

## Technology-integrated Mathematics Education at the Secondary School Level

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Received: April 19, 2017

Accepted: May 23, 2017

Online Published: June 1, 2017

doi: 10.23918/ijsses.v3i4p148

**Abstract:** The potential of technological devices to enrich learning and teaching of Mathematics has been widely recognized recently. This study is founded on a case study that investigates how technology-related Mathematics teaching can enhance learning of Mathematical topics. The findings indicate that when teachers integrate technology into their teaching practices, students' learning of Mathematics is significantly promoted. It was seen that the use of effective presentations through technological devices highly motivated the students and improved their mathematics achievement. This highlights that the availability of technological devices, teacher beliefs, easy access to resources and most importantly teacher skills of using technological devices effectively are decisive factors that can provide learners better understanding of mathematical concepts.

**Keywords:** Technology, Mathematics, Teaching, Learning

### 1. Introduction

With the advent of technology, learning has become more interesting in classrooms. With the use of technological tools, it has been easier to develop creative ways to capture attention of students. Young learners especially are familiar with technological tools from birth (Mtchedlishvili & Serin, 2015). Technology has the potential to engage students in the learning process and motivate them (Serin, 2015). Motivation is a key factor that enables students to accomplish better. One of the great benefits of integrating technology into classroom instruction is its role in motivating students. Variety of sources provided by technological tools produces excitement in the classroom. Learning through technology assisted learning has become more interesting and enjoyable. Technology integrated learning provides easier comprehension, improved student participation and higher concentration. Effective presentations enable students to pay more attention to topics. When high concentration is created, interactivity increases in which students are stimulated to engage in learning process more. Technology has the capacity to change the way students learn. It is true that if appropriately used, the use of technology can help students improve mathematics achievement. This article seeks out whether the use of technology in

secondary schools raises motivation of students and enables them to accomplish learning of mathematical topics better.

## **2. Literature Review**

With the advent of education technology tools, learning has changed because the incorporation of technology provides a student-centered, interactive and discussion-based learning setting (Prensky, 2007). Students are fostered to engage in the learning process actively when teachers employ technological tools. Interactivity in the classroom increases and students become more motivated. Wright (1999) argues that when technology is integrated into mathematics teaching interactive learning occurs which leads to higher student achievement.

Kerrigan (2002) reports that the use of mathematics software and websites enhance thinking skills of students and facilitate their geometric and algebraic thinking. Students create a link between mathematical knowledge and real world problems. Hwang et al. (2007) states that if students formulate a concrete problem into an abstract one, they can easily solve it. The use of visualized materials in classroom instruction develops abstract thinking of students (Bishop, 1989). Students might fail to solve mathematical problems by simply applying the formulas without comprehension of real concepts of formulas (Forbes, 1996). However, if problems are presented visually through technological tools, students can solve them with ease. Technology-based classroom instruction has led to successful learning outcomes because technology-based strategies create a stress free learning environment in which all students confidently perform their tasks. It is highlighted that technological tools help students with mathematical problem solving (NCTM, 2000). Effective presentations created by these tools increase enthusiasm of students to accomplish better. It is true that in support of effective learning technology plays a big role in teaching mathematics (Neiss, 2001).

## **3. Research Methodology**

### **3.1 Design of the Study**

This study used both qualitative and quantitative methods at the same time. While qualitative approach allowed drawing meaningful results from the responses of the students in the questionnaire, quantitative approach enabled to report data results. In the questionnaire a five-point Likert scale ranging from strongly disagree to strongly agree was used.

### **3.2 Sample Selection**

30 students (18 boys, 12 girls) took part in the study. The target population was secondary school students at a private school in Iraq. The school provides education to its students in English language, therefore, all students in the classroom had a good command of the language. Furthermore, the school has well-equipped classrooms. In almost all classes, technological tools have been widely used by the teachers.

