Barriers To Using Technologies When Helping Saudi Primary Students' Difficulties With Mathematics

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***Abstract*— Despite the potential positive effects of using technology with students who have difficulties in mathematics in the Kingdom of Saudi Arabia and the great efforts made by the Saudi Government to improve the education system of the nation, which has included a continuous rise in the educational budget, there still 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 paper will investigate the barriers that teachers face when using technology in their classroom in primary schools, and why some overcame obstacles while others did not. Semi-structured interviews and observations were used for the purpose of this research, which were undertaken with three mathematics teachers from school A which used technology, and the other three from school B, which did not use technology. I found that the major obstacle teachers face when using technology included aspects of 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 was also an important influence on managing the challenges teachers faced, which affected teachers' decisions to use or not use technology in school.**

***Index Terms*— obstacles, reasons to overcome/ not overcome.**

I. INTRODUCTION

There are some students who have difficulties with mathematics subjects at primary schools in the Kingdom of Saudi Arabia. Mathematics learning difficulties is a generic term referring to those pupils "who learn but misconceive, find prescribed steps hard to understand, pattern development, visualizing as well as misunderstanding structures" [5]. It is therefore not surprising to note that many students perceive mathematics as a difficult subject, as it consists of many areas that continue to develop in an increasingly complex way [38]. However, when technology is integrated with teaching techniques, it can promote the translation of mathematical concepts from one mode into another, thereby making ideas more tangible [35].

In Principles and Standards for School Mathematics [23], the National Council of Teachers of Mathematics (NCTM) states "technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances students' learning". Additionally, several research studies have concluded that, by utilising means of technology strategically, acquisition of mathematical processes and abilities can be facilitated, and advanced mathematical competences, including problem solving, reasoning, and validating, can be developed (e.g., [11]; [17]; [25]; [26]; [34]).

The Saudi Government has made significant efforts made to improve the education system of the nation, with one of the goals more effective use of technology in mathematics education. These efforts have included a continuous rise in the educational budget with SR210 billion ($56 billion) for educational development in the 2014 budget, which was double the budget of SR105 billion ($28 billion) in 2008 [19].

However, there are still some teachers who face obstacles in using IWB, and some of these teachers try to overcome these barriers, whilst others do not succeed in this the challenge. Overall the results are not as impressive as expected by the officials, which has been demonstrated in a number of ways. For example, according to the study of TIMSS (2007), Saudi Arabia got an average score of 4 along with 8 science samples was about 403 less than the international average and also below many other countries that have almost similar cultural and economic context [21]. In addition, the country has been experiencing a vigorous debate on the educational crisis that is related to the learning process and teaching quality and has been contributing to the overall results and ranking in TIMSS research.

Therefore, the aim is to improve the system of education in Saudi Arabia through investigating and understanding the barriers that teachers face when using technology in their classroom in primary schools, and particularly why some overcame obstacles and why others did not. Thus, there are two key questions:

1. Why are some mathematics teachers overcoming the obstacles they face when using technology to benefit their students?
2. Why do some mathematics teachers not succeed in overcoming the obstacles that prevent them from using technology to benefit their students?

II. THE ORETIC FRAMEWORK

As a theoretical framework for undertaking this research, the Technological Pedagogical Content Knowledge (TPCK)

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Framework ([30]; [20]) and the Concern Based Adoption Model (CBAM: [14]; [28]) are both selected.

III. LITERATURE REVIEW

A. The Role of Technology in Teaching and Learning Mathematics

Technology is an increasingly important aspect of modern education, and its relevance is spreading to virtually every field ([12]; [18]), and therefore technology has become an integral part of our daily life. Students want to bring what they are doing outside school into classroom, such as computer games, smart phones, social networking and MP3 players ([13]; [27]). According to Natalie (2011), as cited in FoxNews [10], "we know that students live in technology outside the classroom. And we know that if we can spark interest in a subject through technology, students will be more willing to stretch their brains and try new things" .

