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# The impact of educational software on student learning and academic achievement: Evidence from Jordan

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## ABSTRACT

The study examines the impact of educational software on academic achievement and motivation among sixth-grade students in Jordan. The research included designing an educational program for space science and preparing an achievement test. A questionnaire was used to measure motivation. The study sample consisted of 140 male and female students from Elementary Schools. The results showed that there were statistically significant differences in pre- and post-achievement in favor of the experimental group. The study concluded with recommendations on the necessity of providing educational software for all educational levels and subjects, encouraging researchers to conduct more studies on computer use and preparing educational software, and encouraging science teachers to invest in educational software.

KEYWORDS: educational software, teaching performance, science teachers, teaching methods, general curricula

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## 1. Introduction

Rapid technological progress in the world has a significant impact on various aspects of life, including economic, social, and educational aspects. However, the need for technology in education is increasing, and this technology is helping to achieve better educational goals. The use of technology in education is a major change in this area, leading to new opportunities for learning. The use of the variety of technology available in the computer plays an important role in the success of the teacher in the classroom by integrating and employing the teacher in the educational process and as an assistant and support worker (Nari, 2018), the use of video and simulation using educational software in education is a personal and educational tool that promotes learning and social interaction through video games and interactive learning experiences. It also serves as a learning tool through interactive programs linking students to knowledge (Abbud, 2007).

Abu Al-Hatal (2011) believes that the use of technology in education is of utmost importance to solve problems, enhance learning, integrate knowledge and technology, and facilitate the development of scientific applications for students. Computers have a significant impact on education, as software is a crucial tool due to its rapid access to information and diverse display methods, which enhances the enjoyment of learning and motivation without feeling tired or bored. (Al-Surur, 2018), and its advantages also include that it is interactive and the learner can control it, thus shifting the focus of learning from the teacher to the learner.

Teachers and students need software if they are to turn conventional textbooks into dynamic life scenarios that support independence. It calls for a variety of computer skills, including document creation, searching, storage, software use, Internet access, keyboard, and mouse control. It also lets data be gathered, examined, and explained so that students might pick up knowledge from many sources. This method promotes ongoing learning and skill development in many spheres, including education (Al-Sayed, 2009).

In the field of educational software, there is a category known as non-targeted educational software. This refers to commercially available software that is not designed for a specific subject or content area. Examples of such software include electronic spreadsheets, word processors, graphic design tools, image editors, and databases. Specialized educational software, meaning it is designed to focus on a single subject within the curriculum. Its content can be difficult to modify. (Al-Muhasin, 2002).

The teacher plays a crucial role in the educational process, as they cooperate with the school to enhance the academic performance of learners and their enthusiasm for acquiring knowledge, which contributes to the progress of society. The smart teacher seeks to enhance and develop their personal development and professional growth. This is evident in their ability to inspire and motivate their students to engage in learning and achieve academic success using a variety of methods and strategies. In order for learning to occur, the learner must have the desire to acquire knowledge.

This motivation is considered a crucial element in the educational process, as it drives the student to engage in an organized, deliberate, and effective manner to achieve educational goals (Al-Shaibani, 2001). Motivation is the main driver that drives learners to exert their maximum effort and energy (Negovan & Bogda, 2013), and reduces their shyness in an attempt to enhance their abilities in order to achieve educational goals. In order to reduce the learner's distraction, the teacher must have the ability to arouse the learner's attention, integrate it into educational activities, and adhere to rules and directions. Motivation is a means of enhancing learning and improving learners' efficiency and abilities. (Alawneh, 2005).