### 3.3 Data Collection

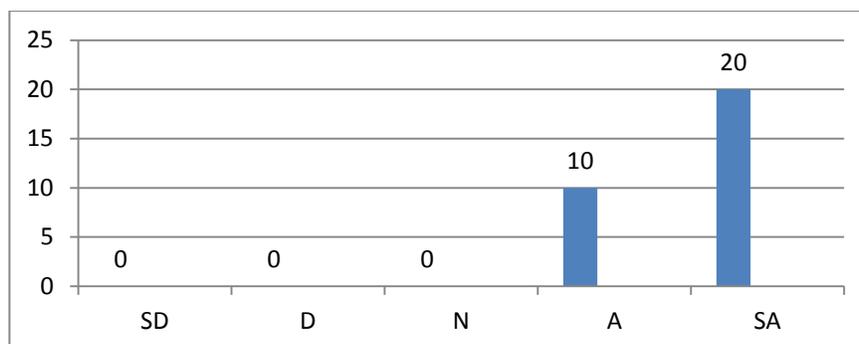
The researcher did not take part in the teaching process but he observed how the teacher used the technological tools in the classroom in mathematics classes for more than a month then he carried out the questionnaire. The present study investigated the role of integrating technology into mathematics teaching. Data were collected through a questionnaire that included 4 questions. After the questionnaire each student was interviewed by the researcher. The interviews took place in the break times and each interview took not more than 10 minutes. The responses and frequencies were shown in tables.

### 4. Discussion and Findings

a. The way the students learn has changed.

It was found that the integration of technology into mathematics teaching provided the students a new way of learning. Compared with traditional way of learning, the use of technological tools was favored by the students. All students reported agreement that the way they learn changed by the use of technological tools. While 10 students agreed with the statement, 20 students strongly agreed.

Table 1: Responses of the students to the first statement



Traditional methods have been removed from classrooms. Boards have been boring. Learning has become more interesting. More visual images now (Student 3).

The way we learn has greatly changed. We just focus on important elements. There are more classroom discussions now. This stimulates us for better success (Student 20).

Visual media, computer touch screen, learning has never been this fun. Discussions, brainstorming, peer-teaching, and collaborative problem solving engage us to learn more effectively (Student 25).

Diversity of sources enables presentation of information more effectively. This provides us more varied opportunities for better comprehension (Student 23).

Today technology is everywhere so the use of technology in education is unavoidable. Things have changed and the way we learn have to change as well (Student 30).

I know how my father studied at school when he was young, but that was 30 years ago. Things are different now, so there is no point in insisting on the same way of learning (Student 9).

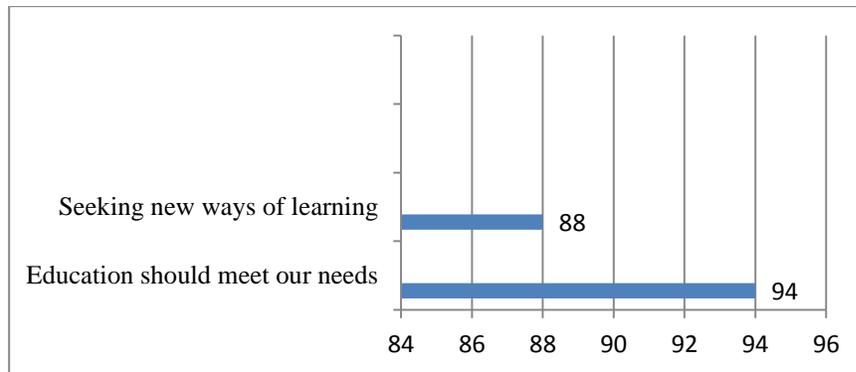


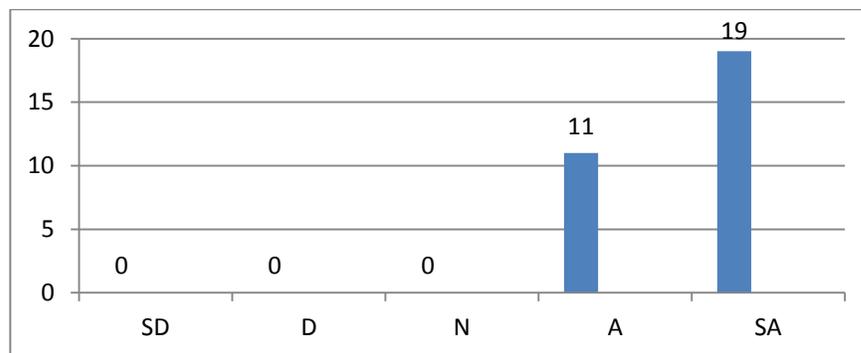
Figure 1: Opinions expressed by the students how technological tools provide new way of learning

It was found that the students stated two major criteria for the first statement. 94 % of the students reported that education should meet the needs of the students, and 88 % of the students reported that new ways of learning should be sought.

b. The use of technology creates enthusiasm for learning

All students reported agreement that the use of technology creates enthusiasm for learning. While 11 students agreed with the statement, 19 students strongly agreed.