Torff and Tirotta [36] conducted research work to establish to what degree the utilisation of interactive whiteboard technology (IWB) contributed to the level of motivation in mathematics reported by upper elementary students. A total of 773 students (241 4th grade, 260 5th grade, and 232 6th grade) took part in the research study. The number of teachers who participated was 32, and 19 of them stated that they used IWB (the treatment group), and 13 of them noted that they did not widely use IWB (the control group). There were 458 students in the treatment group and 315 in the control group. According to the findings of the research study, a higher level of motivation was displayed by the treatment group students, compared with the control group students. Also, students whose teachers are supportive of the utilisation of IWB technology showed a higher level of motivation, in contrast to students whose teachers are less keen on the use of IWB.

B. Barriers to using technology for teaching and learning mathematics

In the light of the use technology, researchers have found that teachers seldom use technology in the school classroom. For instance, in a large-scale survey of teachers, students and administrators by the Gates Foundation, Abbott [1] 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 [24].

In this section, I examine certain researches in order to gain a better idea of some of the barriers to adopting and using technology for teaching and learning mathematics, with the ultimate aim of breaking down those barriers among teachers and technology in schools.

1)The Lack of Training Teachers to Use Technology

A study in the Kingdom of Saudi Arabia by Alabdulaziz [2], which used semi-structured interviews with four mathematics teachers and 12 students at an elementary school in the Kingdom of Saudi Arabia, sought to investigate the effects of applying technology to the mathematical problem-solving abilities of primary school students who have dyscalculia. Overall, the research aims to encourage the use of technology in schools in order to help pupils with dyscalculia in Saudi Arabia so that they may achieve their desired outcomes, as well as continue to improve their abilities.

Although that study has confirmed the positive effects of technology on learning, one of the teachers investigated did not use it with his students 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. Therefore, further study could focus on the obstacles of using technology on primary schools to help students with dyscalculia in the Saudi Arabia because this study found evidence to suggest that there are a variety of obstacles, including the lack of teacher training in using it, especially with such pupils.

Wachira and Keengwe [37] 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 female and 5 male. 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.

2) Lack of Technical Support

Another barrier originates from a lack of technical support in school. Mumtaz [22] indicates a scarcity of on-site support as a reason quoted by teachers for not using technology in the classroom. According to Cuban [6], there is a lack of technical support available in schools generally, leading to equipment remaining out of use for long periods of time; this seriously inhibits the widespread use of technology. An example of this is highlighted in Butler and Sellbom [4]; it took three weeks to replace an expired projector bulb.

Snoeyink and Ertmer [32] 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 [16] reported that there is a close relationship between

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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 [16] 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.

3)Teacher Attitudes and Beliefs About Teaching with Technology

Simpson [31] 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 [15]. 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 [3]. 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 [29].

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, [7]; [8]). In the view of Ertmer [9], 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 [33], 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.

IV. METHODOLOGY

A. Data Collection Method

This case study was conducted at two primary schools in Saudi Arabia, with three male mathematics teachers in school A, who use technology with their students who have mathematics difficulties, and three other teachers in school B do not use it with their students.

Each one of these six teachers were interviewed and asked general questions about the use of technology (Part 1). Each was then observed in their classrooms and, finally, every teacher was individually interviewed and asked specific questions to address the research questions (Part 2).

Interviews and observations were chosen as techniques for the purpose of this research and because data collected through interviews and observations can be compared. In addition, observations are crucial to see the effect of technology on the students' mathematical learning. However, the observations may not be enough (see Table 2), as there remain the need to investigate and understand the barriers that teachers face when they use technology, and why they overcame obstacles or why not.

B. Ethical Considerations

The study was conducted in accordance with the British Educational Research Association Revised Ethical Guidelines for Educational Research (2004) with ethical approval given by the School of Education's Research Ethics Committee at Durham University.

