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Barriers to Using Technology for Teaching and Learning Mathematics: A Review of the Literature

Dr. Mansour Saleh Rashed Alabdulaziz
Department of Curriculum and Instruction
College of Education
Imam Abdulrahman Bin Faisal University
P.O. Box 2375, Dammam 31451
Saudi Arabia

ABSTRACT
Despite the potential positive effects of using technology with students in mathematics, there remain some obstacles for some teachers when using technology, and while some of these teachers overcome these barriers, others do not succeed in this the challenge. This study reviews the literature on the barriers that teachers face when using technology in their classroom, and why some overcame obstacles while others did not. The researcher found from the reviews that the major obstacle teachers face when using technology included the teachers' negative attitudes and beliefs about teaching mathematics using technology, the lack of training in using technology, and the lack of technical support. The head teacher's attitude also had a great effect on managing the challenges teachers faced, which affected teachers' decisions to use or not use technology in school. This study concludes with recommendations regarding future research in this area.

Keywords:- Obstacles to Technology use/ literature review

I. INTRODUCTION

In the light of the use technology, it has been discovered by researchers that teachers rarely utilise technology in the classroom environment. For instance, in a large-scale survey of teachers, students and administrators by the Gates Foundation, Abbott (2003) shows that more than 53% of teachers do not use technology regularly to help their students in the classroom. In 2005, another survey (by CDW-G) found that 80% of teachers use computers for administrative tasks only (National Teacher Survey, 2005).

In this research, I will reviews the literature in order to gain a better idea of some of the barriers to adopting and using technology for teaching and learning mathematics.

II. THE LACK OF TRAINING TEACHERS TO USE TECHNOLOGY

Many study found that technology will not enhance learning unless teachers have training on how to use it appropriately. According to Jessica (2015) study there is an attempt to comprehend the viewpoints of teachers as to how technology and the media have affected mathematics teaching. The information in this qualitative research was obtained by interviewing eight teachers of mathematics, all of whom have been in teaching for a minimum of 15 years, and who also utilise media and technology in the classroom. The purpose of the research is to enable students to be acquainted with the impact of technology on the educational structure, and of particular significance, its impact on each person's learning progression. The summary of this analytical study implies that when technology and media are utilised in the classroom environment, they do not inevitably affect the development and success of the student. A deficiency in teaching training could be responsible for this. Despite the fact that teachers are not utilising technological methods and media comprehensively, they remain conscious of the advantages that emerge. They are also conscious of the deficiency in their training and have a desire to acquire more knowledge. It is evident that the above study adopts an interview and the current study applied semi-structured interviews and observations.

Akkaya (2016) in his study, sought to examine how teachers' viewpoints have changed concerning the utilisation of technology following their training on the co-ordinating technology with the teaching of mathematics. Pre-service teachers participated in a training programme that has been prepared for this purpose. This programme included, co-ordinated technology, didactics and awareness of content. In the course of this research, the exploratory

sequential mixed system was employed. This is a system which includes both quantitative and qualitative research methods. In the quantitative research measure, pre-test/post-test exploratory plans without any control groups were utilised, but in the qualitative measure pre-service teachers' opinions were obtained. A total of 34 pre-service teachers participated in the research which was held at a state university Middle School Mathematics Teaching Department in the spring semester of the academic year 2013-14. Information was obtained by utilising the Perception Scale for Technology Use as well as by interview forms. Quantitative data was examined by employing the t-test and the Perception Scale for Technology Use while the preferred option for examining qualitative data was content analysis. The results of the study revealed there to be important variations in the understanding of pre-service middle school teachers of mathematics concerning the utilisation of technology which followed their training in the incorporation of technology in the teaching of mathematics. On the basis of the results, it was deduced that training, which embodies educational, technological and content awareness is supplied within the teacher training programme, and advances the understanding of pre-service teachers regarding the utilisation of technology in the field of the teaching of mathematics.

