Original Article

Investigating the effectiveness of using researcher-made multimedia software on fifth-grade students' science educational achievement in tarom county

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ABSTRACT

The aim of the present study was to investigate the effectiveness of using researcher-made multimedia software on fifth-grade students' science educational achievement in Tarom County in the academic year of 2017-2018. This is an applied quasi-experimental study. The population of the research included all fifth-grade students in Tarom County (723 people) among whom 60 people were selected as the sample of the study; sampling was done using simple random sampling. A teacher-made test was used for data collection. Test reliability was favorable (Cronbach's alpha=0.838 for pretest; Cronbach's alpha=0.856 for posttest). Independent t-test was used for examining the collected data. SPSS software was used for data analysis. The results of the research indicated that the use of the researcher-made multimedia software affects the students' science learning regarding Bloom's cognitive levels including knowledge but the effect was not significant. It has no effect on the level of 'synthesis'; it has a positive effect on the levels of 'comprehension, application, analysis and evaluation'. Generally, the use of the researcher-made educational software affects the students' educational achievement regarding science.

Keywords: Science, Multimedia, Researcher-made multimedia software, Educational achievement.

Introduction

The world is full of information and communication in which the speed of information transfer is more than that of light. The education organization is among the first institutes which has undergone basic changes; as a new paradigm, e-teaching and e-learning has developed and will develop education; teaching science has been always considered as an important educational field in the education systems. Like literacy and calculation, science is an essential part of life whose significance has become more as the technology advances such that one should be able to constantly adapt and update themselves with the changes happening around and the speed of the information transfer [1]. More than any time, human needs to have creativity, superior thinking, analysis power, and comprehension of various information resources so as to meet their personal and social needs. Therefore, due to the inefficiency of traditional teaching methods especially the inability to meet personal and social information needs, the increasing use of computer technologies and their unique capabilities including educational multimedia has been specially taken into consideration as a new approach in education [2].

Meanwhile, science is divided into some parts including physics, chemistry and biology and its findings are among the most important issues that are dealt with through courses in school and university. In Iran, students get familiar with issues related to science in all educational levels especially in the elementary level; however, they are taught science and its related issues separately in the first grade of high school. Most students find science difficult to learn and fear that they may fail. Moreover,

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getting into the unfavorable status of Iranian students participating in the international science and mathematics assessment project can help us [3]. The International Association for the Evaluation of Educational Achievement (IEA) started its job since 1959. Since then, this association has conducted more than 15 comparative studies in different fields including second language, science, mathematics, social sciences, computer and education. The first international study on science was implemented in the years 1983-1984.'Trends in International Mathematics and Science Study (TIMSS)' is the most important and large study done by the association. The objective of this study was to evaluate the educational achievement of the students participating in the two courses of mathematics and science as well as investigating the effect of curriculum, content, school and family on students' learning in these two courses. For the first time, Iran participated in TIMSS in 1992 and became a member of IEA; TIMSS and Progress in international Reading literacy Study (PIRLS) indicated that the status of Iranian students participating in the research is very disappointing compared to other countries (junior school ranked 37 among 41 countries and the elementary school ranked last among 25 countries). Those who are really familiar with the current status of education in general education course know that this unfavorable condition is not limited to science and mathematics. It is obvious that the authorities should take serious actions regarding different aspects of general education if they decide to reform the condition. Changing traditional passive methods of teaching and learning (the common method of lecture and memorization) to active methods of teaching and learning is one of the most important changes that needs to take place in the overall status of our teaching method in the general course. Hosseini (2003) conducted a research in which the barriers and problems of science teachers regarding the use of laboratories in junior schools of Tehran were studied [4]. Today, the importance of using active methods of teaching and learning for all courses is emphasized in all international education settings. This is a major weakness of Iran's education system. It may originate from various factors such as inappropriate traditional teaching methods in classrooms, unfavorable educational spaces, lack of equipment, facilities and appropriate software for the course, and most importantly, the teachers' emphasis on traditional methods and maladaptation with modern learning methods. Thus, students face difficult contents and boring teachers' methods resulting in reluctance and inactivity for learning the course; then, the class becomes boring and tiresome. Therefore, the science class will have an unfavorably inefficient output and causes educational fall and wasting national capital. In the education system of Iran, as important educational topics, basic sciences have been always taken into consideration and a part of the timetable has been devoted to them in terms of the students' field of study [5]. Investigating the development process of the objectives and plans regarding science education in the schools of Iran shows that it has been attempted to simultaneously emphasize knowledge and scientific procedure in curriculum planning based on the developments offered for different methods of teaching science. However, studies indicate the insufficiency of the actions and a great distance between goals and the manner of implementation. Unfortunately, the goals and methods of teaching science have been neglected to an extent that these constructive courses which demand a great deal of activity and exploration are often limited to a bulk of formulas, relations, scientific facts, and memorization. As a result, the learners acquire some knowledge on science but rarely learn the application of it. In fact, many students are illiterate regarding the application and use of science when they graduate from school. They are not able to take part in the science- and technology-oriented society and cannot lead that. Although this situation is very disappointing, it is never unpredicted.

