



The Effectiveness of Technology for Improving the Teaching of Natural Science Subjects

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Abstrak

Artikel ini mengidentifikasi keefektifan integrasi teknologi dalam metode pembelajaran mata pelajaran sains. Penelitian ini dilaksanakan di sekolah dasar Shahid Abdul-Razaq, Kota Sulaimania, Iraq menggunakan 2 (dua) instrument, yaitu kuesioner dan tes. Responden penelitian ini melibatkan 50 (limapuluh) siswa kelas 3 (tiga) dan 5 (lima). Hasil penelitian menunjukkan bahwa minat siswa dalam menggunakan teknologi dalam pembelajaran sains sebesar 75% dan 95% untuk kelas tiga dan lima. Selain itu angka kelulusan siswa kelas tiga dan lima ketika menggunakan teknologi untuk menunjang pembelajaran sebesar 57% dan 83%, berbeda dibanding ketika menggunakan metode tradisional, yakni sebesar 43% dan 17% juga untuk kelas tiga dan lima pada mata pelajaran sains. Penelitian ini menegaskan bahwa pembelajaran sains yang ditunjang teknologi terbukti dapat meningkatkan minat siswa dalam pembelajaran dan meningkatkan capaian hasil belajar siswa, selain itu juga membantu siswa dalam mengerjakan pekerjaan rumah lebih mudah dibanding ketika sekadar menggunakan metode tradisional.

Abstract

This paper investigates the effectiveness of integrating technology with teaching method for science subjects. For this, the research was conducted in Shahid Abdul-Razaq primary school in Sulaimania city-Iraq. Two methods were used for this investigation: A questioner's form and testing method. The participant students were 50 students from grade 3 and 5. The results showed that student's preference for using technology in teaching science was 75% and 95% for both third and fifth grade. Also, the passing rate for the students of third and fifth grade using technology teaching method is 57% and 83% compared to 43% and 17% respectively when the traditional method used for teaching science subject. This research confirmed that teaching science subjects with technology increased the student's interest in the learning process and improved the student's achievement scores and also helped the students to do their homework more easily compared to the traditional teaching methods.

INTRODUCTION

Over the past decades, there has been a noticeable demand for technology usage in almost every aspect of human life. It has been one of the important building blocks of modern society. Technology has a positive impact on student learning because it encourages the students to be more engaged and motivate them to retain more information (Costley, 2014).

Using technology for teaching and learning is common nowadays (Price & Kirkwood, 2014). It has been proved that teaching with technology can expand and develop student's learning by supporting instructional goals. Moreover, using technology has a significant impact on education applications and changed the way educators teach, how students learn, and the way teachers and students communicate (Storksdieck & Hunter, 2017). However, it can be a real challenge for the teachers to select the best technology tools while not losing sight of teacher's objectives for students learning and understanding (Grant & Basye, 2014).

There is significant attention to raising the student's achievement while integrating technology as a tool. Moreover, a growing gap has been observed between the scientific and technical expertise offered by schools, on the one hand. The social demand in this regard, on the other: societies are showing a requisite need for individuals trained in this field especially teachers, while the number of students attracted to it is deteriorating and in some cases declining (Hasni & Potvin, 2015). Teachers need to be aware of the different kinds of programs that can be useful in both large and small group instruction. They also need to have knowledge and experience about programs that are useful and motivated. There is some computer software such as Power-Point and Publisher help students and teachers with the organization and presentation of information (Bitner & Bitner, 2002).

Science teachers are facing various constraints such as; shortage of time, equipment, teaching tools, pedagogical content knowledge, and pedagogical skills. During implementing teaching strategies and educational technology tools such as computers, data collection, and analysis software, and interactive whiteboards can assist students to actively involve with the achievement of scientific knowledge and development of the nature of science (Guzey & Rohrig, 2009).

Technology considered being a big part of people's daily lives; it is important and vital that children learn how to use it at an early age. When children use technology tools in elementary schools, it makes them retain a sense of confidence and competence in their computer skills will grow as they get older and enter the future that requires many computer skills. Many children today have access to a great deal of technology in their home via using iPad or iPod or any other device that they use for playing games, music or watching cartoons. This access will result in students being comfortable and contented by using technology at school as well. When elementary school teachers use and model different forms of technologies, they actively engage their students and create a stimulating work environment (Kenney, 2011).

Technology use in the classroom has an important role in teaching and learning process. It may change the way teachers use for teaching and how children learn. The field of education has been influenced by technology, which has indeed affected teaching, learning process. Technology have the potential to speed up, enrich, develop and deepen skills, to motivate, encourage and engage students, to help relate school experience to work practices, provide economic viability for tomorrow's workers, as well as reinforce teaching and helping schools change (Yusuf, 2005; Al-Ansari, 2006).