Accordingly, previous studies related to the subject of the study sought to mention some of the variables of the current study, such as Al-Abrath's study (2009), which aimed to evaluate the impact of educational software on the academic performance of seventh-grade students in the Republic of Yemen. To achieve this goal, the researcher developed an educational program consisting of two elements: analyzing the composition of materials and identifying the elements present in our environment, as shown in the scientific book. In addition, the researcher created a multiple-choice achievement test consisting of 20 paragraphs. The research sample included 43 male and female students enrolled in the seventh grade at Al-Malik Model Private School in Dhamar Governorate in the Republic of Yemen. The results showed a statistically significant difference () in academic performance between the experimental group. However, the results revealed that there were no statistically significant differences () regarding gender or the interaction between approach and gender. And the study of Krishan (2012) aimed to create a computer program as an educational software using Visual Basic and study its impact on the academic performance of second-grade children in the subject of science. The research used a

sample of 48 male and female students from the second grade at Al-Hussein Bin Talal Applied School in Ma'an city. In order to evaluate the research results, the t-test was used to measure the variance between the means. The research found a significant difference in academic achievement, with a value of (), which may be related to the use of Visual Basic as a teaching method.

With regard to the Al-Khalayleh (2016) study, the aim was to evaluate how applying programmed learning affected seventh-grade science subject academic performance. Using Adobe Captivate version 9, the work was completed by developing an instructional program especially for the cell section of the science book. The test consisted of thirty multiple-choice questions. Using a sample of seventy-two seventh-grade female students from Aisha Al-Qurtubi Basic School for Girls in Zarqa city, the study adopted a quasi-experimental design. The average scores of students on the achievement test revealed notable variations at a statistically significant level of . These variations could be explained by the preferred experimental group teaching strategy. A growing body of research has highlighted the transformative role of educational software, artificial intelligence, machine translation, audiovisual technologies, and online learning in improving teaching practices, language learning, student engagement, and academic outcomes. Studies have examined the effectiveness of AI-powered educational and translation tools, digital accessibility technologies, subtitle-assisted learning, online assessment, emergency remote teaching, and the psychological and pedagogical impacts of educational technologies on Jordanian learners and educators (Ahmad et al., 2025; Akasheh & Haider, 2024; Akasheh et al., 2024; Al-Abbas & Haider, 2023; Saleh Al-Salman & Ahmad S Haider, 2021a; Saleh Al-Salman & Ahmad S Haider, 2021; Saleh Al-Salman & Ahmad S Haider, 2021b; Al-Salman & Haider, 2024; Al-Salman et al., 2022; Darwish et al., 2025; Haider et al., 2024; Haider & Al-Salman, 2022; Haider & AlKhatib, 2025; Haider et al., 2022; Haider et al., 2025, 2026; Obeidat et al., 2024; Saed et al., 2021; Saed et al., 2022; Tannous & Haider, 2025).

This study stands out from other studies as it examines the impact of educational software on the academic performance and motivation of sixth-grade students in the science subject in Mafraq Governorate. The students in this region face challenges such as overcrowded classrooms, the integration of Syrian refugees in schools, and the absence of computer educational tools. These factors have negatively affected their motivation to learn in today's technologically advanced era. The researchers aim to provide advantages to all professionals in the field of education.

Researchers in the field of education observed that students' academic achievement and motivation were low because science teachers lacked understanding of modern teaching strategies and methods that involve extensive planning and implementation. Instead, they preferred traditional teaching methods that relied on indoctrination. This preference had a negative impact on students' academic achievement and motivation to learn. This study will concentrate on creating educational software that emulates reality and enhances students' scientific, skill-based, and emotional knowledge. The software's aim is to have a lasting impact on students' minds, promoting persistence and continuity, while catering to various learning styles. After examining previous research advocating for teachers to utilize contemporary teaching methods and incorporate educational technology, researchers recognized the necessity of embracing the concept of developing educational software that presents the curriculum in an interactive and enjoyable manner, while adhering to the principles of self-directed learning and personalized education.

The study aims to answer the following questions:

Q1: Are there statistically significant differences in academic achievement between students in the experimental group (using educational software) and the control group (using the traditional method) in the post-measurement, at a significance level of ?

Q2: Are there statistically significant differences in motivation scores between students in the experimental group (using educational software) and students in the control group (using the traditional method), at a significance level of ?

