

The effectiveness of Instructional Software in Addressing the Impact of COVID 19 on 10th Grade Students' Achievement in Biology in Jordan

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Abstract

The study aims to explore the effectiveness of instructional software in addressing the impact of COVID 19 on 10th-grade students' achievement in Biology in Jordan. In this study, the researchers adopt the quasi-experimental approach. The study members consist of (60) female students from the 10th-grade student at Al-Khansaa Secondary School for Girls in Jerash Governorate in Jordan during the second semester 2019/2020. Two groups are purposely selected, one experimental consisting of (30) female students taught using an instructional software method, and the other is a control group consisting of (30) female students taught in the traditional method. To achieve the objectives of the study, an achievement test and instructional software are prepared. The results of the study show that there is a statistically significant difference between the arithmetic means of the two groups at the level of significance ($\alpha = 0.05$) on the post-achievement test for the benefit of the experimental group. The study recommends holding training courses for Biology's teachers so that they are qualified to design, produce and use instructional software and rely on instructional software to increase the effectiveness of the instructional process and effective learning to face challenges in the future, including COVID19.

Keywords: instructional software, achievement, Biology , COVID 19

Introduction

In this day and age, countries are witnessing a tremendous revolution and scientific progress in information systems and technology that have contributed to developing all aspects of life, especially the instructional field, which facilitates the process of effective telecommunication, communication, and information exchange that serves the learner. These days, the COVID19 crisis has had a major impact on the education sector as schools, universities, and instructional institutions being forced to close, reducing the chances of its spread. This has caused great concern among the members of this sector, especially its students in light of a crisis that may be prolonged.

These new developments have prompted instructional institutions to switch to E-Learning as an important alternative to traditional education. There has been a recent and long debate about the necessity of integrating it into the instructional process, especially after the instructional process is directly affected by the automation of the industry, development of technology, Artificial Intelligence, and Internet of Things along with the information technology revolution that breaks into most aspects of human life and becomes one of its integral parts.

The introduction of technology in the instructional process is a global trend that makes the existence of instructional material and its availability through mobile devices for "Generation X" is a catalyst for learning rather than relying on the traditional study alone. Providing the instructional material in this way develops appropriate knowledge and skills that qualify the learner to meet the needs of the labor market. Many related programming languages contribute to the instructional learning process, such as instructional software that contains scientific material and accompanying activities, and interactive instructional methods that contribute to its understanding and clarification, as this development adds an important dimension in finding interaction between the learner and the computer through the contents of the software used as an aid in Education (Haniyeh, 2019).

The instructional software is one of the main elements used through the computer, which helps to differentiate education due to its characteristics featured with instructions for the learners to make it easier for them to use, deal with and apply. Also, the instructional software observes the individual differences among learners in terms of abilities and capabilities available to them and meets their desires and needs, leading to design several programs for different subjects (Sajini & Khalil, 2017). The instructional software aims to present the instructional material encouragingly and serially inside or outside the classroom. Instructional software is distinguished by its ability to link the curriculum to a computer and contributes to helping students and teachers design interactive electronic applications through sound, image, and animation to contribute to developing learners' attitudes towards learning and stimulate their motivation and thus improve and increase their academic achievement (Rifae, 2017).

One of the most important qualitative indicators demonstrating the quality of the instructional process is academic achievement, which is one of the most central factors that greatly affect the formation of the learner's personality and facilitate its integrated growth. Academic achievement is seen as a measure of what the learner has achieved in his education and his ability to express his knowledge, skills, and attitudes. Therefore, several psychologists have considerably paid attention to the important topics and issues that capture the future of students, especially in a society that gives academic achievement and access to excellence great attention due to its key role in determining the path of the learner and his scientific future and defining her profession in life (Jalali, 2016).

Raising the level of academic achievement has become a necessity based on trying to reach success and excellence in test standards compared to the best international scientific standards, as it indicates the individual's motivation to a greater degree in dealing with information, regardless of its difficulty. Besides, it is the responsibility of educators to raise the level of expectations achieved by students, and thus there will be a motivation and incentive to learn whose limits may exceed their

capabilities in line with the expectations of their teachers (Zghoul & Hindawi, 2019).