Many types of research have been conducted to explore the importance of using technology in teaching many subjects at primary and secondary schools. Parvin & Salam (2015) stated that using technology to present the content of English language book has significantly affected the learning and understanding of the students. The researched pointed out that using technology not only brought better presentations to students, it also improved teachers' learning of content, thus improving content presented to students.

Moreover, mathematics has been described as one of the subjects that most students lack interest in learning and facing difficulties to understand and analyze mathematical concepts. Baglama et al. (2017) reported that mathematics in school curriculum include many skills and concepts such as numbers, fractions, four operations, geometrical shapes, solving problem and measurement for students to function in the society as an independent individual. Therefore,

learning such skills requires teachers of mathematics to create an environment that maximizes students' learning opportunities (Galligan, Loch, McDonald, & Taylor, 2010). To create such environment, using technology considered to be one of the powerful tools to help and motivate students to understand practical meaning of mathematical tasks.

Cunska and Savicka (2012) showed that technologies could make learning environment for mathematics alive and more attractive. Additionally, Pachemska et al. (2014) stated that the use of information and computer technology gives dynamics to the process of knowledge and skills acquisition in the school subject Mathematics. Moreover, the interest and motivation in mathematics are increasing, and the usual barriers with pupils concerning the abstractness of the teaching material and the fear of failure in solving the given task is being reduced or absent.

Teaching science is not a simple process. It requires a dynamic profession that can be difficult for science teachers to stay up-to-date. In order to make a teacher to grow professionally and become better as a teacher of science, a special, continuous effort is required. To prepare students for the science and technology of the 21st century, the current science education asks science teachers to integrate technology and inquiry-based teaching into their instruction (Guzey & Roehrig, 2009). Thus, to meet such requirements in teaching science integrating technology with daily-teaching science can be the greatest vehicles for the 21st century and has been proven to be one of the best solutions to help students raise achievements (Costley, 2014).

Technology can also serve as a key answer for scientific questions and can make them explore and develop hypotheticals skills in science. A study conducted by Hennessy et al. (2007) indicated that using technology in teaching science can encourage the students to predict a scientific phenomenon. The study suggested that using technology can engage students to "What if" explorations where the outcomes of 'practical' experiments and investigations can be immediately accessed, for example through using a simulation. The teachers in the study used simulations, data logging, projected animations and other dynamic digital resources as tools to enhance and support prediction and to demonstrate scientific concepts and physical processes so that 'bridging the gap' between scientific and informal knowledge. Moreover, the teachers

also integrated technology carefully and sensibly with other practical activities to support stepwise knowledge building, association and application (Hennessy et al., 2007).

Technology can also help students improve their score achievements. A study has been conducted in Turkey to observe the effects of information and communication technologies on students' math and science achievement with 4,996 students. The results of the study revealed that students' contact with information and communication technology at home and school had a positive impact on their math and science achievement scores. Additionally, students' who spent a lot of time using technology for studying and preparing reports or Googling information were shown to have increased science knowledge.

They also performed better in learning math skills. Information and communication technology has a significant impact on students learning and should be included in classroom instruction (Delen & Bulut, 2011). Using technology can assist the students with doing their homework as well. Moreover, a study revealed that students experienced a genuine sense of enjoyment and were more motivated when used technology and computer to complete their homework assignments (Cyr, 2013).

The effectiveness of technology presented by a number of works from our team in last year. In the first work the classrooms of some primary schools were enriched and supported by new technology tools, the results showed that learning process was increased by 22.9% compared with traditional learning school (Wakil, Qaisar, & Mohammed, 2017). In the second work, the focus was about the role of computer games on students GPA record, the result showed that computer games help students to thinking more effectively if used for less than one hour per day but their GPA decreased if the usage passed the mentioned time scale per day (Wakil, Omer, & Omer, 2017). While, in the third work, teaching ICT subjects in the primary schools study revealed positive feedback in the process learning as shown in (Wakil, Muhamad, Sardar, & Jalal, 2017). In the fourth work, new style of learning was conducted called microlearning technology, and most students preferred this style compared to other traditional learning styles (Mohammed, Wakil, & Nawroly, 2018).