The significance of this study lies in the imperative to stay up-to-date with technological advancements and utilize them in the classroom to enhance the educational learning process. Therefore, researchers aim to determine the influence of utilizing educational software on students' academic performance and their level of motivation towards learning.

## 2. Method and procedures

### 2.1. Study Sample

The study sample was selected randomly, where 132 male and female students were selected from the sixth-grade students at Abu Bakr Al-Siddiq Elementary School for Boys and King Abdullah Neighborhood Elementary School for Girls in the staff of the Education Directorate in Mafraq Governorate. They were divided into two groups, with (76) male and female students for the experimental group, with (47) male students and (29) female students, and (56) male and female students for the control group, with (24) male students and (32) female students.

### 2.2. Validity of the Achievement Test

The examination was administered to a panel of experts who specialise in educational technology and the pedagogy of science. In order to ensure the conformity of the test items with the specifications table and the proper allocation of marks among the items, their comments were duly considered.

### 2.3. Achievement Test Reliability

To ensure the reliability of the test, it was verified using the test-retest method by applying the test and reapplying it two weeks later to a group outside the study sample consisting of (20) male and female students, and then the Pearson correlation coefficient was calculated between their estimates in the two times, which amounted to (0.92). The reliability coefficient was also calculated using the internal consistency method according to the Kuder-Richardson equation -20, which amounted to (0.88), and these values were considered appropriate for the purposes of this study.

### 2.4. Analysis of Achievement Test Paragraphs

Using the (SPSS) program, the responses of a group of (20) outside the study sample were analyzed to calculate the difficulty and discrimination coefficients for the test items, where the percentage of students who answered the item incorrectly was adopted as a difficulty coefficient for each item of the test, while the discrimination coefficient for each item was calculated in the form of the item's correlation with the total score. Table (1) shows the difficulty coefficients and discrimination coefficients for each item of the test.

**Table 1:** Difficulty and discrimination coefficients for paragraphs

| Paragraph number | Coefficient of difficulty | Discrimination coefficient |
|---|---|---|
| **1** | 0.55 | 0.53* |
| **2** | 0.45 | 0.56* |
| **3** | 0.55 | 0.64** |
| **4** | 0.35 | 0.66** |
| **5** | 0.45 | 0.52* |
| **6** | 0.35 | 0.51* |
| **7** | 0.55 | 0.69** |
| **8** | 0.6 | 0.60** |
| **9** | 0.45 | 0.59** |
| **10** | 0.5 | 0.49* |
| **11** | 0.55 | 0.68** |
| **12** | 0.6 | 0.51* |
| **13** | 0.5 | 0.56* |
| **14** | 0.6 | 0.69** |
| **15** | 0.45 | 0.55* |
| **16** | 0.4 | 0.56* |
| **17** | 0.55 | 0.68** |
| **18** | 0.35 | 0.54* |
| **19** | 0.35 | 0.62** |

| | | |
|---|---|---|
| 20 | 0.45 | 0.59** |

*** Statistically significant at the significance level (0.05).**

****Statistically significant at significance level (0.01).**

Table 1 indicates that the paragraph difficulty coefficients varied from 0.35 to 0.60, while the discrimination coefficients ranged from 0.49 to 0.69. According to Awda (2010), a paragraph is considered to have an acceptable level of difficulty if it falls within the range of 0.20 to 0.80. In terms of paragraph discrimination, a coefficient higher than 0.39 indicates that the paragraph is good. We consider the paragraph acceptable but suggest improvements if the discrimination coefficient falls between 0.20 and 0.39. If the coefficient falls below 0.20, we consider the paragraph weak and recommend its deletion. We should exclude it if the discrimination coefficient is negative and falls within the range of 0 to 0.19. Consequently, neither the difficulty coefficient nor the discrimination coefficient led to the removal of any items. We validated the test using the test-retest method to ensure its reliability. We administered the test to a group of 20 individuals who were not part of the study sample, and then repeated it two weeks later. We then calculated the Pearson correlation coefficient between their scores on the two occasions, yielding a coefficient of 0.92. We determined the stability coefficient using the internal consistency method, specifically the Kuder-Richardson equation -20, yielding a value of 0.88. We deemed these values suitable for the objectives of this study.