Table 2: Responses of the students to the second statement



The use of technology increases our enjoyment and motivation, and studying in an enjoyable environment facilitates learning (Student 7).

I believe that motivation is the key factor in effective learning and technology assisted learning has the potential to motivate us to learn better (Student 9).

Technology assisted learning provides numerous opportunities for involving us in the learning process. The use of technology has a positive effect on motivation (Student 15).

The use of technology has the capacity to raise motivation. I believe that we are both intrinsically and extrinsically motivated by presentations displayed in the classroom (Student 27).

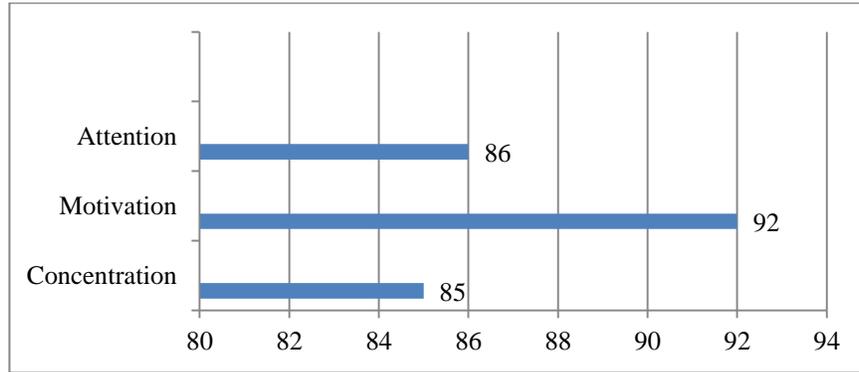


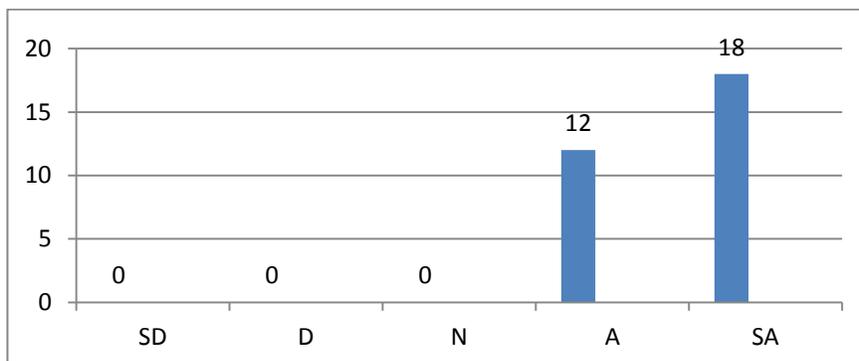
Figure 2: Opinions expressed by the students how technological tools creates enthusiasm for learning

It was found that 86 % of the students reported that the use of technology increase their attention in the classroom, 92 % of the students stated that technology enhanced their motivation, and 85 % of them reported that their concentration on the topics promoted when technology is used in the classroom.

c. The use of technology stimulates interactivity in the classroom

All students reported agreement that the use of technology stimulates interactivity. While 12 students agreed with the statement, 18 students strongly agreed.

Table 3: Responses of the students to the third statement



Using technological tools in the classroom is important in that they promote engagement and participation which are important factors of interactivity (Student 19).

The use of technology has a positive effect on engagement in the learning process. It enables us to interact with each other in the classroom which creates classroom discussions (Student 11).

Technology stimulates interactivity. We engage in the learning process to a greater extent. Our participation increases and we accomplish better (Student 8).

