

The Effectiveness of Using Educational Software on Academic Achievement in Science among Deaf Students

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Abstract

The purpose of this study was to explore the effectiveness of educational software on the academic achievement of eighth-grade students in science in the Hashemite Kingdom of Jordan. The study implemented a quasi-experimental design and included (60) participants from both genders, who are students in the eighth grade at Al-Amal Basic Mixed School for the Deaf in Zarqa. They were distributed into two groups, 30 students in an experimental and 30 students in a control group. An achievement test was designed and educational software was built using the computer. The results indicated the presence of variations in the scores of both groups. The experimental group scored higher than the control group in the achievement test. The use of software in providing lessons to students has proven to be an effective technique, which helps students in improving their levels.

Keywords: educational software, achievement, science, deaf people.

1. Introduction

The computer helps in reaching educational goals, especially by developing higher-order thinking skills, as thinking is an intertwined psychological and neurological process that occurs in individuals when they are exposed to new experiences that are combined with previous experiences. The responsibility falls on the family and officials to create appropriate conditions for developing individuals' thinking skills and work to develop them. This leads to increasing individuals' motivation to use their cognitive and mental capabilities, in addition to their role in developing latent abilities by using special programs to develop thinking and developing plans to integrate the teaching of different thinking skills (Reda & Al-Amri, 2013).

The development of the use of computers and the diversity of programming languages has led to the emergence of many computer programs and applications that contribute to the development of the educational process. Examples include software containing scientific content and the relevant activities and interactive educational methods, which help in to understanding and explaining lessons, and creating interaction between the computer and the learner through the contents offered by computerized educational software used as a mechanism to assist in education (Haniyeh, 2019).

Educational software contributes to individualizing education due to its characteristics, which are characterized by clear instructions and instructions for the learner, which facilitates their use, application, and dealing with them. They also take into account the differences between learners' levels and the resources that meet their needs and desires, and this is what encourages the construction of many software in various academic courses (Al-Sajini & Khalil, 2017). The goal of educational software is to present educational materials attractively and sequentially. It can be used in classrooms or outside classrooms. It helps teachers and students design advanced applications and stimulate thinking by designing software to solve problems and exercises by creating an interactive electronic environment using sound, images, and animation. The nature of the educational software varies depending on the target group, its characteristics, and the stages of education, to improve the attitudes of learners and teachers towards learning, stimulate their motivation, help them remember and understand facts, and develop attitudes among students in entertaining and useful ways, which boost their academic achievement (Al-Rifae, 2017).

Academic achievement is a vital indicator for the high quality of the educational process. It is an important factor influencing the shaping of the students' personality and facilitates their growth. Academic achievement measures learners' progress and the acquired experiences, as it measures the learner's abilities in expressing the skills, information, and attitudes he has learned, and a standard through which we can determine the educational level of the learner and a source of appreciation and interest for him from those around him (Al-Jalali, 2016).

1.1. Problem statement

The subject of computer-based education is one of the basic axes in the education process at the local and global levels, as computer-mediated education, understanding it, and linking it to practical reality has become a matter

connected to environment. Mastering the use of the computer is one of the important matters in practical, personal, social, and educational lives. It is used in all sectors, which necessitated taking advantage of this technology and employing it in the educational process, especially with the emergence of different educational software that helps in training, practice, problem-solving, teaching, and many other methods that contribute to achieving educational goals, developing learning outcomes, and enriching the process. Computer-based education takes into account the individual differences and special circumstances of students, especially students who suffer from deafness. These technologies provide knowledge in a modern environment based on the element of suspense, excitement, and fun in the educational process, which improves the academic achievement of students by providing an attractive educational environment that motivates them to learn.

1.2. Questions of the study

This investigation explored the following question, which states: “What is the effectiveness of educational software on academic achievement in science among deaf students?”

The following sub-questions emerge from the main question:

1. Are there variations in the scores of eighth-grade students in science due to the variable teaching method in the Hashemite Kingdom of Jordan?
2. What is the size of effect of the effectiveness of the educational software on the academic achievement of eighth-grade students in science in the Hashemite Kingdom of Jordan?

1.3. Objectives

The current study is based on the main objective of identifying “the effectiveness of educational software on academic achievement in science among deaf students.”

The following sub-questions emerge from the main question:

1. Identifying the variations between the average academic achievement scores of eighth-grade students in science due to the variable teaching method in the Hashemite Kingdom of Jordan.
2. Identifying the size of the effect of the effectiveness of educational software on the academic achievement of eighth-grade students in science in the Hashemite Kingdom of Jordan.