### 2.5. Group Equivalence: Pre-Achievement

We extracted the arithmetic means and standard deviations of the study sample scores on the pre-achievement test based on the group variable (experimental, control), and used the "t" test to illustrate the statistical differences between the arithmetic means, as shown in Table 2.

**Table 2:** Arithmetic Averages, Standard Deviations and T Test According to the Group Variable on the Achievement Test

| | Group | Number | Arithmetic mean | Standard deviation | Value "T" | Degrees of freedom | Statistical significance |
|---|---|---|---|---|---|---|---|
| Tribal collection | **Experimental** | **76** | **9.95** | **3.35** | **0.711** | **130** | **0.478** |
| | **Control** | **56** | **9.52** | **3.537** | - | - | - |

Table 2 shows that there are no statistically significant differences () attributed to the group in the pre-achievement test, and this result indicates the equivalence of the groups.

### 2.6. Motivation scale tool

The researchers developed the learning motivation scale using the following:

(1) Reviewing the theoretical literature that dealt with learning motivation in general to determine the areas of learning motivation and reviewing previous studies such as the study (Bani Marai, 2018) and the study (Haddah, 2013) to benefit from the paragraphs of the learning motivation scale and modify some of them and formulate some paragraphs in a way that is consistent with the format of the educational content prescribed for the science subject, the space unit, for the sixth grade.

(2) Determining the axes of the motivation scale, writing the paragraphs of each axis, and presenting them to a group of arbitrators, and modifying them according to their suggestions and comments.

### 2.7. Validity of the Motivation to Learn Scale

To verify the validity of the motivation scale towards learning, it was presented to seven arbitrators from specialists in Jordanian universities and the Educational Supervision Department, and their opinions and directives were monitored and taken into account to produce the scale in its final form. The scale in its final form consisted of four axes and 20 paragraphs, as shown in Appendix (7). The construct validity of the motivation scale towards learning was also calculated. To extract the construct validity indications of the scale, the correlation coefficients

of each paragraph and the total score were extracted, and between each paragraph and its correlation with the field to which it belongs, and between the fields with each other and the total score, in a survey sample from outside the study sample consisting of (20), the correlation coefficients of the paragraphs with the tool as a whole ranged between (0.46-0.86) and with the field (0.58-0.89), and Table (3) shows that.

**Table 3: Correlation coefficients between the item and the total score and the domain to which it belongs**

| Paragraph number | Correlation coefficient with domain | Correlation coefficient with the tool | Paragraph number | Correlation coefficient with domain | Correlation coefficient with the tool | Paragraph number | Correlation coefficient with domain | Correlation coefficient with the tool |
|---|---|---|---|---|---|---|---|---|
| 1 | .89** | .86** | 8 | .73** | .74** | 15 | .70** | .53* |
| 2 | .67** | .81** | 9 | .61** | .61** | 16 | .77** | .61** |
| 3 | .82** | .67** | 10 | .61** | .58** | 17 | .58** | .61** |
| 4 | .71** | .59** | 11 | .60** | .48* | 18 | .88** | .53* |
| 5 | .69** | .46* | 12 | .83** | .81** | 19 | .63** | .79** |
| 6 | .81** | .82** | 13 | .79** | .52* | 20 | .80** | .53* |
| 7 | .72** | .68** | 14 | .62** | .71** | | | |
| * Statistically significant at the significance level (0.05). | | | | | | | | |
| **Statistically significant at significance level (0.01). | | | | | | | | |

It should be noted that all correlation coefficients were of acceptable degrees and statistically significant, and therefore none of these items were deleted. The correlation coefficient of the domain with the total score was also extracted, as well as the correlation coefficients between the domains with each other, and Table (4) shows this.