A study in the Kingdom of Saudi Arabia by Alabdulaziz (2013), which used semi-structured interviews with four mathematics teachers and 12 students at an elementary school in Saudi Arabia, sought to build a picture on the effect of using technology with pupils who have mathematics difficulties from the teacher's point of view. The interviews consisted of eight questions. In the answers to the first question, the teachers' perceptions on the use of technology with those pupils varied. It was apparent that these teachers had experience with different types of technology software. Teacher 4's experience differed from that of Teachers 1, 2 and 3. This teacher does not use technological aids for three reasons: firstly, lack of teacher training; secondly, there is no reward system for encouraging teachers to be innovative; and lastly, he prefers the traditional blackboard for explaining step-by-step mathematical answers to a student struggling with arithmetic. Teacher four further added:

> *I am very aware of the problems that plague traditional schooling, but I feel that technology could push me out of my job, because buying and implementing technology is more cost-effective than hiring teachers. I hope to use it as a supplement to teaching rather than an alternative to teachers, especially with those students who have dyscalculia.*

With regard to the three other teachers had not been trained on how to use technology effectively in the classroom when they were at university. The researcher noticed that those teachers were trying to use technology with their students because they understood that it can be very useful for those pupils who have difficulties with maths. It is important to acknowledge that the training of teachers will play a crucial role in increasing the use and effectiveness of technology in education. It is worth noting in that study that teachers rely heavily on their students for information about technology, such as how it works, how to conduct an Internet search for general information, or how to send and receive emails. Here, students play a vital role in the improvement process, although adding to the major challenges facing teachers when using technology with those students. The researcher found that all three teachers felt the need for more training in using technology in the classroom, and they feel that this is a major obstacle in their use of technology. For example, one teacher said:

> *Technology training is the main factor that could help me develop positive attitudes toward integrating technology into my mathematics teaching.*

Another one said,

> *Appropriate and integrated use of technology impacts every aspect of mathematics education… I do not have any training on this.*

Wachira and Keengwe (2011) investigated urban school teachers' perspectives on barriers that hinder technology use in mathematics classrooms. This study employed a varied methodology which coordinated qualitative and quantitative elements. A total of 20 teachers participated, 15 females and 5 males. Certain barriers to the improving and increasing the use of this technology were discovered by the study; examples of these being the

time factor and the restricted number of technology tools, additional the scarcity of teachers trained for this technology, and the lack of a reward system for imaginative teaching. The researchers found that there are two types of obstacles. The first is external: the lack of availability of technology, unreliability of technology, and the lack of technology support and technology leadership. The second is internal: the lack of time, the lack of knowledge, and scarcity of confidence and had anxiety in teaching involving technology. With regard to lack of knowledge, teachers responded that a lack of training in the relevant technology as the main cause of the lack of technological knowledge. The majority of the teachers indicated that their training had been generic and not specifically geared to particular technology integration. It was explained by one teacher that many teachers were unaware of how to involve their students with technological learning.

III. LACK OF TECHNICAL SUPPORT

Another barrier originates from a lack of technical support in school. Mumtaz (2000) indicates a scarcity of on-site support as a reason quoted by teachers for not using technology in the classroom. An example of this is highlighted in Butler and Sellbom (2002); it took three weeks to replace an expired projector bulb. Snoeyink and Ertmer (2001) discovered that teachers who attempted to perform a function on a computer failed as a result of technical issues, and that they would then not use a computer for a number of days. Sharing a similar view, Jones (2004) reported that there is a close relationship between technical assistance and barriers; barriers in this case represent a lack of technical support, and teachers will be discouraged from using technology if they know that no one will be on hand to offer immediate technical support. Jones (2004) agrees that, if technical support is lacking at school, it will likely be the case that technical maintenance is not executed on a regular basis, which leads to a greater risk of technical failures.

