Review

Integrating Technology into Mathematics Education in the Saudi Context

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This paper aimed to investigate technology integration into mathematics education in the Saudi context. To achieve that, a wide range of literature was critically reviewed, including research articles, books, government records, dissertations and web sites. As a result, technology has an impact on every aspect of modern life, its use considered as one of the most critical issues facing teacher education programs, and its progress has inevitably made a variety of new demands in all school disciplines such as mathematics. Consequently, mathematics curriculum and its components (objectives, content, teaching activities, and evaluation styles) are changing. The integration of technology into mathematics education in Saudi environment is considered as one of the current, issues under-investigation; and the term of integration is still a controversy for a great number of mathematics educators and teachers. In addition, recent studies have shown the need to better align mathematics teachers' preparation with the integration of technology in mathematics classrooms. In the light of findings, the paper recommended integrating technology into mathematics education, and suggested the topic itself can be searched further.

Education considers one of the most important aspects of one's life. Saudi Arabia is an example of a developing country that has given a greater weight to education, which based on Islamic culture concepts, used Arabic as its formal language, centralized, and free for all students. Its general objective is to ensure that education becomes more efficient, to meet the religious, economic and social needs for the country and to continue to reduce illiteracy among Saudi adults (Alhogel, 2003).

Technology has the potential to support education across the curriculum and provides opportunities for effective communication between teachers and students in ways that have been possible (Dawes, 2001). It offers many means of improving teaching and learning in the classroom (Lefebvre, Deaudelin and Loiselle, 2006). It has been taking place at all levels of Saudi education. For over two decades, many writers have highlighted the potential of integrating technology into mathematics education. The USA National Council of Teachers of Mathematics (NCTM), for example, in its position statement claims that "Technology is an essential tool for learning mathematics in the 21st century, and all schools must ensure that all their students have access to technology" (NCTM, 2008).

The purpose of this paper is basically an attempt to explore the current status of technology integration – integrated mathematics education in the Saudi context, barriers/obstacles related to that, and how it can be developed into an effective medium for employing the integration. It seemed to the best of the researcher's knowledge that the topic of this paper has not taken much concerns and research in the Saudi environment, which may enrich the literature in integration of technology and mathematics education in general with respect to the Saudi context, and urge decision makers to take steps forward to implement integration in school subjects including technology and mathematics, as well as helping mathematics teachers integrating technology in the instructional process. Furthermore, this paper provides suggestions and recommendations to those for the integration of technology into mathematics education.

However, to achieve the goal of this paper, a review of the relevant literature and current research perspectives from around the world is summarized and critically assessed.

Technology is globally changing teaching and learning environments. There has been a vision towards shifts in all disciplines of general education, particularly teaching methods. The National Council of the Accreditation of

Teacher Education (NCATE, 2002) and the International Society for Technology in Education (ISTE, 2007) advocate the use of technology in education and suggest students should be provided opportunities to engage in technology-supported activities that enhance their learning experiences. Other mathematics organizations have also encouraged the use of technology for every aspect of teaching and learning mathematics (e.g., Mathematics Association of America, 1991; National Council of Teachers of Mathematics, 2000).

The research literature, in concert with these national recommendations, provides supporting evidence that technology can enhance students' understanding of mathematics concepts (Graham and Thomas, 2000) and improve their achievement (Heller, Curtis, Jaffer and Verboncoeur, 2005). Furthermore, technology use has been found to improve classroom experiences for students (Walker and Dugdale, 2004).

Specifically, technology has enabled students to visualize mathematics, engage in active learning strategies, verify conjectures, have positive attitudes, and build confidence in their ability to do mathematics. It is now commonplace in classrooms, and the integration of it into the teaching and learning of mathematics is supported by the government policy of Saudi Arabia. Saudi Ministry of Education (2004) urged using technology in teaching mathematics, first to be recognized for students and teachers, and second to be used in teaching. Albalawi (2010) stated that technology related to mathematics education occupied a rank-two among the eight domains of research priorities of mathematics education in Saudi Arabia. But, calculator technology has not been encouraged despite the strong research evidence of the positive impact of calculators in instruction, and that depends on a certain extent on teachers attitudes, which seem mathematics teachers' attitudes of high school stages towards the use of calculator technology were more favorable than elementary teachers' attitudes.