**Table 4:** Correlation coefficients between domains and the total degree

| | Active Learning Hub | Science Learning Value Pillar | Performance and Achievement Pillar | Learning Environment Hub | Learning motivation scale |
|---|---|---|---|---|---|
| Active Learning Hub | 1 | | | | |
| Science Learning Value Pillar | .848** | 1 | | | |
| Performance and Achievement Pillar | .626** | .715** | 1 | | |
| Learning Environment Hub | .502* | .693** | .533* | 1 | |
| Learning motivation scale | .890** | .959** | .831** | .750** | 1 |
| * Statistically significant at the significance level (0.05). | | | | | |
| **Statistically significant at significance level (0.01). | | | | | |

Table 4 shows that all correlation coefficients were of an acceptable degree and statistically significant, indicating an appropriate degree of construct validity.

### 2.8. Reliability of the Motivation Towards Learning Scale

To ensure the reliability of the study instrument, it was verified using the test-retest method by applying the scale and reapplying it after a fortnight to a group of 20 individuals outside the study sample. Then, Pearson's correlation coefficient was calculated between their ratings in both instances.

The reliability coefficient was also calculated using the internal consistency method according to Cronbach's

alpha equation. Table 5 shows the internal consistency coefficient according to Cronbach's alpha and the test-retest reliability for the domains and the total score. These values were considered suitable for the purposes of this study.

***Table 5:*** *Cronbach's alpha internal consistency coefficient and test-retest reliability for the domains and total score*

| Domain | Replay stability | Internal consistency |
|---|---|---|
| Active Learning Hub | 0.83 | 0.81 |
| Science Learning Value Pillar | 0.80 | 0.77 |
| Performance and Achievement Pillar | 0.82 | 0.79 |
| Learning Environment Hub | 0.84 | 0.80 |
| Learning motivation scale | 0.89 | 0.84 |

2.9. **Group Equivalence: Pre-test Motivation Towards Learning Scale**

To verify group equivalence, the arithmetic means and standard deviations were extracted for the dimensions and total score of the study sample's grades on the pre-test Motivation Towards Learning Scale according to the group variable (experimental, control). To show the statistical differences between the arithmetic means, a t-test was used, and Table (6) illustrates this.

***Table 6: Arithmetic means, standard deviations, and t-test according to the group variable on the dimensions and total score of the study sample's grades on the Motivation Towards Learning Scale***

| | Group | Number | Arithmetic mean | Standard deviation | Value "T" | Degrees of freedom | Statistical significance |
|---|---|---|---|---|---|---|---|
| Active Learning Hub Tribal | Experimental | 76 | 3.23 | 0.377 | 1.681 | 130 | 0.095 |
| | Control | 56 | 3.11 | 0.448 | | | |
| The value of learning science before me | Experimental | 76 | 3.35 | 0.423 | 1.297 | 130 | 0.197 |
| | Control | 56 | 3.26 | 0.355 | | | |
| Performance and achievement axis before me | Experimental | 76 | 3.32 | 0.438 | 1.35 | 130 | 0.179 |
| | Control | 56 | 3.22 | 0.419 | | | |
| The axis of the learning environment before me | Experimental | 76 | 3.23 | 0.544 | 0.17 | 130 | 0.866 |
| | Control | 56 | 3.21 | 0.686 | | | |
| Motivation scale towards learning before me | Experimental | 76 | 3.30 | 0.289 | 1.728 | 130 | 0.086 |
| | Control | 56 | 3.21 | 0.305 | | | |

Table 6 shows no statistically significant differences () attributed to the group in all dimensions and in the total score of the pre-test Motivation Towards Learning Scale. This result indicates group equivalence.

## 3. Study Results

### 3.1. Statistical Results Related to Answering the First Question

To answer this question, arithmetic means, standard deviations, and adjusted arithmetic means were calculated for the study sample scores on the achievement test in the pre- and post-measurements according to the group (experimental, control), as shown in Table 7.