A study in the United States by Hsu (2016) being a mixed-methods research, the intention of which was to examine the current practices, beliefs and obstacles regarding the technological incorporation ranging from teachers of Kindergarten up to Grade Six in the United States Midwest. Three data gathering methods were employed, namely surveys conducted online involving 152 teachers, in addition to observations of and interviews with eight teachers The findings revealed that most teachers had constructivist pedagogical beliefs regarding technological incorporation. This research discovered that the teachers having constructivist pedagogical beliefs regarding the utilisation of technology had high self-efficacy beliefs regarding such utilisation placed a positive value on the utilisation of technology, and had at least two instances of high-level learning within their lessons. Language Arts was the subject which attracted the greatest attention for technological incorporation. The following four obstacles identified by the study were; deficiency in teacher training regarding technology, deficiency in computer proficiency, deficiency in technological support for teachers and shortage of time for teachers to introduce technology-incorporated lessons.

Another study by Alghamdi (2016) sought to assess the technique employed by Saudi teachers in utilising IWBs in the classroom environment and to recognise the problems they experience in the utilisation of such technology. This research was undertaken in Jeddah city, Saudi Arabia. A mixed-methods technique, both qualitative and quantitative, was utilised in the present study, by employing three approaches. These are a questionnaire (online and paper-based), semi-designed consultation and observation inside the classroom. The questionnaire, specifically written for this research, was completed by 587 teachers (286 male and 301 female) from primary schools within Jeddah city. The three main problems encountered by the participating Saudi teachers when employing IWBs were; scarcity in training courses' availability, technical difficulties in the utilisation of IWBs and deficiency of help and encouragement. Contrastingly, the three least encountered difficulties were; students experiencing problems with IWBs, the position of IWBs and problems in the incorporation of IWBs in conducting lessons.

IV. TEACHER ATTITUDES AND BELIEFS ABOUT TEACHING WITH TECHNOLOGY

Simpson, Koballa, Oliver, and Crawley (1994) indicated that attitudes can be construed as certain sentiments as to whether someone likes or dislikes something. Consequently, teachers' attitudes and

opinions regarding technology can be another obstacle to the incorporation of technology (Hermans, Tondeur, Valcke, & Van Braak, 2006). Because the attitudes of educators play a significant part in the area of educational interaction, as well as in teaching choices, these are basic in analysing the consequences of the results of classroom technological integration (Albion & Ertmer, 2002). Nevertheless, the software being available and the teachers being ready to use the software can positively impact the attitudes of teachers regarding the implementation of technology in the classroom (Sepehr & Harris, 1995).

Kersaint, Horton, Stohl, and Garofalo (2003) discovered that teachers having positive attitudes are more comfortable when they use technology and usually include it in their teaching work. On the other hand, although a school may have an appropriate level of technology utilisation, it may fail to offer technology-supported learning, if the teachers themselves are not have a positive attitude towards technology. In this case, school head teachers may play an important role in changing teachers attitude and belief through providing support and enhancement, rather than supervision them only. School principals need to offer personal advice to teachers and staff, not only act as official supervisors, if they want to bring about a change in the perceptions of teachers (Kim, Kim, Lee, Spector, & DeMeester, 2013).

The reasons have been offered as an explanation for this barrier

Ertmer, Addison, Lane, Ross, and Woods (1999) examined the barriers to using technology in the classroom, with seven primary teachers, through interviews and observations. The researchers found that there are two types of obstacles. The first is external; this includes the lack of resources, insufficient time to fully prepare for an instructional task and lack of administrative support. The second is internal; one of the aspects researchers mean by internal is negative beliefs on the part of teachers toward the use of technology. One reason has been offered as an explanation for this barrier; according to Handal (2004), some teachers, while they were studying at schools or college, found that no technology was available to them. Thus, they tend to employ a certain pattern of teaching that obviates the need for technology. For example, the average age of teachers in New South Wales is 47, meaning that they studied teaching before many technologies had become available (Godfrey, 2001).