Alrasheed *et al.* (2003) indicated that lecture and dialogue teaching methods are the focus of many Saudi schools, which the content of curricula was designed to reflect these methods and tended to concentrate upon rote learning, and no attention given to other affective teaching methods, such as e-learning and the use of information and communication technology. Hence, Aljarf (2005) confirmed that the Saudi educational system requires developing alternative teaching methods, updating the content of many curricula, and increasing scope of teacher training and the use of technology in the classroom. Based on that, King Abdullah of Saudi Arabia (2007) announced a new project for redeveloping the general education sector, which came into practice in 2008; among of its

objectives: redeveloping the curricula to cope with the fast development in cognitive learning and technology, and improving and developing the learning environment by integrating technology and digital world in the classrooms.

Several studies pointed out the problems facing teachers using technology in general education. Klein *et al.* (2001) stated that in using technology, some important factors in learning can be missed, namely face-to-face communication and social/group-based interactions. Klassen and Vogel (2003) added that lack of evaluation or assessment of learning, the facility for plagiarism, and the loss and gain of study skills are other problems arising from using technology.

Technology has had a long history to be integrated into the school curricula. Its progress has inevitably made a variety of new demands in the teaching and learning of all school disciplines. Thus, one area in which technology has been taking place in curricula has been the discipline of mathematics, which its content and the methods by which it is taught and learning assessed are changing. It is rapidly gaining popularity in the teaching and learning of mathematics around the world. Its use, including digital technology, calculators, computers, educational software, internet, etc. have had important elements in the teaching and learning of mathematics. A number of international organisations and conferences strongly endorsed the increased use of technology in mathematics education, e.g., International Congress on Mathematical Education (ICME, 1996) and National Council of Teachers of Mathematics (NCTM,1989, 2000) recommended implication technology in teaching mathematics at all school stages.

In Saudi context, Mahboob and Baroom (1997) expressed their worries that one of the emerging challenges to national schools is that a large proportion of teachers of both sexes lack knowledge and experience in how to deal with computers and make use of the internet in their teaching, which will have negative impact on the quality of their scientific productivity and teaching strategies. Al-Daud's (2004) study revealed that teachers in Saudi schools suffer from a large number of problems, most of which are linked to insufficient training and weak professional preparation, particularly, in the field of technology. Since technology considers as an activity, and research provides evidence that the learning to be acquired though student activities should no longer be considered supplementary to the content of any subject, but should rather be viewed as complementary and essential to the full implementation of school goals. Al-Abdulkareem (2008) especially communication infrastructure, lack of specialists, lack of technological knowledge and skills among teachers and administrators, lack of English language, and high cost of technology.

A closer observation of mathematics teachers' practices suggested that many challenges must be overcome in order to promote the appropriate integration of technology in mathematics instruction. Kersaint, Horton, Stohl and Garafalo (2001) recommended that mathematics teacher educators should take a greater role in helping teachers of mathematics to incorporate technology as part of their mathematics instruction. Other opinions related to mathematics content crowd, where there is enormous pressure on mathematics teachers to cover school syllabi but this has not been too successful. benefits and challenges faced by the teachers in integrating technology into mathematics teaching-learning process

Overall, this paper has shed light on related literature review on integration of mathematics education through technology in Saudi context, which showed that today mathematics education objectives have been greatly broadened and given a new thrust. previous research indicated that technology has been proven useful as a tool in supporting and transforming teaching and learning mathematics. Initiatives and policies of the Saudi Ministry of Education appeared the importance of technology use in mathematics education (or in general education), but it is not a panacea for all problems in education, such as lack of funds, unmotivated students and teachers, quick changes in environment, etc. and inappropriate use of it can also do more harm than good. that there was improvement of mathematics teachers to urge students (early grades) to master concepts or procedures before being allowed to use calculators and to gain skills in technology, as well as public awareness of the importance of technology use in mathematics education should be enhanced. In mathematics classroom, technology can help both teachers and students make it easier to locate and access information related to technology uses in mathematics education through the Internet, perform calculation, analyse data, make spreadsheets, explore mathematics concepts, and reduction of needed effort and better clarity. Finally, the integration of technology into mathematics education in the Saudi context, particularly on culturally conservative educational settings cannot be underestimated. Both teachers and students represent the key to integration mathematics education through technology, and hence every effort must be made to construct eco-system in which all thrive.

It is recommended that Saudi schools should be an example of a technologically rich learning environment. That is, well equipped, official support to use technology is strong and there is adequate in-service training. Although the schools should increase the use of technology and the amount of technology integration into mathematics classrooms.

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