1.4. Significance of the study

The study addressed an important segment of the social fabric in Jordan, which is the student group. The study also focused on a group of people with special needs, specifically students who suffer from deafness. The study increases teachers’ awareness of the importance of using educational programs in the education process to improve the level of students’ academic achievement. The results might contribute to changing the attitudes of officials and administrators of the educational process for the basic grades and people with special needs regarding teaching methods and strategies, and moving towards them and integrating them with technology to make the teaching and learning process successful. The results open the way for researchers and those interested in the topic of educational software and its importance in increasing academic achievement.

1.5. Study limitations

The study was applied in Al-Amal Basic Mixed School for the Deaf in Zarqa Governorate in the Hashemite Kingdom of Jordan. The study was limited to a sample of eighth-grade students, and was implemented during the second semester of the year 2022-2023.

2. Literature Review

2.1. Educational Software

Educational software is a method that supports education and changes the role of students in it from a recipient who relies on memorization to a participant who creates, thinks, and interacts. The learning method supports the principles on which educational theories are based, which work to develop the learner’s skills and increase their achievement and motivation towards the learning process. It includes E-learning uses educational software, texts, videos, and the Internet by storing and editing educational curricula on a computer disk or uploading them to websites (Asrksoy, 2017).

Ibrahim (2019, p. 32) defined educational software as “the process of writing instructions and directing commands to a computer or any other device, to direct and inform it how to deal with data or how to perform a series of required actions.” Al-Omari (2017, p. 251) argued that it is “used to write an algorithm or design a program that executes certain commands and has several levels: high-level languages such as Java, and low-level languages such as assembly language.” Clark and Mayer (2016) see educational software as an electronic application that

contains a curriculum specific to a specific academic subject, which has been computerized in a way that facilitates its learning and application through exercises and feedback that teach each skill included in the software. Kaleliog (2015) defined it as a language based on self-reliance in starting and making decisions in learning and depends on logical thinking and simple procedures to solve problems.

Many computer-based educational programs differ according to the nature of the programmed material and the learning style (Issa, 2018). Practice and exercise programs are based on the fact that the students have been taught, and their role is to present many examples to increase the students' efficiency in applying the skill. They also provide many questions in different ways and allow for attempts to be made before providing a correct answer. Private education software presents information in small units, followed by questions for each unit, after which the computer analyzes the learner's responses compares them with the correct answer stored in the software, and then provides feedback to the learner. Simulation software puts the learner in a situation similar to the situations he faces in his real life. There are several types of simulation software, including physical, situational, treatment, practical, and procedural. Gaming programs are based on playing in situations other than playing, and it is an educational method that aims to motivate students toward learning (Al-Shammari, 2019).

2.2. Previous studies

Herzallah and Abu Jaber (2023) explored the role of educational programs in promoting the achievement level of eighth-grade students in the computer course in Jordan. The experimental methodology was implemented on 60 students, who were divided into two groups, an experimental (30 students) and a control (30 students). An achievement test was prepared and educational software was built as instruments. The findings revealed the presence of differences between the experimental group which was taught using an educational program and the control group which was taught using the traditional method in the post-achievement test. The experimental group scored higher.

Ababneh and Abu Jaqim (2022) proposed an educational software to promote the ability of first-grade students in Jordan to distinguish between letters of the Arabic language that are similar in form and different in pronunciation. The study was based on the quasi-experimental approach and was applied to a sample of (47) male and female students from Al Karama Basic Mixed School. The sample was divided randomly into two groups, one experimental (26 students), and the other a control group (21 students). An educational software and two tests were prepared for reading and writing letters that were similar in shape and different in pronunciation. The results showed that there were differences in the students' responses to the reading and writing posttests in favour of the experimental group.

Al-Juhami and Issa (2021) explored the effectiveness of educational software and its impact on developing information security concepts and measured the attitudes of female middle school students in Bisha Governorate towards information security concepts. The experimental approach was used, and the study sample consisted of (46) female second-year middle school students in Bisha Governorate. An achievement test was prepared for information security concepts. The results showed that there is an impact of the proposed educational software in developing information security concepts and that there is an effective impact of the proposed educational software in directing female students to use it in developing information security concepts.

Damra and Al-Kilani (2020) studied how educational software based on the Bybee model affects the learning of scientific ideas in third-grade students in Jordan. This study used a method called the quasi-experimental approach. The participants were 50 students, split into two groups: an experimental group and a control group. Each group had 25 male and female students. The computer program for education was made using the Bybee model. The findings showed that the experimental group performed better on the scientific concepts test than the other group.

Amawi (2020) investigated the effect of computerized educational software on students' achievement in the Arabic language. The study used a quasi-experimental design and included (60) students in the first grade in Jordan. They were distributed into two groups, an experimental (30 students) and a control (30 students). An educational program was built using the computer, and an achievement test was prepared to measure reading and writing skills. The results also showed variations in the students' achievement in favor of the experimental group.