Another study, by Norton, McRobbie, and Cooper (2000), investigated the reasons why mathematics teachers do not use technology in their teaching in order to support students; their research was conducted at a school where mathematics teachers rarely use technology with their students, despite the availability of hardware and software. According to the findings of the study, the resistance of individual teachers was linked to their beliefs about the teaching and learning of mathematics and their existing pedagogies. This involves their ideas about tests, apprehensions about time restrictions, and preference of certain text resources. The study also concluded that teachers with transmission/absorption views of teaching and learning, and pedagogy focused on the educator and the content, had an obscured view of the prospects of using computers in the area of teaching and learning mathematics. By way of comparison, a teacher who holds a view of teaching methods in line with the social constructivist learning theory and learner-focused education displayed a broader view of the computers' prospects in the teaching of mathematics.

In the light of teacher beliefs, researchers suggest that the beliefs of the educator could serve as a crucial element in assisting or impeding the incorporation of technology by the educators (for example, Cuban, Kirkpatrick, & Peck, 2001; Dexter, Anderson, & Becker, 1999; Niederhauser & Stoddart, 2001). In the view of Ertmer (2005), to utilise or not technology for instruction purposes is a decision that eventually rests on the educators themselves as well as on their beliefs towards how effective technology is. In a study by Sugar, Crawley and Fine (2004), beliefs held by educators about the decision to embrace technology were discussed. The qualitative and quantitative data gathered were sourced from educators from four schools in the south-eastern part of the USA. Based on overall findings, the decision to embrace technology was impacted by the individual stances of the educators on the incorporation of technology. Their stances were shaped by virtue of certain fundamental personal beliefs they hold about the effects of technology incorporation. Elements of inconsequential impact on the educators' decision to embrace technology included outside support from key individuals as well as contextual resources, such

as funding. Their recommendation, based on their findings, was that head teachers should collaborate closely with educators to address their beliefs and apprehensions about the incorporation of technology as well as offer them a significant degree of personal support and resources. Indeed, I see that this study used qualitative and quantitative approaches, and the present study used only qualitative approaches.

Miller et al. (2003) stated that the technology-related beliefs of educators consist of three components, which are connected, but still independent; the first is pedagogical beliefs on tuition and learning, the second self-efficacy beliefs on the utilisation of technology, and the third beliefs on the perceived value of computer use in the student learning process. Another research study, conducted by Russell, Bebell, O'Dwyer, and O'Connor (2003), discovered that these three elements played the main role in the prediction of the incorporation of technology by the educators in the classroom.

On pedagogical beliefs about teaching and learning, it can be argued that constructivist pedagogical beliefs held by educators about the teaching and learning process play an influential part in the determination of strands of utilisation of technology in classrooms (Higgins & Moseley, 2001; Inan & Lowther, 2010). Honey and Moeller (1990) established that a successful technology incorporation into instruction was achieved by educators holding constructivist-oriented pedagogical beliefs. As suggested by Ertmer (2005), technology was more likely to be adopted in the classroom by educators holding robust constructivist pedagogical beliefs than by educators with traditional-oriented pedagogical beliefs. Likewise, following their examination of the influence of the intricate relationship between the educators' ways of thinking and the adoption of technology, Sang, Valcke, van Braak, and Tondeur (2010) suggested that educators' constructivist pedagogical beliefs have a significant impact on their potential utilisation of technology. Additionally, Sang et al. established that educators holding more robust constructivist pedagogical beliefs had a greater tendency to incorporate technology into instruction, as compared with educators who did not have those beliefs. Nonetheless, Sandholtz and Reilly (2004) suggested that educators with constructivist beliefs might not necessarily be active tutors, given the possibility that they can be unskilled in the utilisation of technology or do not have enough time in the classroom.

