang, Ertmer, & Newby, (2004) and Kotrlik-Redmann Technology Integration Survey (2005). The survey questionnaire consisted of four sections. Section I was for demographic information. Section II consisted of 8 items and obtained information regarding teachers' technology integration in teaching and learning. Section III consisted of 8 items and obtained information regarding teachers' technology knowledge**.** Section IV consisted of 7 items and obtained information regarding teachers' self-efficacy towards using technologies. Four point scales were used in sections II, III and IV.
Questionnaire was submitted to experts to judge the items for their adequacy to measure the level of the technology integration, technology knowledge and self-efficacy. These experts also assessed the clarity in the instructions, the questions, the appropriateness of the variables that correspond with the scale, format of the instrument and time allocated to questionnaire completion. An English language teacher assessed the English language and grammar for the questionnaire. Based on the suggestions from experts minor changes were made to the survey questionnaire to make it clearer.

Statistical reliability of the survey questionnaire was tested using Cronbach's alpha coefficient of internal consistency. Cronbach's alpha coefficient was calculated for each construct separately. These calculations showed a Cronbach's alpha value of (.815) to technology integration in teaching and learning scale, (.821) to technology knowledge scale and (.703) to teacher self-efficacy towards technology integration scale. Total reliability of the whole scale was (.864).

Data Collection and Data Analysis

The questionnaires were administered to 128 secondary grade teachers in the selected secondary schools. After discarding the incomplete ones 119 questionnaires were used for data. Data was analyzed using descriptive and inferential statistics. Data was coded and entered to Statistical Package for the Social Sciences (SPSS). Data was screened and tested for normality. Assessing normality was necessary because the study utilized the parametric statistic technique. Normality was assessed by obtaining skewness and kurtosis values and the obtained values fall within the range of normal distribution.

Results

Analysis showed that from the 119 participants in the study, 79 of the participants were female (66.4%), and there were 40 male participants (33.6%). Furthermore, analysis of participants' age showed that 12 participants (10.1%) were 20- 24 years, 39 participants (32.8%) were 25-29 years of age, and 19 participants (16.0%) were 30-34years of age and 27 participants (22.7%) were 35-39 years of age. And 22 participants (18.5%) were over 40 years of age. These findings showed that the majority of the participants in this study were 25-29 years. Based on subject they teach, teachers were classified into science

and non-science teachers. Majority of participants taught non-science related subjects, that is 71 participants (59.7%). 48 participants (40.3%) were teaching science related subjects.

Research question 1 - What is the level of technology integration by teachers in teaching and learning?

The mean value for technology integration was 2.60. An analysis of frequency of technology integration for teaching and learning indicated that most teachers used technology to plan lessons, followed by implementation of interactive lessons. Analysis also showed that technology was least used to give feedback to students, followed by implementing games during teaching and learning. Table 1 shows the mean and standard deviation for technology integration.

Table 1. Mean and standard deviation value for all 8 items of technology integration

	N	**Mean**	**SD**
I use technology to plan my lessons.	119	3.24	.799
I use technology to implement interactive lessons.	119	2.93	.733
I use technology to explain lessons in my classroom.	119	2.82	.830
I use technology based games in my classroom.	119	2.11	.757
I design learning activities using technology that helps to explain the content easily.	119	2.75	.784
I use technology to assess the students' test scores.	119	2.48	.946
I use technology to provide feedback to my students (e.g. - email and SMS).	119	2.09	.957
I design learning activities that enable students to use technology to collaborate with other students.	119	2.41	.848
total mean technology integration	**119**	**2.60**	**.553**

Research question 2 - what is the knowledge level of teachers regarding technology integration in teaching and learning?

The mean value for technology knowledge was 3.01. An analysis of frequency of technology knowledge for teaching and learning indicated that most teachers had knowledge to search the internet for information, followed by preparing power point presentations. Also analysis showed that teachers had less knowledge to develop Web Pages and audio video clips. Table 2 shows the mean and standard deviation for technology knowledge.