Bin Dakhil (2019) explored using an educational software to develop health concepts in the subject of health and feminist education among secondary school students in the city of Riyadh. The study was based on the use of a quasi-experimental approach. The study sample consisted of (70) female students, who were distributed into two experimental groups. (35) female students and (35) female control students. A list of health concepts was designed and educational software was built. The results of the study showed that there were differences in testing the concepts between the experimental group and the control group and in favor of the experimental group.

Previous studies have differed in dealing with educational software according to their different objectives. Harzallah and Abu Jaber (2023) addressed the effectiveness of educational programs on achievement. Amawi

(2020) aimed at the impact of educational software on achievement. The current study agrees with the two studies in addressing the strategy of educational software as a teaching mechanism and its effectiveness in achievement, and it differs from the sample in the class it is subject to and the subject. Ababneh and Abu Jaqim (2022) addressed the effectiveness of educational programming in distinguishing between the letters of the Arabic language. Al-Juhami and Issa (2021) addressed the effectiveness of educational software in developing information security concepts and Dhamra and Al-Kilani (2020) touched on the impact of educational software in developing. The current study agrees with previous studies in addressing the effectiveness of educational software and differs in the dependent variable. The current study investigated the effectiveness of educational software on achievement among eighth-grade students. The study addressed an important group of society, namely those with special needs. The study defined this category as those suffering from deafness.

3. Methodology

The study used the quasi-experimental approach because it is suitable for the nature of the study, where the study sample was divided into two groups. The experimental group was taught using educational software for the selected lessons, while the control group was taught traditionally.

3.1. Sampling

All eighth-graders at Al Amal Mixed Basic School for the Deaf in Zarqa Governorate of the Hashemite Kingdom of Jordan during the academic year (2022/2023) made up the study population. The study sample consisted of (60) male and female students from the eighth grade at Al Amal Mixed Basic School for the Deaf. Two groups were divided out of the sample. The first was an experimental group (30 students) who received education using educational software, and the second was a control group (30 students) who received education using the traditional method.

3.2. Instrument of the study

First: the achievement test

A multiple-choice achievement test was prepared to measure the effectiveness of the educational software in the achievement of exponential eighth-grade students in the science subject. The unit (Earth and Environmental Sciences) was chosen for the topics prescribed in the science subject for exponential eighth-grade students.

A group of experts checked the validity of the content by presenting their opinions and comments, and the reliability coefficient reached (0.81).

Second: The educational software

The educational software was built using the computer and designed to include the same educational content as the educational material contained in the traditional teaching method. This software was designed to teach the Earth and Environmental Sciences unit to students in the eighth grade. After reviewing the teaching steps and methods for building educational software using multimedia, the educational software was prepared using a computer and configured through several stages:

- [1] Analysis and preparation and contain.
 - a) Selecting the educational subject: The Earth and Environmental Sciences unit was chosen as the science subject for the eighth grade.
 - b) Determining the academic stage and age group characteristics: The study was applied to a sample of eighth-grade students who suffer from deafness at Al-Amal Basic Mixed School in Zarqa Governorate.
 - c) Defining educational objectives: Specific objectives and outcomes have been identified for the Earth and Environmental Sciences unit.
 - d) Identifying the software and material elements: The computer-based educational software included a set of elements: pages designed using HTML, interactive lessons designed using a set of programs such as videos, images, and Adobe Flash, tests (formative and summative with feedback to students), and activities designed using design programs. Preparation and mind maps link the content of the educational material and activate the learner's memory, in addition to a computer to display and interact with the software.
- [2] Script writing and design: This stage included the following.
 - a. Scenario writing: The educational material was transformed into detailed procedures recorded on paper. This stage went through a set of steps.
 - i. Determining the work plan, which included recording what should be displayed on the screen, including drawings, shapes, animations, videos, and written texts, determining

- the ways to move from one frame to another, the number of programming screens and their infiltration, in addition to probing questions, enrichment activities, and training.
- ii. Arranging the software in using HTML pages, where each page contains a start page, a page for computerized educational lessons and their outcomes, a calendar, enrichment activities, general information about the software, a help page, and a comprehensive guide and steps in text and video explaining how to use the software step by step.
- b. Design phase: It contains a set of steps:
 - i. Design the display interface by specifying the page colours and shape.
 - ii. Determine the shape and size of the material to be displayed.
 - iii. Design information and lists that explain the contents of the software.
 - iv. Collect drawings and information and put them in an appropriate form and design.
 - v. Design mind maps and determine their final form in the software.
 - c. Software implementation: It includes choosing the appropriate software to design the software and providing all the required hardware.
- [3] Experimentation and development: The educational software was presented to several arbitrators, university professors and specialists, to express their opinions and suggestions about the suitability of the software to the standards of design and production.
- [4] Evaluation and feedback: It aims to modify and improve at each of the previously mentioned stages, as the process of review and improvement is continuous and interactive for all aspects of the educational software.