Obviously, in an educational system in which the student can not learn freely and actively, knowledgeable insight can not emerge and grow [6]. Besides, today the school must train the student in such a way that he can adapt to the unpredictable issues that are likely to occur during his lifetime. But unfortunately, our schools are often plagued by dry structure and superficial and inefficient learning methods. They usually do not prepare learners for activities due to changes in society and the workplace; On the contrary, teacher-centered and book-centered teaching methods inactivate and silence learners and prepare them for familiar and anticipated situations Ebrahimzadeh (2003).

According to numerous studies on the use of multimedia software in teaching and creativity and academic achievement of students,

It can be said that educational software when used in addition to the traditional teaching method and in the classroom will probably improve learning outcomes. For example, in the past, the concepts of experimental science were traditionally taught using the lecture method. With the rapid growth of computers in recent years and the use of software and the use of simulations, many important concepts of science have become clearer and easier to understand for elementary students [7]. Numerous research records have examined this important issue and its impact:

Therefore, the main question of this research is to investigate the impact of researcher-made multimedia software on the academic achievement of science students in the fifth grade of the elementary school in the city.

For this purpose, sub-questions were formulated as follows:

1. To what extent does the use of researcher-made multimedia software have a positive effect on learning science in the field of cognition and at the level of "knowledge"?
2. To what extent does the use of researcher-made multimedia software have a positive effect on the learning rate of science courses in the field of cognition and on the level of "understanding"?

3. To what extent does the use of researcher-made multimedia software have a positive effect on the level of learning science in the field of cognition and at the level of "application"?
4. To what extent does the use of researcher-made multimedia software have a positive effect on the learning rate of science courses in the field of cognition and at the level of "analysis"?
5. To what extent does the use of researcher-made multimedia software have a positive effect on the learning rate of science courses in the field of cognition and at the level of "composition"?
6. To what extent does the use of researcher-made multimedia software have a positive effect on the learning rate of science courses in the field of cognition and at the level of "evaluation"?

Research Method

This research is quasi-experimental in terms of method and applied in terms of purpose. To influence the application of researcher-made multimedia software on the academic achievement of an experimental science course for fifth grade elementary school students in Tarom city in the academic year "2017-2018". Also, the present study was performed by a quasi-experimental method with two groups of pre-test and post-test.

Table 1- Experimental design of two experimental and control groups

Study groups	Post-test	independent variable	Pre-test	Number of classes
Experimental group	2	T2	X	T1
control group	2	T2	___	T1

The table above shows that two different tests were performed on two independent groups (experimental and control). The first test (pre-test) was performed before the test to determine the amount of students' prior knowledge of the subject and to ensure that the study groups matched. The second test (post-test) was performed after the test to determine the extent to which students achieved the desired goals.