C. Data Analysis

Firstly, all interviews were recorded and transcribed verbatim after each session. The each transcript, interview data and observation notes were read and re-read. Secondly, thematic coding was used, underlining the text in different colours, and matched data in categories separately which allowed reduction and synthesis of large quantities of information. Thirdly, all the identified commonalities were divided into themes, and supported with quotes.

V. RESULTS

The results which emerged from each case study were compared with each other through the responses to the interview questions and the observations, which enabled the research questions to be addressed. These comparisons were divided into four categories, as follows:

A. Teaching Approaches

From the responses of the three teachers in school A, I find that they are eager to take advantage of the positive potentials offered by IWB, and are willing to incorporate it in their teaching permanently. This became evident upon their agreement on three points: technology has become an integral part of developing the mathematics curriculum, attending training sessions, and the daily use of IWB. Teacher one also added that he wanted to take advantage of the rapid development of technology in teaching students, while teacher two found that the best way to teach students with mathematics difficulties was through the use of technology as compared with other methods. Teacher three believed that, in the current time, students live with technology outside the school to entertain themselves; therefore, using these technologies inside the school will excite students' interest in learning mathematics, which will lead to them being willing to receive more information. In addition, I can also find from the observations that their current method of teaching students with difficulties in mathematics was dependent on technology in contrast with the three teachers in school B. The former group knew the benefits of teaching students with difficulties in mathematics using technology. However, their answers showed that they faced challenges with their head teacher, which led them to not use IWB. This included a lack of the rewards system and encouragement. Moreover, I can notice from their teaching methods that they did not use IWB, except

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for teacher six who used his laptop and projector for one week only, then returned to his usual method.

B.The Effect of Technology on Students Who have Difficulties in Mathematics.

It is clear from the interviews' responses and the observations that the teachers' believed that using IWB had a positive effect on students with difficulties in mathematics, evident from teachers one, two and three in school A, and teacher six in school B, who tried to use his laptop and projector for one week only. Teachers one and six agreed at one point that IWB can increase levels of learners' motivation, and each one of them added different points to this view.

Teacher one said that it draws the attention of students, while teacher six added that it improved communication between teachers and students. Teachers two and three had answers different from each other: teacher two mentioned that the continuity of negative results could be avoided through early intervention by using IWB, while teacher three said that IWB can boost students' confidence and improve their memory. In the observations, I noticed that IWB helped teachers one, three and six's students in building their confidence and improving their memory. In addition, it helped some students of teacher one overcome the obstacle of math anxiety, while students of teacher two were supported in reducing the negative outcomes emanating from the difficulty and speed of response of overcoming these difficulties. With regard to its effect on mathematics teaching, I noticed that this tool was able to save time in the classrooms of teachers one, two and six. In case of teacher six, it gave him the chance to identify the strengths and weaknesses of students.

With respect to the three teachers in school B who did not use IWB, I found negative effects on students as a result of non-use. In the observations session, I noticed that the traditional method used by teachers four and six wasted class time. In addition, students under teacher four disliked mathematics, thus increasing the difficulties. Students of teacher six found their recall process to be difficult, resulting in a decline in their self-confidence. In teacher five, I found a lack of interaction, motivation and focus during the lesson. Although all three teachers believed that IWB has a positive impact on learners, they did not use it because of the challenges they faced, which I will analyse further in the next session.

C.The Challenges Faced in the Use of Technology

All six teachers agreed that the school context was the main reason behind the decision of the mathematics teacher to not use technology, except teacher two, who believed that the reasons depended on the teachers themselves, as well as the school. It is interesting to state here that all six teachers, when they said school, meant the principal, who plays a big role in the teachers' decisions, and is concentrated on their attitudes towards technology. With regard to the major obstacles facing teachers when using IWB, I found that the responses of the three teachers in school A using IWB varied from one another, and centered around teachers' negative attitudes and beliefs about teaching mathematics with technology, the lack of training in using technology, and the lack of technical support.