In Kurdistan Region of Iraq (KRI), the use of technology for teaching is newly introduced

to the schools, especially elementary schools. The objective of this research is to determine the existence of differences in efficiency (greater success, activity, attention, score rate and motivation) of science curriculum with technology application and those with traditional method and whether those differences were statistically significant. For solving this problem, we prepare a questionnaires form for students and teachers at the primary schools in KRI; then we get the result after their answers. The paper is organized as follows: Section 2 displays the related work that has been conducted on the potential of using technology in learning and teaching science. Section 3 includes the research process for solving the problem. In section 4 evaluate the result of implementation research process. Section 5 presents some concluding remarks and points to future works.

METHOD

In order to determine the impact of applying technology in teaching science, the research was conducted in Shahid Abdul-Razaq primary school in Sulaimania city-Iraq. A questionnaire and testing methods were used for assessing the achievement and understanding of the students for the science subjects. The population of the research was selected in the third and fifth graders.

Two groups for each grade was determined for the research, one week of teaching was introduced for each grade in each subject for both classes. For the traditional teaching method, solar system and Moon phase's subjects were introduced to the students for third and fifth grade respectively. While for the technology teaching method, Earth layer and water cycle were introduced the students for third and fifth grades respectively as shown in figure 1.

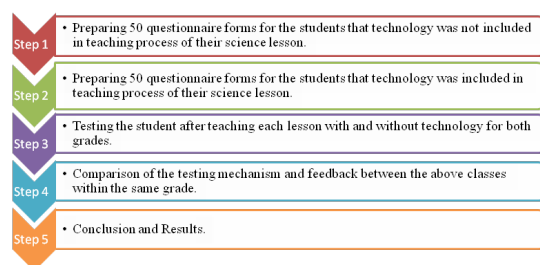


Figure 1 Steps of Research Process

After teaching the lessons a set of 5 steps were applied as a research process via using questionnaire forms and testing process for evaluating both teaching methods as shown in figure 2.

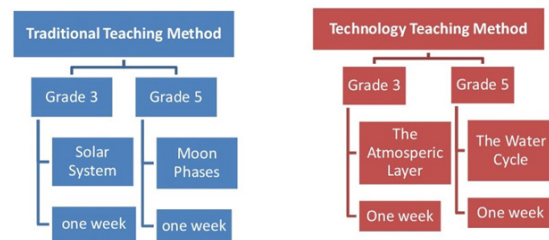


Figure 2 Steps of Conducting Research for Evaluating both Teaching Methods

Step 1 and 2: In these steps we prepared questionnaire included 4 questions for 50 students, which consist four questions. Step 3: The students of each grade were tested to evaluate their understanding and comprehension of the science subjects with and without technology in two different subjects using daily quiz without prior notification as a tool for comparison, observation, and evaluation. Step 4: Comparing the outcomes of both testing and feedback forms will be conducted for each group in each grade for studying science with and without technology. Step 5: A conclusion will be displayed, and the results will be discussed to explain the impact of using technology in teaching science for both grades.

RESULT AND DISCUSSION

The hypothesis set is if there is a statistically significant difference between the level of pupils' achievement and understanding in control (traditional teaching method) and the level of pupils' achievement and understanding in the experimental group (Technology teaching method). After implementing the mentioned methodology in the Shahid Abdul-Razaq primary school in Sulaimania city-Iraq, Two grades were determined for the proposed research: Third and Fifth grades with two groups for each grade. The participant students in research were 50 students, 20 students in third grade (10 in each group) and 30 students in fifth grade (15 students in each group).

The research period was three weeks, two weeks for teaching the students using both traditional and technology method and the third week was dedicated for testing and taking feedback forms. In the first week, science subject was taught using the traditional method. While, in the second week a technology teaching method was applied using (data-show projector, videos, and pictures). As mentioned before, a feedback form was provided to them to evaluate their opinion about both methods and which method

Table 1 Group 1 and 2 of third grade feedback after teaching science in both traditional and technology method

No.	Questions	Strongly disagree	Disagree	Normal	Agree	Strongly agree
1	I prefer using technology in learning science	-	-	-	25%	50%
2	I prefer traditional method in learning science	-	-	-	5%	10%
3	I prefer using both traditional and technology methods in learning science	-	-	-	-	10%
4	Do you use technology in preparing your science lesson homework	-	40%	-	35%	25%

Table 2 Group 1 and 2 of fifth grade feedback after teaching science in both traditional and technology method

No.	Questions	Strongly disagree	Disagree	Normal	Agree	Strongly agree
1	I prefer using technology in learning science	-	-	-	65%	30%
2	I prefer traditional method in learning science	-	-	-	3%	-
3	I prefer using both traditional and technology methods in learning science	-	-	-	2%	-
4	Do you use technology in preparing your science lesson homework	7%	10%	7%	50%	26%

they prefer in learning science subjects.