Research tools

1- Pre-test and post-test questionnaires were developed by experienced researchers and teachers. To assimilate the experimental and control groups, first, a pre-test was taken which was related to their previous learning of the subjects of the research. The average of the two groups in the pre-test in science was almost at the same level. The mean of the experimental group in the pretest was 15.02 and the control group was 14.78.

2- The researcher-made multimedia software was approved by the Tarom County Education Department and in accordance with the latest changes in the fifth grade experimental science textbook. Features of this software are teaching science concepts with animation, pictures, puzzles, games, PowerPoint slides, videos, and e-books of science lessons and solving exercises by the student. Adding user-friendly features and user interaction to this software has improved its training and made it more attractive than other existing software. Among the features of this software, the following can be mentioned:

1. Using multiple senses
2. Establishing interaction and two-way relationship with the user
3. Ease of copying to the number of students
4. More attractive software than educational booklets
5. Presenting in the form of a compact disc and no space limitation, unlike educational sites
6. Combining language skills such as reading, writing, listening, and seeing
7. Increasing students' literacy and acquiring technology-based communication skills
8. Saving educational costs by creating a virtual workshop or laboratory
9. Save time
10. The possibility of repeating the material by the learner and specifying the training schedule by himself.

Table 2- Distribution of statistical sample students by gender

Experimental group type	Girl	Boy	Total
Common	67	71	138
Multimedia	61	78	139
Total	128	149	277

To conduct the research, four schools were first introduced by Tarom County Education. Then, by referring to the schools, the necessary coordination was done to conduct the research. Before performing the test, the necessary planning and coordination were done to provide the hardware and software equipment, prepare the environment, and compile the necessary time to perform the test. The educational tool of the research was researcher-made software that was designed for the fifth grade experimental science course (Chapter 2: material changes). This software was approved by the Education Department of Tarom city. The features of this software are in accordance with the latest changes in textbooks, teaching science with animation, slides, PowerPoint, videos, games, and solving exercises by the student and feedback by the software. Before running the pre-test software, the teacher-made test was taken from both experimental and certification groups, which was related to the students' pre-learning in the subjects of the test. After the pre-test of the researcher-made software for two weeks and 2 sessions of 45 minutes each week from 2017-11-2. In all sessions, teachers taught along with the software, and after this period, the post-test was performed on 2017-11-21 for both experimental and control groups. It should be noted that the concepts of the science course for conducting research include "matter changes, chemical change, physical change, change in

the service of life, and different types of materials." The researcher also explained to students and teachers in a few sessions on how to use the researcher-made educational software.

Statistical Society

The statistical population of this study was 723 students (337 girls and 386 boys) in the fifth grade of the elementary school in Tarom in the academic year 2017-2017.