Table 2. Mean and standard deviation value for all 8 items of technology knowledge

	N	Mean	SD
Form documents using word processor.	119	3.32	.833
Draw charts and graphs using spreadsheet.	119	3.13	.907
Searching the web to find information.	119	3.59	.694
Make presentations using presentation software (e.g. PowerPoint).	119	3.45	.789
Develop audio/video clips using audio visual software.	119	2.58	.970
Develop web pages using software.	119	1.97	1.073
Communicate with others for academic purposes, using social networks (e.g. Facebook).	119	3.18	1.030
Use and install antivirus software for computer.	119	2.91	.939
Total mean knowledge		**3.01**	**.608**

Hypothesis 1 - There is no significant relationship between teachers' knowledge towards technology and technology integration in teaching and learning.

The relationship between technology integration and technology knowledge was investigated using Pearson product-moment correlation coefficient. There was a moderate positive correlation between technology integration and technology knowledge (r= .452) as shown in table 4.7. According to Cohen (1988) r=.39 to .49 is medium correlation. Hence the results suggested that when technology knowledge increased the technology integration also increased. Therefore, the null hypothesis is rejected as there is a relationship between technology integration and teacher knowledge.

Hypothesis 2 - There is no significant relationship between teachers' self-efficacy towards technology and technology integration in teaching and learning.

The relationship between technology integration and teacher self-efficacy was investigated using person product-moment correlation coefficient. There was a moderate positive correlation between technology integration and teacher self-efficacy (r= .394) as shown in table 3. According to Cohen (1988) r=.39 to .49 is medium correlation. Suggesting that increased self-efficacy increased the technology integration Therefore, the null hypothesis is rejected as there is a relationship between technology interrogation and teacher self-efficacy. Pearson correlation values obtained for technology integration, technology knowledge and self-efficacy are shown in table 3.

Table 3. Pearson correlation between technology integration, technology knowledge and self-efficacy.

	Knowledge	Self-efficacy
Technology integration	.452**	.394**

**. Correlation is significant at the 0.01 level (2-tailed).

Hypothesis 3- There is no significant difference between teachers' technology integration in teaching and learning for science and non-science subject teachers.

An independent sample t test was conducted to compare the technology integration scores of science subject teachers and non-science subject teachers. There was a significant difference found in the technology integration between science subject teachers (M=22.16, S=3.94) and non-science subject teachers (M=19.96, S=4.55), Where $t(109)=.007, p<.05$, thus rejecting the null hypothesis. Table 4shows independent sample t test values for technology integration of science and non-science subject teachers.

Table 4. Independent sample test for technology integration based on subject

		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	T	Df	Sig. (2-tailed)
Technology integration	Equal variances assumed	.796	.374	2.689	117	.008
	Equal variances not assumed			2.765	109.918	.007

Discussion

Results showed that teachers often integrated technology for teaching and learning. Two highest areas for teachers' technology integration were, using technology to plan lessons and using technology to implement interactive lessons. However, Technology integration was less in terms of giving feedbacks to students using technologies such as face book or through SMS. Another area where less technology integration occurred was to implement lesson activities in the form of games using technology. This can be due to the fact that to prepare learning activities in the form of games requires more knowledge compared to what teachers' already know. In addition, giving feedback using e- mail and SMS was less because it is not considered as a formal way of communication between teachers and students or teachers and parents. In this technological age mobile, e mails and social networking is very common, teachers and students may even be frequently using them.

However, it is not utilized as a tool for communication purposes between teachers and students. Overall, it is identified that teachers often integrated technology for teaching and learning. They integrated technology at various levels in different areas of teaching and learning. Hence they have a positive sense regarding technology integration. These findings agreed with the findings from other studies that indicated teachers integrated various technologies for teaching and learning, such as findings from Cherry (2014) and also Kandasamy and Shah (2013).