These barriers have also been demonstrated in a number of studies, such as Alabdulaziz (2013),[37], and Jones [16]. On the other hand, the three teachers in school B without IWB had the same answers in general, which cited the attitude of the head teacher towards technology with regard to providing, integrating and using it in the classroom. However, when each of them elaborated what they meant by the attitude of the head teacher according to his belief and experience, I noticed that they agreed on some points, such as when teachers four and six mentioned that the head teachers, who are advanced in age and lacked knowledge about the effect of technology on students with difficulties in mathematics, are critical factors affecting technology integration and use in schools. They also disagreed on some fronts, which appeared when teacher five mentioned the attitude of the head teacher in general without specifying, and when teacher six talked about the principal who do not graduate from technical subjects, influencing their beliefs and attitudes towards IWB. I also saw the keenness of the three teachers in school A, who advised other head teachers and teachers on how they overcame these three obstacles, trying to transfer their positive experiences with their head teacher in this aspect.

Turning to the observations session, I noticed that the head teachers' attitude affected the challenges their teachers faced. In school A, he succeeded in encouraging and supporting his teachers in overcoming the difficulties they faced when using IWB, which led us to notice that the teachers did not face any challenges or difficulties during the use of IWB. That reflected positively on the teaching and the learning of students with difficulties. On the other hand, the head teacher in school B did not help his teachers overcome challenges to achieve their desires to take advantage of the positives of the use of IWB, which led to a lot of challenges when they taught their students, reflecting negatively on the teaching and learning of students with difficulties. It is an important to mention here that the findings of both interviews responses and observations are consistent with the CBAM model of concerns (CBAM: Hall and Loucks, 1978; Sashkin and Ergermeier, 1993).

D. Difficulties In Mathematics

I can see that some pupils under the first, third, fifth and sixth teachers had the same difficulty, which was that they failed to understand that any number multiplied by zero equals zero. In addition, there were differences between some learners under the first and third teachers with regard to the difficulties mentioned earlier. Some students with the second and fourth teachers also had the same difficulties, which centered on borrowing from zero in subtraction. In addition, it is clear from their interview answers that teachers one and two focus on the reasons for these difficulties and their decision to use IWB, while teacher three concentrates only on the reason of using this tool with his students. A number of the findings about difficulties in mathematics and technology use can therefore be related to the Technological Pedagogical Content Knowledge (TPCK) Framework ([30; [20]).On the other hand,

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all three teachers in school B focus only on the causes of not using technology with students who have difficulties in mathematics, and mentioned nothing about the reasons for the difficulties that their students face. It appeared that the school's principal played a key role on their decision to not use IWB with students, despite their eagerness to acquire it to help students overcome their difficulties.

VI. ANSWERS TO THE RESEARCH QUESTIONNS

Why are some mathematics teachers overcoming the obstacles they face when using technology to benefit their students?

I can answer this question through the three mathematics teachers in school A, who used IWB with their students that had mathematics difficulties. I found four main reasons that made these three teachers enthusiastic to overcome the obstacles they faced in the use of IWB.

The first reason given by teacher one was his desire to take advantage of recent technological developments in his teaching practice. Throughout his teaching career, teacher two had used various methods to attempt to address the difficulties his students faced while learning mathematics. He found that teaching with IWB facilitated learning through making the lessons more enjoyable and the topics easier to understand.

According to teacher three, as technology is now so widely used for entertainment purposes by students in their daily lives outside of school hours, technology should be harnessed and applied to engage the students' interest within the classroom environment which would help stimulate their interest in the subject of mathematics, and also help them absorb the information more easily as a consequence.

The second is the way of structuring the topics after the development of the mathematics curriculum, which requires teachers to use technology to help them deliver and simplify information for students, as technology has now become an integral part of the curriculum. The third is the teachers' belief that the IWB technology has a positive effect on teaching and learning students with mathematics difficulties; this was shown in the second section of the analysis above, entitled the effect of IWB on students who have mathematics difficulties.