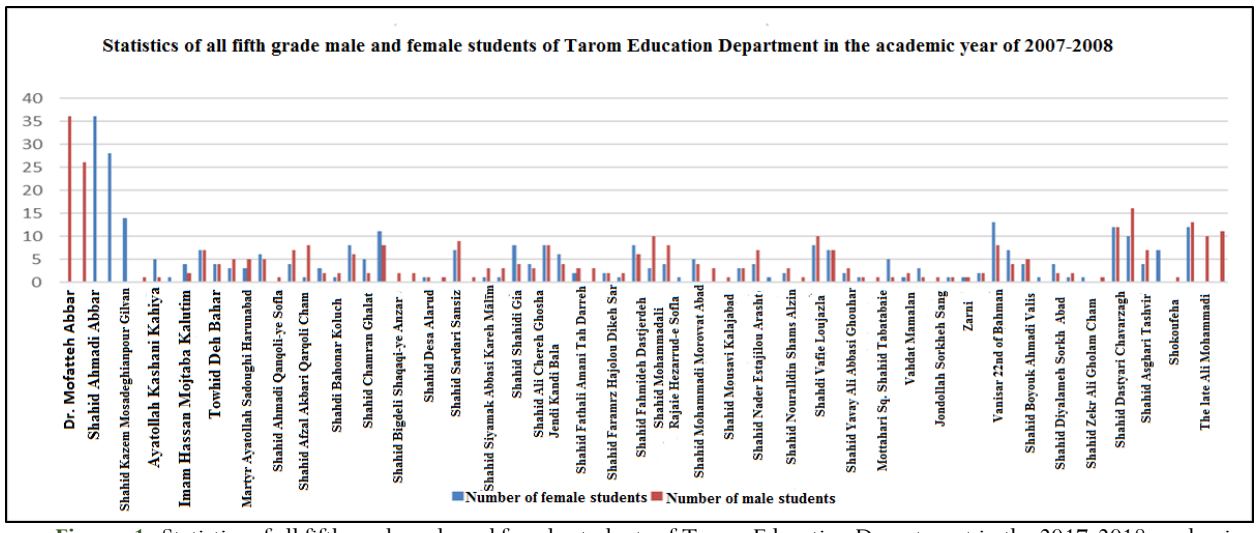

Figure 1- Statistics of all fifth grade male and female students of Tarom Education Department in the 2017-2018 academic year

Sample size and sampling method

Since the research method is quasi-experiential, the number of our samples is limited. Therefore, at first 4 schools were selected using a simple random sampling method, and then a sample of 60 students was selected via the available sampling method. 2 predetermined classes (n = 30) from two schools were selected as the experimental group, and 2 predetermined classes from another two schools (n = 30) were selected as the control group. Both groups (experiential and control) were similar in terms of information level in the experiential science course according to the previous semester average. The averages of this course in the previous semesters in the experiential and control groups were 15.75 and 15.03, respectively.

Validity and reliability of the test

In this research, a scholar-made test has been used. The questions of this test were designed with the cooperation of one of the experienced teachers of the fifth-gradeof elementary school, and then, several experts, educational leaders, and experienced teachers of the fifth-gradeof primary education in Tarom city evaluated its validity. After making the necessary changes, the validity of the test was confirmed by experts.

Cronbach's alpha method was used to evaluate the reliability of the test and through the implementation of a pilot design, 24 questionnaires were distributed among 24 school students other than the experimental group, and the results were analyzed using SPSS software. Cronbach's alpha coefficient was 0.838 for the pre-test, and 0.856 for the post-test, which confirms the test necessary reliability to be applied.

Table 3- Cronbach's alpha coefficient

Cronbach's alpha coefficient	Pre-test	0/838
Cronbach's alpha coefficient	Post-test	0/856

Validation of the scholar-made multimedia software

For optimal validation of the scholar-made multimedia software, experienced supervisors, primary education experts, educational technologists, and experienced teachers were consulted. Some suggestions for optimal use and better performance of this software in schools have been mentioned:

1. Besides teaching the experiential science course, music should be used.
2. In designing pages and layers of the software, cheerful and uplifting colors should be used.
3. The level of questions used in the software should evolve from easy to difficult.
4. Students should be given enough time to use the software.
5. The software usage guide should be used.
6. Qualified and attractive images should be used in the software design. Images along with texts can play a complementary role and may enforce the effectiveness of a text. They can also be used as the main content.
7. Mention valid and active phone numbers in the "Contact Us" or "Contact Information" section. The possibility of making a phone call will have a great positive effect on the credibility of the program. In addition, users' important questions can be answered carefully over the phone by the application designer.

This newly-designed software attempts to fill some gaps in the current Persian-language software of teaching the experiential science course. It has also various capabilities (suggested by educational technologists and experienced teachers) to make teaching the experiential science course more impressive.