Technology knowledge level of teachers was intermediate. Analysis showed that the highest area of teachers' knowledge was about the use of internet for search purposes, followed by forming PowerPoint presentations. These are basic skills and are taught in basic computer training programs. Hence most of the teachers have the required knowledge regarding those areas. Furthermore, power point is one of the teaching mediums most commonly used by teachers. In modern classrooms and even in traditional classrooms power point is still used to deliver lessons. Since it is frequently used, often teachers are expected to have the knowledge about creating presentations as a part of requirement of the job. In case of using internet to browse information is also easy nowadays. As the internet comes with so many free tutorials and guides on how to use certain websites teachers find it easy to gain knowledge about searching through the World Wide Web.

However, the areas where teachers' have least technology knowledge were creating web pages such as blogs and audio visual clips. Tasks such as creating web page and audiovisual clips require more than basic knowledge. It can be seen that teachers does not have the required knowledge in such areas. These findings suggested that teachers have basic technology knowledge but lack the advance knowledge needed for more complex tasks.

Data was analyzed to find out whether a relationship exists between teacher technology knowledge and technology integration, and also between teacher self-efficacy and technology integration. Analysis for teacher technology knowledge and technology integration showed a correlation coefficient of (r= .452) indicating a moderately positive correlation between teacher technology knowledge and technology integration. This finding supported previous research work where similar relationships were obtained, such as research from Erdogan (2010) showed a significant correlation between the levels of knowledge about ICT and the use of ICT in education (Kandasamy, & Shah, 2013). Moderately positive correlation (r= .394) was also found for teacher self-efficacy and technology integration. A study conducted by Haight (2011) also showed significantly strong positive correlation between computer self-efficacy and the adoption of technology in classroom instruction.

Study reveals that increase in teacher technology knowledge level leads to increase in technology integration for teaching and learning. In addition higher self-efficacy towards technology also leads to increase in technology integration for teaching and learning. Hence it is important for teachers to have knowledge on how to use different technologies in their teaching and learning so that teachers are competent in technology integration. In addition to having the required knowledge, teachers need to have a high confidence towards using technology which can lead to increase in technology integration by the teachers.

In the study technology integration by subject area was compared. Subjects were grouped into science and non-science subjects. It was found out that there was a significant difference in technology integration between science and non-science subject teachers. Several researchers have conducted studies for difference in technology

integration for different subject areas. Kotrlik and Redmann (2009) found from their study that business teachers in Louisiana adopted technology in teaching and learning at higher levels than other teachers. Cherry (2014) also found a significant difference in technology adoption between business teachers and teachers of other subjects particularly Math and science.

The present study did not differentiate between business teachers and other teachers. Teachers who participated in the study was categorized into science and non-science teachers because science is one of the major curricular areas essential to prepare students for life and field of work in the 21st century and in Maldives science is a growing subject area. Secondary teachers who taught non-science subjects were not integrating technology at the same levels as those who taught science related subjects. This might be because science is a subject with a lot of abstract concepts teaching them using technology will provide a better understanding for students, hence science teachers integrated technology more in teaching and learning.

Conclusion

These findings would be helpful to school administrators where they can focus to encourage teachers to use new technologies in teaching and learning. Teachers should be provided with sufficient knowledge regarding how to use different types of technology. In addition, help should be provided for teachers to develop their self-confidence regarding technology integration.

This study was conducted quantitatively, and findings from the study would be helpful for the literature review of a qualitative study. A qualitative study would provide more insight into the findings articulated here, qualitative study with interviews from teachers would provide a deeper understanding of different variables related to technology integration. Furthermore, study observed whether a relationship existed or not, but does not evaluate the causes and effects of relationships obtained between the variables. These finding can be used as a source of literature for an experimental study. In addition, according to literature regarding the topic there are several variables associated with technology integration in teaching and learning. Using these findings it is recommended to conduct more correlation research in Maldives to find out if relationships exist between technology integration and other variables such as attitude or availability.

These findings highlight the importance of training the teachers regarding how to use different types of technologies especially providing knowledge on using advanced technologies. It is also important to encourage teachers and enhance their confidence in using technology. As teachers who had more knowledge and high self-efficacy integrates technology more frequently in teaching and learning.

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