The Problem of the Study

The problem of the study stems from the conditions in which all humankind lives due to the outbreak of the COVID19. Certainly, this crisis has faced the educational sector, which decides to keep pace with the crisis by adopting e-learning seen as an irreplaceable choice. The teachers have also faced great challenges to cope with this sudden transformation, but with appropriate planning, many obstacles can be overcome. The importance of activating instructional software in improving the quality of the instructional process has been addressed in several studies, including Zabin's study (2018), Abu Muthina's study (2017), and Rifaa'e's study (2017). The researchers have also noted that most of our schools still use traditional teaching methods due to their lack of computer skills and advanced teaching methods. Accordingly, there is a need and necessity to use new methods that can contribute to improving student performance and raising their achievement level. UNESCO (2019) has also indicated that the wealth of digital instructional resources has made new requests to public education systems and institutions, which include developing innovative curricula, alternative study programs, and educational pathways, where all these works can be facilitated via the Internet, distance learning and short skills-based courses. With that, in light of the COVID19 outbreak, there is a special need and necessity to prevent its spread to save the instructional process and to keep it running without interruption while improving students' performance and raising their achievement level. Against this, the problem of the study is to explore the effectiveness of instructional software in addressing the impact of COVID 19 on 10th-grade students' achievement in Biology in Jordan.

Questions of the Study

In light of the problem of the study, the following question is articulated.

- Are there statistically significant differences at ($\alpha = 0.05$) among the arithmetic means of achievement of the 10th-grade students in Biology due to the teaching method of instructional software and the traditional method?

Objectives of the Study

In light of the problem of the study, the following objective is formatted.

- This study aims to improve achievement in Biology for 10th-grade students through the use of instructional software in light of the outbreak of COVID19.

Significance of the Study

The significance of the study stems from its key subject matter, as it seeks to attract the attention of those in charge of the instructional process to the importance of identifying the effectiveness of instructional software in the achievement of scientific subjects in general and Biology in particular. It is hoped that the results of this study will encourage those who are responsible for the instructional process to be fully prepared to face any novel challenges or emergent crises impacting the instructional process. The significance of the study is also articulated by providing computer teachers in the instructional sector with modern teaching patterns to benefit from them in teaching and raising students' academic achievement levels.

Previous Studies

Several studies have been done on the importance of instructional software in the teaching process. Sagri's study (2015) aims to identify the effect of instructional software in the Area Unit on the achievement of sixth-grade students in mathematics. The sample of the study consists of (99) students from the sixth grade of primary school in Baljurashi Governorate in Saudi Arabia. The study has used an achievement test and instructional software designed according to the aims of the study. The results of the study show that there are statistically significant differences among the means of the pupils' scores in the post-achievement test at the lower cognitive levels (remember, understand, and apply) for the benefit of the experimental group. The study also shows that there is a statistically significant difference at the significance level ($\alpha = 0.05$) among the means of the scores of students in the post-achievement test at the higher cognitive levels (analysis, synthesis) for the benefit of the experimental group. The results also show that there are statistically significant differences among the means of scores of students in the post-achievement test at all cognitive levels in favor of the experimental group, alongside the presence of a statistically significant effect of the use of instructional software in achievement the Area Unit in mathematics. The study has recommended paying more attention to the computer environment as an instructional environment for teaching mathematics.

David's study (2016) aims to determine the degree of the effect of the instructional program of the reading comprehension on the reading and mathematics capabilities of fourth and fifth graders. The sample of the study consists of 39 students (25 males, 11 females) from the fourth and fifth graders at an elementary school in Central Florida in America who suffer from lack of skills of reading comprehension during the academic year 2015/2016. To achieve the objectives of the study, the researcher has used four tools to collect data pre and post remedy plans to measure students' achievement and determine the degree of the impact of the instructional program on student achievement. The results of the study show that there are statistically positive and significant differences in increasing reading comprehension skills that can benefit students in reading and understanding mathematical problems. The results also show that instructional software has had a side effect on students obtaining higher scores with math word problems.