4. Results and Discussion

4.1. The first question

The first question was answered using the mean scores and standard deviations for the achievement of eighth-grade students in science were extracted according to the group variable (experimental, control), and the following table shows the results.

Table 1. The mean scores and standard deviations of the study sample's scores attributed to the teaching method variable

Group	No.	Pre-test		Post-test	
		Mean score	St. Dev	Mean score	St. Dev
Experimental	30	5.34	2.914	17.66	2.814
Control	30	6.56	2.311	10.37	1.872

The table shows apparent variations between the average scores of the students on the pre-test in the experimental group and the control group. The mean score of the experimental group in the pre-test was (5.34) with a standard deviation of (2.914), while the mean score of the control group in the pre-test was (6.56) with a standard deviation of standard (2.311). This indicates that the variation in the mean score for the two groups in the pre-test was (1.22).

The table also shows that there is a difference between the average scores of the students on the post-test in the experimental group and the control group. The mean score of the experimental group in the post-test was (17.66) with a standard deviation of (2.814), while the mean score of the control group in the post-test was (10.37), with a standard deviation of (1.872). This indicates that there is a difference in the mean scores between the experimental group and the control group (7.29).

To find out whether there were differences between the scores of the experimental and control groups in the post-academic achievement test, a one-way analysis of variance (ANCOVA) was applied, and the following table shows the results.

Table 2. Results of the one-way ANCOVA for the study sample's performance on the post-test

Source of variance	Sum of square	Freedom value	Mean square	F value	Sig.
Pre-test	51.677	1	51.677	10.385	.001
Method	768.814	1	768.814	148.274	.000
Error	293.280	57	4.998		
Adjusted total score	1183.100	59			

The table above revealed clear variations in the scores between the experimental group (studied using educational software) and the control group (studied using the traditional method) on the post-achievement test, where the calculated (F) value was (148.274) with statistical significance of (.000), and in favour of the experimental group.

The findings showed that the students have a positive view of educational software and that the educational software helped organize the educational material smoothly and logically, which facilitated the process of teaching the material to the students. The concepts presented in the science subject enabled the students to deal with the software in an easy way, far from compliance. The software also contributed to forming a mental image for students about the subject. It also enabled them to participate in activities in educational situations during their presentation in the educational software. The tools and programs that were designed and programmed worked on students' acquisition of concepts and terminology, in addition to that educational programming provided a lot of examples related to science, specifically in the chosen unit, and presented easily and realistically. This result is consistent with previous studies (Harzallah & Abu Jaber, 2023; Ababna & Abu Jaqim, 2022; Al-Jahmi & Issa, 2021; Damra & Al-Kilani, 2020; Amawi, 2020; Bin Dakhil, 2019).

4.2. The second question

To identify the effectiveness of educational software for teaching science on the academic achievement of deaf eighth-grade students, the Eta square measured the size of the effect and to know the return of differences, and the adjusted mean score for the performance of eighth-grade students in science was extracted for the post-academic achievement test, and the following table shows the results.

Table 3. The adjusted mean scores and standard errors for the study groups' scores on the post-academic achievement test

Group	No.	Mean score	standard errors	Eta square ²	Effect size
Experimental	30	18.16	.398	.893	Large
Control	30	7.87	.425		

The table shows that the adjusted mean score in the posttest for the grades of the eighth-grade students for the posttest academic achievement in science for the experimental group was (18.16), which is higher than the mean score for the control group, which was (7.87). This indicates the difference in the performance of the eighth-grade students in the post-achievement test in science and favour of the experimental group. The table shows that the size of the effect is large, reaching (0.893). This indicates that (89.3%) of the variance in the performance of the study sample is after using the educational software in teaching.

This result explains that educational software is important in increasing students' academic achievement, as the software provides students with feedback for tests and activities, differences in content presentation methods, and flexibility in the number of repetitions of presentation, which focused their concepts and created an attractive and enjoyable atmosphere, which increased the effectiveness of the educational software in academic achievement. The use of such software allowed students and teachers to interact with the learning material in an optimal way. Using ICT tools in the classroom have several benefits and advantages to students. These tools and software allow students to interact with the materials presented in the lessons. They also help the teacher to navigate in the classroom freely while helping students to focus on the outcomes of the lessons.

5. Recommendations

The study recommends employing educational software in the education process for students in general and students who suffer from deafness in particular, because of its role in improving academic achievement. It is recommended to hold training courses aimed at introducing teachers to the importance of using educational software and its effectiveness in learning science and developing teachers' abilities to prepare and use educational software, and methods for employing it in an optimal way with students. The study also recommends providing specialists in educational technology for people with special needs in all schools, centres, and institutes.

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