***Table 7:*** Arithmetic means, standard deviations, and adjusted arithmetic mean for the study sample scores on the overall achievement test for pre and post-measurements according to the group (experimental, control)

| Group | Number | Pre-measurement | | Post-measurement | | Adjusted arithmetic mean | Standard error |
|---|---|---|---|---|---|---|---|
| | | Arithmetic mean | Standard deviation | Arithmetic mean | Standard deviation | | |
| Experimental | 76 | 9.95 | 3.35 | 13.99 | 2.982 | 13.824 | 0.176 |
| Control | 56 | 9.52 | 3.537 | 10.84 | 3.944 | 11.06 | 0.205 |

Table 7 shows apparent differences between the arithmetic means and the adjusted arithmetic mean for the study sample scores on the achievement test in the pre- and post-measurements according to the group (experimental, control). To determine whether these apparent differences were statistically significant, one-way analysis of covariance (ANCOVA) was used for the post-measurement of the overall achievement test according to the group (experimental, control) after neutralizing the effect of their pre-measurement. The following presents these results as shown in Table 8.

***Table 8:*** Results of one-way analysis of covariance (ANCOVA) for the post-measurement of the study sample scores on the overall achievement test according to the group (experimental, control) after neutralising the effect of their pre-measurement.

| Source of variance | Sum of squares | Degrees of freedom | Mean sum of squares | F value | Significance level | Eta squared |
|---|---|---|---|---|---|---|
| Pre-measurement | 1220.847 | 1 | 1220.847 | 522.018 | 0 | 0.802 |
| Group | 245.343 | 1 | 245.343 | 104.905 | 0 | 0.448 |
| Error | 301.693 | 129 | 2.339 | | | |
| Total | 841.97 | 131 | | | | |

Table (8) shows statistically significant differences at the significance level () in the study sample scores on the achievement test according to the group (experimental, control). The F value reached (104.905) with a statistical significance of (0.000), which is a statistically significant value. The differences were in favor of the experimental group, who were exposed to educational software, compared to the control group members.

Table 8 also shows that the effect size of the teaching method was large; the eta squared value () explained (44.8%) of the explained variance (predicted) in the dependent variable, which is the achievement test.

### 3.2. Statistical Results Related to Answering the Second Question

To answer this question, arithmetic means, standard deviations, and adjusted arithmetic means were calculated for the study sample scores on the motivation towards learning scale in the pre- and post-measurements according to the group (experimental, control), as shown in Table 9.

***Table 9:*** Arithmetic means, standard deviations, and adjusted arithmetic mean for the study sample scores on the overall motivation towards learning scale for pre and post-measurements according to the group (experimental, control)

| Group | Number | Pre-measurement | | Post-measurement | | Adjusted arithmetic mean | Standard error |
|---|---|---|---|---|---|---|---|
| | | Arithmetic mean | Standard deviation | Arithmetic mean | Standard deviation | | |
| Experimental | 76 | 3.3 | 0.289 | 4.57 | 0.296 | 4.56 | 0.038 |
| Control | 56 | 3.21 | 0.305 | 3.68 | 0.39 | 3.694 | 0.044 |

Table 9 shows apparent differences between the arithmetic means and the adjusted arithmetic mean for the study sample scores on the motivation towards learning scale in the pre- and post-measurements according to the group (experimental, control). To determine whether these apparent differences were statistically significant, one-way multivariate analysis of covariance (MANCOVA) was used for the post-measurement of the overall motivation towards learning scale according to the group (experimental, control) after neutralizing the effect of their pre-measurement. The following presents these results as shown in Table 10.