Saleh's study (2016) aims to explore the effect of employing software on the achievement of eighth-grade students in the Light Unit and their attitudes towards learning science in Tubas Governorate in Palestine. The study population consists of all eighth-grade students in government schools of the Tubas Education Directorate in Tubas Governorate in Palestine during the second academic year 2014/2015. The study sample consists of (60) students from the study population as follows: (30) students from the control group, and (30) students from the experimental group from the eighth-grade primary students who are purposely selected. The results of the study show that there is a statistically significant difference at the level of significance ($\alpha = 0.05$) among the means of the achievement of students of the experimental group and the control group due to the teaching method in favor of the experimental group that has studied the Light Unit from the eighth-grade textbook using instructional software. The results of the study also indicate that there is a statistically significant difference at the level of significance ($\alpha = 0.05$) among the means of the female students' attitudes towards science due to the teaching method in favor of the experimental group that has studied the Light Unit from the eighth-grade textbook using a software strategy. The study has recommended activating the teaching method using instructional software in the science subject by those who are in charge of the science curriculum.

Meanwhile, Zabin's study (2018) aims at identifying the effect of using an instructional software "Authorware" on the achievement of the first basic grade students in the Islamic Education course. To achieve the objectives of this study, instructional software in the Islamic education textbook and an achievement test are designed and prepared. The study sample consists of (39) male and female students purposely selected from two sections and randomly distributed, as one of them is experimental with (20) male and female students from the Khan Zabeeb Primary Mixed School and Zumailah Comprehensive Secondary Mixed School for the Central Badia Education / Giza District in Jordan during the 2017/2018 academic year. The results of the study show that there are statistically significant differences between the experimental and control groups on the achievement test and in favor of the experimental group. Among the most prominent recommendations of the study is that the Ministry of Education shall hold training courses for first-grade and first-grade primary teachers, especially during service, to train them to design and use instructional software.

Cakir's study (2019) aims to examine the effect of the online IQ system on students' achievement and motivation in the Computer Introduction course. The sample of the study consists of (80) male and female students distributed into two groups: experimental groups with (40) male and female students, and the other is a control group consisting of (40) male and female students from the Faculty of Sciences at the University of Amasya in Turkey during the second semester of the academic year 2018/2019. A quasi-experimental approach is also used. To achieve the objectives of the study, an instructional software supporting artificial intelligence "Office Master" that is accessible online has been designed and developed. The results of the study show that the achievement of the experimental group students has increased significantly compared to the students of the experimental group, and the results also showed the students' increasing enthusiasm towards the use of instructional software.

Against this, the review of previous studies reveals that none of these studies has directly addressed the subject matter of the study that will be done in the current study. It is found that zero studies and their strategies are directly related to the subject of research, as most studies show the effect of using instructional software and achievement as a Saqri's study (2015). It also differs from Saleh's study (2016) in the use of the software applied to students, as it is used in ready-made software, and differs from the study of Zabin's study (2018) in the selection of the material taught to students where the researcher has used the Islamic Education course that has been previously addressed by other researchers. However, the current study aims to reveal the effectiveness of instructional software in addressing the impact of COVID 19 on 10th-grade students' achievement in Biology in Jordan.

Terms of the Study

To attain its objectives, the current study adopts the following terms:

Software: it is characterized by the ability to combine audio, moveable and unmovable images, text, and video clips and interactively to be called multimedia (Eiadat, 2014). Converting instructional paper material into electronic material is required to make it easier to trade, faster to spread, and less expensive (Shurman, 2019).

Instructional software: it works on organizing electronic instructional content based on the integration between audio and visual media, and provides an opportunity for interaction between the learner and the instructional material through the computer to achieve the required educational goals (FathAllah, 2009, P. 166). However,

Eiadat (2014) maintains that instructional software is prepared using the computer in the form of a set of screens (interconnected frames) in a specific sequence according to a specific educational strategy to present the required content using an integrated set of multimedia such as images, sound, and colors. These screens can be organized and presented using one of the software programming languages while providing the opportunity for a positive interactive atmosphere for the learner.