The fourth is indeed a very important reason, that the help and support of the head teacher is critical for these three teachers to achieve all the three points above easily. These include the provision of IWB in each classroom through communicating with the Ministry of Education, encouraging teachers to use IWB, giving assistance and support to overcome all the obstacles that prevent their use of IWB, such as offering relevant training and technical support. The head teacher in their school was extremely supportive and enthusiastic towards IWB; he was very creative in offering ideas to help his teachers exceed the challenges and make the most of the possibilities offered by IWB. For instance, making part of the teachers' evaluation scores on attending the necessary training, and providing technical support in the school. All these factors led these three mathematics teachers to continue successfully in the use of IWB.

Why do some mathematics teachers not succeed in overcoming the obstacles that prevent them from using technology to benefit their students?

I can answer this question from the other three teachers in school B without IWB, who believed that the use of this technology in teaching had a positive effect on students who had mathematics difficulties. This was shown through their interview responses, mentioned in the second section of the analysis above, regarding the effect of IWB on students who experience mathematics difficulties.

However, I found that there were reasons why the three teachers in school B did not succeed in overcoming the obstacles they faced with IWB. To identify these we need to revisit the analysis above, which appeared in four positions as follows:

Firstly, I can find this in first section, when all the three teachers mentioned the reasons for not using IWB with their students. These included the lack of a reward system from their head teacher for innovative teaching through technology, the lack of support from the principal in providing technology, appropriate training and technical support. Moreover, teacher three found that the advance age of the head teachers, and also not receiving in-service training may reduce the head teachers' enthusiasm for providing IWB in the schools, which impacted negatively on the teachers' decision to use the technology.

Secondly, I can see from the third section that all three teachers mentioned that the main reason behind their decision not to use technology to help students with mathematics difficulties was solely due to the school itself. By the term, school only, they were referring to the attitude of head teachers towards technology with regard to provision, integration and use within the classroom.

Thirdly, each teacher mentioned the meaning of the attitude of head teacher according to his own belief and experience. I noted that they agreed on certain points, such as when teachers four and six mentioned the advance age of the head teachers and the lack of the directors' knowledge regarding the positive impact of technology on students with mathematics difficulties, which are critical factors may affecting technology integration and use in schools, but they disagreed on others. This appeared when teacher five mentioned the attitude of the head teacher in general without further detail, and when teacher six added that the fact that the principal who had not graduated in a computer subjects would influence teachers' belief and attitude toward IWB.

Fourthly, it is clear from all the three points above that the attitude of their head teacher was the main reason for the teachers' own reluctance to overcome these barriers.

Overall, I found from the interviews' responses of all six teachers and the consequent observations, that the head teacher's support was the main reason behind their decision to overcome or not overcome the obstacles they face when using IWB to help students with difficulties in mathematics. The principals of both schools played a crucial role in managing the challenges they faced with IWB. This became evident when the head teacher of school A helped the teachers in overcoming the obstacles they faced when using IWB by

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training teachers and through technical support, which reflected positively on teaching and learning mathematics, leading to a continued and enthusiastic use of IWB. On the other hand, the head teacher in school B did not help or support his teachers in providing IWB in school, nor help with overcoming the challenges they faced with IWB, which reflected negatively on their enthusiasm to continue to overcome barriers such as the provision of IWB in the school, and the lack of training and technical support, in spite of their belief that IWB has a positive impact on teaching and in the learning of students who have difficulties in mathematics.

VII. CONCLUSION

This paper investigated the barriers that teachers face when using technology in their classroom in primary schools, and why some overcame obstacles while others did not. Semi-structured interviews and observations were used for the purpose of this research, which were undertaken with three mathematics teachers from school A which used technology, and the other three from school B, which did not use technology. I found that the major obstacle teachers face when using technology included aspects of 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 was also an important influence on managing the challenges teachers faced, which affected teachers' decisions to use or not use technology in school.

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