***Table 10:*** Results of One-way ANCOVA for the post-test scores of the study sample on the overall learning motivation scale according to group (experimental, control) after neutralizing the effect of their pre-test scores

| Source of variance | Sum of squares | Degrees of freedom | Mean sum of squares | F value | Significance level | Eta squared |
|---|---|---|---|---|---|---|
| Pre-measurement | 23.65 | 1 | 23.65 | 217.018 | 0 | 0.627 |
| Group | 0.902 | 1 | 0.902 | 8.279 | 0.005 | 0.06 |
| Error | 14.058 | 129 | 0.109 | | | |
| Total | 40.591 | 131 | | | | |

Table (10) shows statistically significant differences at the significance level () in the study sample scores on the learning motivation scale according to group (experimental, control). The F value reached (217.018) with a statistical significance of (0.000), which is statistically significant. The differences were in favor of the experimental group, who were exposed to educational software, compared to the control group. The table also shows that the effect size of the teaching method was large; the eta squared value () explained (62.7%) of the explained (predicted) variance in the dependent variable, which is the achievement test.

The arithmetic means, standard deviations, and adjusted arithmetic mean for the pre- and post-tests of the learning motivation scale dimensions were also calculated according to group (experimental, control), as shown in Table 11.

**Table 11:** Arithmetic means, standard deviations, and adjusted arithmetic mean for the pre- and post-tests of the learning motivation scale dimensions according to group

| Dimensions | Group | Number | Pre-test | | Post-test | | Adjusted arithmetic mean | Standard error |
|---|---|---|---|---|---|---|---|---|
| | | | Arithmetic mean | Standard deviation | Arithmetic mean | Standard deviation | | |
| Active Learning Hub Tribal | Experimental | 76 | 3.23 | 0.377 | 4.58 | 0.33 | 4.564 | 0.042 |
| | Control | 56 | 3.11 | 0.448 | 3.71 | 0.419 | 3.731 | 0.049 |
| The value of learning science before me | Experimental | 76 | 3.35 | 0.423 | 4.62 | 0.276 | 4.614 | 0.042 |
| | Control | 56 | 3.26 | 0.355 | 3.71 | 0.475 | 3.717 | 0.049 |
| Performance and achievement axis before me | Experimental | 76 | 3.32 | 0.438 | 4.51 | 0.383 | 4.501 | 0.043 |
| | Control | 56 | 3.22 | 0.419 | 3.75 | 0.368 | 3.756 | 0.051 |
| The axis of the learning environment before me | Experimental | 76 | 3.23 | 0.544 | 4.55 | 0.329 | 4.547 | 0.052 |
| | Control | 56 | 3.21 | 0.686 | 3.44 | 0.59 | 3.448 | 0.061 |

Table 11 shows apparent differences between the arithmetic means and adjusted arithmetic means in the pre- and post-tests of the learning motivation scale dimensions resulting from the difference in group (experimental, control). To verify the significance of these apparent differences, a one-way MANCOVA was applied, as shown in Table 12.

*Table 12:* One-way MANCOVA for the effect of group on the post-test for each dimension of the learning motivation scale after neutralizing the effect of their pre-test

| Source of Variance | | Sum of squares | Degree of freedom | Mean Square | F | Error Probability | Effect Size |
|---|---|---|---|---|---|---|---|
| Group Hotelling=1.856 p=.000 | **Active learning dimension post-test** | 21.586 | 1 | 21.586 | 166.83 | 0 | 0.57 |
| | **Value of science learning dimension post-test** | 25.043 | 1 | 25.043 | 188.49 | 0 | 0.599 |
| | **Performance and achievement dimension post-test** | 17.249 | 1 | 17.249 | 121.78 | 0 | 0.491 |
| | **Learning environment dimension post-test** | 37.615 | 1 | 37.615 | 185.46 | 0 | 0.595 |
| Active learning dimension pre-test (covariate) | **Active learning dimension post-test** | 0.142 | 1 | 0.142 | 1.097 | 0.297 | 0.009 |
| Value of science learning dimension pre-test (covariate) | **Value of science learning dimension post-test** | 0.052 | 1 | 0.052 | 0.391 | 0.533 | 0.003 |
| Performance and Tribal Achievement Pillar (Companion) | **Performance and achievement dimension post-test** | 0.009 | 1 | 0.009 | 0.063 | 0.802 | 0 |
| Learning environment dimension pre-test (covariate) | **Learning environment dimension post-test** | 0.231 | 1 | 0.231 | 1.137 | 0.288 | 0.009 |
| Error | **Active learning dimension post-test** | 16.303 | 126 | 0.129 | | | |
| | **Value of science learning dimension post-test** | 16.74 | 126 | 0.133 | | | |
| | **Performance and achievement dimension post-test** | 17.847 | 126 | 0.142 | | | |
| | **Learning environment dimension post-test** | 25.554 | 126 | 0.203 | | | |
| Kidney Corrector | **Active learning dimension post-test** | 41.785 | 131 | | | | |
| | **Performance and achievement dimension post-test** | 36.85 | 131 | | | | |
| | **Learning environment dimension post-test** | 67.138 | 131 | | | | |