Academic achievement: it is considered one of the most important topics receiving the attention of psychologists, social, pedagogical and instructional specialists due to the key role it plays in preparing the younger generations to explore their energies and contribute to achieving the objectives of the society. Interest in academic achievement has emerged as the basis for the instructional process, as it is crucial in deciding the learner's attitudes because the learner's success or failure determines whether she can continue in the instructional process or not (Juhuria, 2010). Yet, Jalali (2016) refers to academic achievement as an indicator or a group of indicators that specify the extent to which the objectives or outputs are expected to be achieved.

Limitation of the Study

This study is limited to study the Genetics Unit in the 10th-grade Biology textbook. It is also limited to tenth-grade students at Al-Khansaa Secondary School for Girls in Jerash Governorate in Jordan. Moreover, it is applied in the 2nd semester of the academic year 2019/2020. Generalizing the results of the study is limited to study populations similar to its study population in light of the validity and reliability of the study instruments, its coefficients, and the objectivity of respondents.

The Methodology of the Study

The semi-experimental approach is used for its suitability for the objectives of the study depending on applying specific processing to one group rather than another one to explore its effect. The 60-student study sample is purposely selected from the study population and distributed into two female groups: a 30-student control group and a 30-student experimental group of the 10th-grade students at Al-Khansaa Secondary School for Girls in Jerash Governorate in Jordan during the second semester of the 2019/2020. The experimental group is taught the proposed unit of Biology textbook titled "Genetics" using software via Edmodo platform, which is a free social platform that provides teachers and students with a safe environment for communication and cooperation, and the exchange of educational content, and digital applications, along with homework, grades, and discussions. However, the control group is taught in the traditional method via the Edmodo platform.

Study population

The study population consists of tenth-grade female students at Al-Khansaa Secondary School for Girls in Jerash Governorate in Jordan.

Study Sample

The study sample of the study consists of 60 female students purposely selected from the study population and distributed into two groups: a 30-student control group and a 30-student experimental group of the 10th-grade students at Al-Khansaa Secondary School for Girls in Jerash Governorate in Jordan during the second semester of the 2019/2020.

Study Instrument

Due to the nature of the study, the current research factors in the following instruments.

1. Instructional Software

Instructive software comprising the instructional content of the Genetics Unit is included in the instructional material taught by instructive software. After reviewing the steps of designing teaching and the foundations of building instructional software using multimedia, the instructional software is prepared, produced, and validated by those specializing in curricula and teaching methods, scientific subject experts, and instructional technology specialists.

2. Achievement Test

It is an achievement test consisting of (20) questions in its final form and is applied to the study sample.

Achievement Test Validity

To verify the validity of the content of the achievement test, the content is presented to a group of experts and specialists in Jordanian universities to express their views in the questionnaire items in terms of clarity of meaning, linguistic construction, and the degree of suitability for the field to which it belongs, and any other appropriate modifications and notes. The necessary modifications are made to (10) items of the test, so the test in its final form has become (20) items. The internal consistency is also calculated by the Pearson correlation coefficient between the degree of each test question and the total degree of the test as illustrated in Table (1).

Table (1) shows that there are acceptable correlation coefficients between the degree of each question and the total degree of the test, as some of the items are statistically significant at the level of significance ($\alpha = 0.05$) and others are statistically significant at the level of significance ($\alpha = 0.01$), and this indicates the consistency of the test levels and its validity for application.

Achievement Test Reliability

To verify the reliability of the test, this test in its final form is applied to a pilot sample at Lababa Bint Hareth Secondary School in Jerash Governorate, consisting of (20) students from the eighth grade from outside the study sample. Then, the test is re-applied after two weeks, and the Cronbach's Alpha coefficient is (0.822). Next, with the calculation of the Pearson correlation coefficient between the two applications, it is found to be equal to (0.799) which is statistically significant at the significance level ($\alpha = 0.01$) and is considered an acceptable result for the study.

Analysis of Test Items

The objective of analyzing the test items is to improve the test by revealing the weak items and working to reformulate or delete them. Therefore, the difficulty and differential coefficients for the test items are calculated, and it clear that the difficulty coefficient ranges between (0.2 - 7.0), and the differential coefficient ranges between (0.75-0.25). These percentages are considered acceptable for study purposes as illustrated in Table (2).

Results

- Results related to answering the study question that states "Are there statistically significant differences at ($\alpha = 0.05$) among the arithmetic means of achievement of the 10th-grade students in Biology due to the teaching method of instructional software and the traditional method?"