Table 4- Several points reviewed by the educational technologists for optimal validation of the scholar-made multimedia software

Characteristic	Explanation	Self-teaching	Teaching aid	Teacher's tool	Encyclopedia	Educational play
Easy installation	Easy installation, the possibility of installing other peripheral software	✓	✓	✓	✓	✓
Help	Instructions for installing and using the software	✓	✓	✓	✓	✓
Interactivity	User-software interaction, role of the user during training	✓	✓	✓	✓	✓
Teaching style	Teaching style (teaching method design)	✓	✓	✓	✓	✓
Accuracy of content	Accuracy of software content (based on source)	✓	✓	✓	✓	✓
User interface	Convenient user interface, page format, graphics and sound	✓	✓	✓	✓	✓
User friendly	User-friendliness (achieving the desired section in the shortest possible time, and the possibility of controlling training speed, et.)	✓	✓	✓	✓	✓
Test	Ability to test the user, variety in the type of test	✓	✓	✓	✓	✓
Prefer tools	Ancillary facilities including workshops and laboratories, image galleries and introducing resources (if needed)	✓	✓	✓	✓	✓
About	Availability of software ID (manufacturers, software contacts and required hardware)	✓	✓	✓	✓	✓

Data analysis method

In this study, data were analyzed by SPSS software at two levels of descriptive statistics (including frequency tables, mean of standard deviation and statistical graphs), and inferential statistics (independent samples T-test).

Statistical method of information analysis

In this section, descriptive statistics were used to analyze the data in order to determine the frequency, median, and mean of students' scores, and inferential statistics from Student's t-test. Normalization and significance of tests were discussed by Kolmogorov-Smirnov test.

Descriptive analysis of data

In Table 5, the status of the research main components, including knowledge, comprehension, application, analysis, composition, evaluation, and the overall score of both the experiential and control group are specified. Descriptive statistics describes and organizes data and by determining statistical indicators define their status (including frequency, mean, median, exponent, variance, standard deviation, mean error, tables and graphs, and etc.)

As Table (4-1) shows, the average total post-test score of the experimental group (19.07) has increased compared to the control group (15.04). This difference was due to using the scholar-made multimedia software in teaching the experiential science course. Also in the cognitive dimensions, the average post-test scores of all components (except "composition") had increased in the experimental group more than the control group.

Table 5- Frequency distribution, mean and standard deviation of the main research components

Group	Sub-groups	Variables	Frequency	Min	Max	Mean	Sd
Experimental group	(pre-test)	Knowledge	30	0.00	5.00	2.56	1.43
		Comprehension	30	0.00	5.00	2.44	1.78
		Application	30	0.00	6.00	2.86	1.69
		Analysis	30	0.00	5.00	2.70	1.87
		Composition	30	0.00	5.00	2.46	1.85
		Evaluation	30	0.00	6.00	1.66	1.19
		Total score	30	6.75	18.75	14.68	1.57
	(post-test)	Knowledge	30	0.00	6.00	2.46	1.81
		Comprehension	30	1.00	6.00	3.26	1.46
		Application	30	2.00	6.00	3.86	1.30
		Analysis	30	2.00	6.00	2.95	1.51
		Composition	30	2.00	6.00	2.41	1.43

		Evaluation	30	1.00	6.00	4.13	1.89
		Total score	30	12.55	20.00	19.07	1.57
		Knowledge	30	0.00	5.00	2.46	1.54
		Comprehension	30	0.00	5.00	2.63	1.47
		Application	30	0.00	6.00	2.63	1.75
	(pre-test)	Analysis	30	0.00	6.00	2.40	1.56
		Composition	30	1.00	5.00	2.63	1.89
		Evaluation	30	0.00	6.00	1.90	1.67
		Total score	30	9.00	19.00	14.65	1.66
Control group		Knowledge	30	0.00	6.00	2.26	1.94
		Comprehension	30	1.00	6.00	2.56	2.01
		Application	30	1.00	6.00	3.00	1.55
	(post-test)	Analysis	30	0.00	6.00	2.60	1.95
		Composition	30	1.00	6.00	2.42	1.98
		Evaluation	30	1.00	6.00	2.56	1.87
		Total score	30	8.78	20.00	15.04	1.88