Table (12) shows statistically significant differences at the significance level () according to the effect of group (experimental, control) in all dimensions. The differences were in favor of the experimental group members who

were exposed to the educational software compared to the control group members. It should be noted that the effect size for the dimensions ranged between ().

## 4. Conclusion and Recommendations

The results of the statistical analysis showed statistically significant differences at the significance level () in academic achievement between students of the experimental group (educational software) and the control group (traditional method) in the achievement test. The researchers attribute this difference to the advantages of the educational software used in teaching the experimental group students in developing academic achievement in science, stimulating their motivation towards learning, motivating them for continuous learning, and breaking the stagnation that characterizes traditional teaching methods. Additionally, the researchers observed students' enthusiasm for learning through the new educational software, which is related to students' love for change and the opportunity to repeat and relearn multiple times according to their pace, abilities, and needs. This study agreed with the studies discussed in the introduction, namely (Al-Abrat, 2009), (Abu Al-Hatal, 2011), (Bani Mari, 2018), and (Al-Khalayla, 2016).

The results of the statistical analysis showed statistically significant differences at the significance level () on the motivation scale for students of the experimental group (educational software) and the motivation scale for students of the control group (traditional method). The differences in each dimension of the scale can be interpreted as follows:

- First dimension (Active Learning): The researchers believe that the superiority of the experimental group over the control group is due to the fact that learning with educational software relies on understanding content and describing and classifying concepts in a visual way that works to link events, and this is done through cooperative and participatory learning.
- Second dimension (Value of Science Learning): In the researchers' opinion, the superiority of the experimental group over the control group is due to providing students with a sense of confidence in their learning and the ability to imagine, innovate, and reflect on God's creation by converting data from written texts to visual and auditory forms, which led to increased motivation towards learning.
- Third dimension (Performance and Achievement): The researchers believe that the reason for the superiority of the experimental group over the control group is that practicing science activities increases their cognitive level, thus moving them to higher levels of creativity and innovation, which increases their motivation towards learning to a higher degree.
- Fourth dimension (Learning Environment): The researchers attribute the superiority of the experimental group over the control group in this dimension to students' feeling of freedom and interaction in learning without being restricted by time or place, and the ability to repeat learning according to speed, ability, and need, which increases their motivation.

The results agreed with the findings of studies by Bani Mari (2018) and Hadda (2013) in proving the effectiveness of educational software in raising the level of students' motivation scale towards learning science.

After reviewing the results of the statistical analysis, the researchers recommend the following:

(1) Encourage teachers to use modern teaching strategies in teaching science, especially educational software, due to its clear impact on improving students' academic achievement.
(2) Work on generalizing this type of study to be adopted by other researchers and expand the circle of research and investigation to other educational stages.
(3) The necessity of urging responsible authorities to provide computerized educational software for all educational stages and for all subjects, and to generalize them to primary stage students in preparation for their use in education.
(4) The necessity for science subject supervisors to follow up on activating and using the software by teachers.
(5)

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