To answer this question, both the arithmetic means and standard deviations for the achievement of the 10th grade students in Biology

Table 1. Pearson Correlation Coefficient between the Degree of Each Question and the Total Degree

Question	Correlation Coefficient	Question	Correlation Coefficient
1	0.38*	11	0.42*
2	0.47**	12	0.59**
3	0.38*	13	0.47**
4	0.42*	14	0.51**
5	0.67**	15	0.41*
6	0.57**	16	0.41*
7	0.54**	17	0.44*
8	0.51**	18	0.59**
9	0.41*	19	0.44*
10	0.53 **	20	0.41*

* Statistically significant at the significance level ($\alpha = 0.05$)

** Statistically significant at the significance level ($\alpha = 0.01$)

Table 2. Difficulty and Differential Coefficients for Achievement Test Items

Question	Difficulty Coefficient	Differential Coefficient	Question	Difficulty Coefficient	Differential Coefficient
1	0.33	0.25	11	0.47	0.5
2	0.43	0.5	12	0.33	0.5
3	0.2	0.38	13	0.33	0.63
4	0.2	0.5	14	0.5	0.63
5	0.3	0.63	15	0.27	0.38
6	0.7	0.75	16	0.27	0.38
7	0.5	0.75	17	0.33	0.5
8	0.27	0.5	18	0.23	0.63
9	0.3	0.38	19	0.2	0.5
10	0.67	0.5	20	0.37	0.63

subject are calculated according to the group's control and experimental variable as shown in Table 3.

Table (3) shows an apparent variation in arithmetic means, standard deviations, and adjusted arithmetic means for the achievement of students of the 10th grade in the Biology subject between students of the experimental group and of the control group, where the arithmetic mean of the experimental group for pre-test is (6.57), and the standard deviation of this group (2.31). The arithmetic mean for the control group in the pre-test is (8.17), and the standard deviation for this group is (1.68), meaning that the apparent variance in the arithmetic means of the two groups for the pre-test reached (1.6).

Table (3) also shows an apparent variance in the arithmetic means and the standard deviations of the achievement of the 10th-grade students in Biology subject between the experimental group and the control group on the post-test, where the arithmetic mean of the experimental group is (14.5), and the standard deviation of this group is (3.54). As for the arithmetic mean of the control group is (10.73), and the standard deviation for this group is (3.46), this indicates that there is an apparent variance in the arithmetic means between the two groups is (3.77).

To find out whether there are statistically significant differences at the level of significance ($\alpha = 0.05$) between the arithmetic means of the control and experimental groups on the pre and post achievement test and isolate the statistical differences between the two groups on the pre-test if any, the adjusted arithmetic means are calculated as the experimental group is (14.78), and the control group is (10.45). Then, Analysis of Covariance (One-Way ANCOVA) is used on the post-test as illustrated in Table 4.

Table 3. Arithmetic Means, Standard Deviations, and Adjusted Arithmetic Means for Achievement of the 10th Grade Students in Biology Subject Due to the Group Variable

Group	Number	Pre-Test		Post-Test		Adjusted Mean of the Post-Test	Adjusted Standard Deviation of the Post-Test
		AM	SD	AM	SD		
Experimental	30	6.56	2.31	14.5	3.54	14.78	541.
Control	30	8.17	1.68	10.73	2.12	10.45	541.
Sum	60	7.37	2.16	12.61	3.46	12.61	368.

Table 4. Results of the (One-Way ANCOVA) of the Group's Effect on the Achievement of 10th Grade Students in Biology on the Post-test

Source of Variance	Sum of Squares	Degrees of Freedom	Mean of Squares	Statistical Value (V)	Statistical Sig.	Size Effect (Eta-squared)
Pre-test (ANCOVA)	29.588	1	29.588	3.636	.062.	
Method	242.248	1	242.248	29.773	.000*	.343
Error	463.779	57	8.136			
Total Adjusted	706.183	59				

* Statistically significant at the significance level ($\alpha = 0.05$)

The statistical results presented in Table (4) show that there is a statistically significant difference between the experimental and control groups at the level of significance ($\alpha = 0.05$), on the post achievement test, where the calculated value of "F" is (29.77) with a statistical significance of ($\alpha = 0.000$). With that, it is seen that the differences are in favor of the experimental group whose adjusted arithmetic mean is 14.78 which is higher than the adjusted arithmetic mean for the performance of the control group of 10.45.