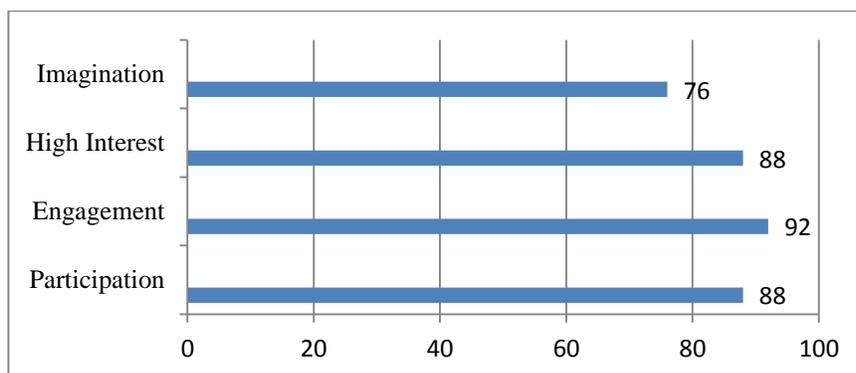


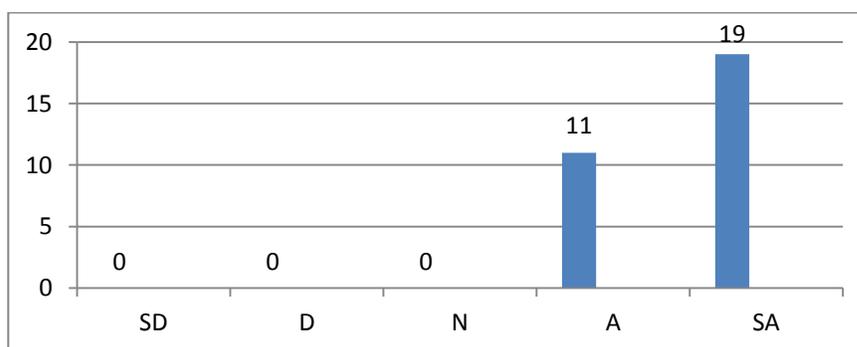
Figure 3: Opinions expressed by the students how technological tools stimulates interactivity

Figure 3 indicates that 76 % of the students stated that technology integrated learning developed their imagination, 88 % of the students stated that technology increased their interest in the topics, 92 % of them reported that technology enhanced their engagement, and finally 88 % of them reported increased participation in the learning process.

d. Learning is facilitated when technology is integrated in learning.

All students reported agreement that the use of technology facilitates learning. While 11 students agreed with the statement, 19 students strongly agreed.

Table 4: Responses of the students to the fourth statement



I pay better attention when teachers use technology in the classroom (Student 5).

There are a great many varieties when technology is used in the classroom. The use of technology provides us a lot of resources and exercises. We practice more (Student 17).

We can revise the previous topics, and have more interaction. Learning turns into an interesting activity. These factors allow us to learn more easily (Student 13).

Effective presentations create enthusiasm for learning. Classroom activities when technology is used bring true excitement to the learning process. Our engagement significantly increases and of course we learn more effectively.

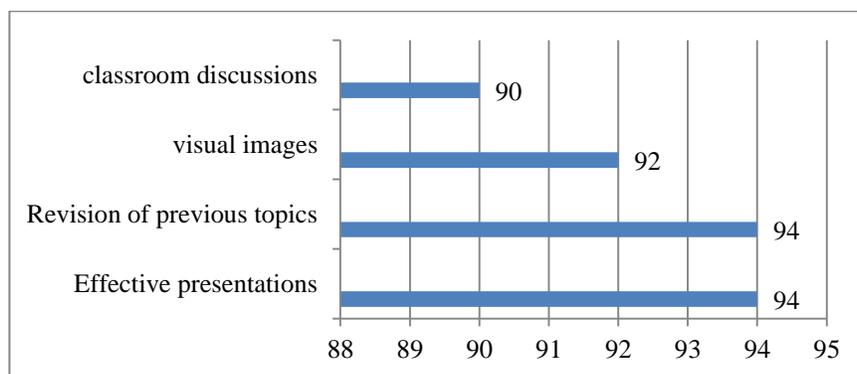


Figure 4: Opinions expressed by the students how technological tools facilitates learning

Figure 4 shows that 90 % of the students stated that technology provides classroom discussions that allows them better comprehension, 92 % of them stated that visual images created by the use of technological tools bring about better understanding, 94 % of them reported that technology makes it possible to revise previous topics, and finally 94 % of them stated that effective presentations through technological tools facilitate learning.

## 5. Conclusion

Technology has influence on education. It can provide new ways of learning for the students. The study found that technological tools had impact on motivation, interest, and concentration of students. The use of technology increases engagement and participation of students in the learning process. The integration of technology in the classroom creates classroom discussions that increase interactivity of students. Visual images, revision of previous topics, and effective presentations with the help of technological tools create a learning setting for students where they can understand mathematical problems and concepts with ease.

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