Teachers' self-efficacy beliefs about the utilisation of technology can play a crucial role influencing in the practices of educators in relation to the employment of technology. In the definition by Bandura (1997), self-efficacy is individual beliefs about one's ability to learn or execute tasks according to certain standards. Putting it more explicitly, the self-efficacy beliefs of educators consist of beliefs about what they are able to achieve with the incorporation of technology in the classroom, as compared to their information about what to do (Ertmer et al., 2003). Based on findings by researchers (Albion, 1999; Lumpe & Chambers, 2001; Marcinkiewicz, 1994; Oliver & Shapiro, 1993), self-efficacy beliefs of educators, or their confidence about the utilisation of technology, play a crucial role in the prediction of the incorporation of technology in the classroom by educators.

On beliefs about the perceived value of computers for student learning, Newhouse (1998), based on a survey he conducted, involving 60 Australian educators, discovered that tutors were unwilling to apply technology in their classroom, even those educators who were technically skilled. In the educators' views, the use of computers in teaching is unbeneficial, and the application of technology plays an extremely restricted part in the classroom. According to the author, preferring conventional methods of teaching was one of the reasons behind the educators' unwillingness to adopt technology. I see that this study used a very large sample compared to the current one. A survey involving 2,170 school teachers by Niederhauser and Stoddart (1994), concluded that there were two groups of educators. The first group, which was linked to constructivist-oriented views, believe that computers are instruments employed by the learners to gather, analyse, and supply information. Meanwhile, the second group, which was linked to transmission views, perceive computers as teaching equipment that can be employed for supplying information and instant support, as well as tracking the progress made by the learners.

V. SCHOOL LEADERSHIP' ATTITUDES TOWARD TECHNOLOGY

From the viewpoint of teachers, the attitudes of school headmasters on technology play an extremely significant role in the encouragement of technology incorporation into school (Atkins & Vasu, 2000). Baylor and Ritchie (2002) examined the effect of seven aspects linked to school technology (planning, leadership, curriculum alignment, professional development, utilisation of technology, teacher open attitude to change, and teacher use of computers outside school). Powerful leadership in technology was found, through interviews with teachers and administrative staff, to have an impact in students' acquisition of content. Moreover, when head teachers had a positive stance towards technology, this promoted the integration of technology into the classroom and spurred teachers and students to utilise technology more often (Baylor & Ritchiem, 2002).

Another study discussed the effect of head teacher's technology training on the integration of technology into schools. For example, Dawson & Rakes (2003) conducted a study entitled "The influence of principals' technology training on the integration of technology into schools". The intention of this study was to analyse if training in technology given to principals had any effect on the incorporation of technology in the classroom. The standards of technology incorporated into the schools' curricula concerning the volume and kinds of training given to K-12 school principals were analysed in this study. In addition to the standard of technology, this study analysed regarding the demographics listed below: age, sex, principal's length of time of experience in administration, size and level of school. The study discovered important statistics regarding the among and kinds technological training received by the principals, stating each of these may impact on the standards of incorporation into a school's curricula. It was revealed that the age of the principal has a major effect on incorporation of technology into the curriculum. Dawson & Rakes (2003); they believed that successful implementation of technology was dependent on the age and attitude of the principal. According to the researchers, the younger the principal, the more successful the implementation, and the older the principal (aged between 41-55 years) the greater the resistance to incorporating technology in the school.

VI. RECOMMENDATIONS

The researcher recommends that additional research be conducted in several areas:

1- More research needs to be conducted to determine the role of students in influencing the attitudes of school principals toward technology.

2- More research needs to be conducted to determine the role of students in influencing the attitudes of teachers toward technology.

3- There is also an urgent need to see the views of head teachers in regard to the effect of technology in teaching and learning, and what the main obstacles are that are faced by his or her teachers through the use of technology.

VII. CONCLUSION

The purpose of this review was to examine the literature on the barriers that teachers face when using technology in their classroom. The researcher found from the reviews that the major obstacle teachers face when using technology included the teachers' negative attitudes and beliefs about teaching mathematics using technology, the lack of training in using technology, and the lack of technical support. The head teacher's attitude also had a great effect on managing the challenges teachers faced.

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