To reveal the effectiveness of using instructional software to teach the proposed unit of Biology subject in the achievement of the 10th-grade students, a size effect (Eta-squared) is used to measure the size of the effect that is (.343). This means that (34.3%) of the variation in performance is due to the method of teaching using instructional software.

The study attributes this positive result among the female students of the experimental group to the role of instructional software in organizing the instructional material in a logical sequence helping in facilitating the material for students, presenting various concepts in genetics, and dealing with the software easily without restrictions. The female students' motivation and inclination to learn through the software demonstrated through participation and interaction among female students remotely using the Edmodo platform due to the ban on female students to limit the spread of COVID19 causing the closure of educational institutions have revealed the degree of the contribution of distance learning and its methods such as software teaching program to raise instructional competence and maintain the functioning of the teaching and learning process.

More tellingly, the difference in achievement between the experimental group and the control group and favor of the experimental group may be explained by the experimental group's increasing interest and demand of female students on self-reliance in instruction as a result of the prohibition, curfew, and the closure of other methods have become unattainable due to this COVID19 pandemic, along with the desire of female students to keep pace with progress and technology face challenges and investment opportunities. The results also explain that the instructional software has contributed to the formation of

a mental image among students about the biological terms in the Genetics Unit in Biology, especially chromosomes and genes. Because they are microscopic molecules unseen with the naked eye and far from the scientific imagination and the extent of understanding of the students, the software has embodied these abstract and accurate scientific concepts to preserve the impact of learning because the software mimics the virtual reality and the scientific content of the unit of genetics being abstract ideas that no one can touch or see. The software has also provided the students with the opportunity to participate actively in the instructional situation through the programs, tools, and video clips produced and included in the software, which in turn increases students' acquisition of concepts and the formation of a related mental image. The instructional software has easily presented several different realistic examples of terms, concepts, and components of the animal cell, and the biological structure of DNA.

Of note, the use of instructional software has led to increasing female students' self-reliance in understanding and inferring and providing adequate opportunity in making attempts and errors in an atmosphere of privacy without feeling embarrassed or fear. This has greatly helped them take a sufficient opportunity in making the appropriate decision regarding their instruction in terms of activities, content, location, and selecting the appropriate time, and thus has led to raising their achievement in Biology.

Importantly, the result of the current study is consistent with Sagri's study (2015) whose results show a statistically significant effect of the use of instructional software in achievement in favor of the experimental group. It also agrees with the results of Saleh's study (2016) whose results show the presence of statistically the significant difference in favor of the experimental group that has approved teaching using a software strategy because a software program provides a comfortable learning environment for the learner and increases the interest of students in instruction. Distance learning provides students with the opportunity to discuss and compete with other students freely. Also, the learner's access to knowledge resources at high speed through multiple media and technologies, and the anxiety that users may have in using the electronic network due to the abundance of information available may have an impact on learners challenging themselves to prove their presence and the ability to face COVID19 pandemic and this could affect their achievement.

More importantly, it also agrees with Zabin's study (2018), which has concluded that there are statistically significant differences between the experimental and control groups on the achievement test and in favor of the experimental group using instructional software (Authorware). This is because the software is designed based on the most prominent modern learning theory, which is the social constructivist theory (Community of Inquiry) that focuses on how the students learn and think, as the instructional software's design for the proposed unit is appropriate to the needs of students and meets their desires and inclinations, so they can use it via the instructional platform "Edmodo" commensurate with their skills, which is reflected positively in achievement.

Recommendations

In light of the results and discussion, several recommendations have been made such as using instructional software to increase the effectiveness of the instructional process and effective learning, conducting more studies on codifying and preparing the necessary instructional software in various subjects, especially in facing challenges, including the spread of COVID19, working on equipping government school laboratories with the necessary equipment, parts, and software to train students on them, and holding training courses

for teachers, in particular, to increase their eligibility so that they can design and produce instructional software.

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