In this research, it was shown that most of the students in both grades preferred technology teaching method for learning science. For third grade, the results of their agreement about using technology are 25% and 50% compared to those who preferred a traditional method which rated 5% and 10% respectively as shown in Table 2. While for fifth grade (Table 3), the results were 65% and 30% in comparison to traditional method which was 3% only.

Moreover, few students enjoyed using both methods in learning science due to their learning style that can be visual and auditory. It was also noted that most of the students used technology in preparing their homework. The result recorded was 35% and 25% for third graders and 50% and 26% of fifth graders.

In the third week, the students were tested in the taught subjects to evaluate their understanding. The test for both grades (third and fifth) included five questions, and the results showed that the students recorded better score in the subjects taught by using technology compared to the traditional method. As shown in Figure 2 and Figure 3, the passing rate for the students of third and fifth grade using technology teaching method is 57% and 83% compared to 43% and 17% when the traditional method used for teaching science subject.

In education systems is widely endorsed to have a positive impact on improving and enhancing student learning. In this research, it was shown that (75%) of third graders preferred integrating technology with teaching science compared with only (15%) who preferred traditional teaching method. While in fifth graders the

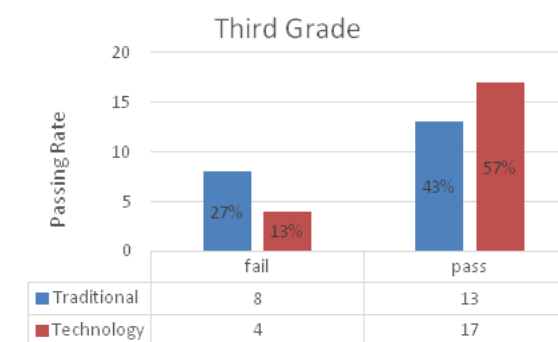


Figure 2 The passing rate of third grade

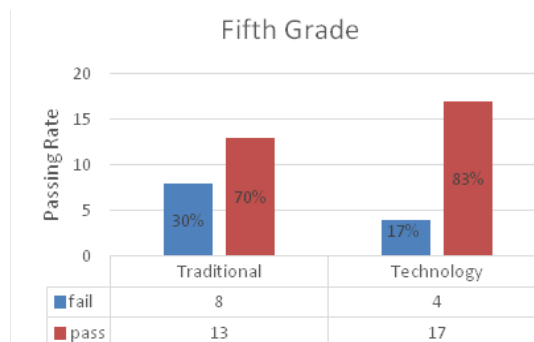


Figure 3 The passing rate of fifth grade

preference was 95% for technology compared to only 3% for traditional method and 2% who showed interest in both methods (Table 2 and 3). This result is compatible with the outcomes of (Hennessy et al., 2007; Galligan et al., 2010) who mentioned that using technology can create an interesting environment for the students and help the students to learn, built information and motivate, and enhancing their understanding. However, those who showed interest in the traditional method might be is due to their learning type which may have been auditory, and they prefer lecturing rather than using a visual aid for teaching the subjects.

As for the passing rate for the students of third and fifth grade using technology, the teaching method is 57% and 83% compared to 43% and 17% when the traditional method used for teaching science subject. This result indicates significant differences between these two methods as shown in Figure 2 and 3. This result is compatible with the study of (Delen & Bulut, 2011; Costley, 2014) who stated that using technology in teaching will raise student's score and improve their achievements.

It was also noted that most of the students used technology in preparing their homework. The result recorded was 35% and 25% for third graders and 50% and 26% of fifth graders. This result confirms the outcome of Cyr (2013) that stated using technology enhance student's motivation and completing their homework.

CONCLUSION

Teachers and educational teaching method are essential parts of the educational process. The use of computer technology gives proper understanding to the process of knowledge learning and skills achievement in the school science subjects. In this paper, we determined 50 students in two different grades in Sulaimania city. The results showed that student's preference for using technology in teaching science was 75% and 95% for both third and fifth grade. Moreover, the passing rate for the students of third and fifth grade using technology teaching method is 57% and 83% compared to 43% and 17% when the traditional method used for teaching science subject.

This result indicates that using technology in teaching science plays an important role in motivating, enhancing and improving student's achievements. Further work is required to com-

pare the technology teaching method with other tools, and teaching methods such as using flash cards and field trips to determine the effectiveness of using technology in teaching science subjects. Furthermore, we recommend investigating which tool of technology teaching methods is more effective in building technology and developing constructive ideas in science subjects. .

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