Inferential Analysis of Data

Testing research questions

The purpose of this study is to determine the effectiveness of using the scholar-made multimedia software on the academic achievement of the experiential science course for fifth-grade elementary students in Tarom city in the 2017-2018 academic year. Therefore, the effect of one variable (scholar-made multimedia software) on several variables (knowledge, comprehension, application, analysis, composition, evaluation, and overall score) should be determined between the two experiential and control groups. In this situation, the best statistical method is to compare the means of two groups' scores. A comparison of means has three basic assumptions that we briefly describe. If these three assumptions are met, the independent t-test will be used; otherwise, the Mann-Whitney test or the independent t-test - but from the data of the second line (which belongs to when groups' variances are unequal) should be applied. The three basic assumptions of the independent t-test are the variables' quantity (interval or ratio), the groups' independence, and the equality of groups' variances.

1. The variables (knowledge, comprehension, application, analysis, composition, evaluation, and overall score) are quantified.
2. Groups' independence (experimental group and control group)
3. Equality of groups' variances: Levin test is used to examine the equality of groups' variances

Table 6- Equality of groups' variances in the pre-test

Variable	Value of Levene's f	fd 1	fd 2	Significance level of Levene's f
Knowledge	0.231	1	58	0.633
Comprehension	0.149	1	58	0.701
Application	0.307	1	58	0.582
Analysis	0.451	1	58	0.504
Composition	0.055	1	58	0.816
Evaluation	0.487	1	58	0.891
Total score	0.538	1	58	0.540

In the above table, a significance level greater than 0.05 indicates equality, and less than 0.05 shows a difference in group variance. The significance level of Levene's f in Table 2-4 in all variables is more than 0.05, which shows that the variances in the experiential and control groups are equal in all variables. Therefore, a parametric test (independent t-test) can be used to analyze research questions. We now turn to research questions.

In analyzing the questions:

- Null question/hypothesis indicates that there is no significant difference between the variables (H0 = 0)
- Research question/hypothesis indicates a significant difference between variables (H0≠0)

This study contains one main question and six sub-questions which are tested through inferential statistics index (independent t-test).

Testing the main question

Main question: Does the use of the scholar-made educational software have an effect on the academic achievement of the experiential science course for the fifth-grade elementary students in Tarom city in the academic year 2017-2018?

Since the significance level of Levene's statistic in Table (4-4) is less than 0.05 (5%), the data of the second line of this table should be used. Therefore, because on the one hand, the calculated t is equal to 9.102 and more than the table critical t (1.98) with a freedom degree of 44.36, and on the other hand, the significance level of the t-test is less than 0.05, it is concluded that the means' difference between the two experiential and control groups is significant. Therefore, the null question is rejected and the main research question is confirmed. In other words, applying the scholar-made multimedia software had a significant effect on the

academic achievement of the experiential science course for the fifth-grade elementary students in Tarom city in the academic year 2017-2018. For this reason, the rate of academic achievement of the students in the experimental group improved after using the scholar-made multimedia software. These changes are clearly shown in Figure (4-1).

Table 7- Frequency, mean and standard deviation of the academic achievement in the groups related to the main question

Statistical indexes – construct's name	Groups	Numbers	Mean of pre-test	Mean of post-test	Mean difference between pre-test and post-test	Standard deviation
Main questions of academic achievement	Experimental group	30	14.68	19.07	4.39	1.57
	Control group	30	14.65	15.04	0.39	1.88

Table 8- Independent t-test assumptions for the main question

Index	Levene's test for variance equivalence		(t test for mean equivalence)			
Main question (academic achievement)	Levene's F	Significance level of Levene's F	Calculated T	Table critical T	Freedom degree	Significance level of T
The variance is assumed to be equal	6.097	0.017	9.102	1.98	58	0.00
The variance is assumed to be unequal			9.102	1.98	44.36	0.00

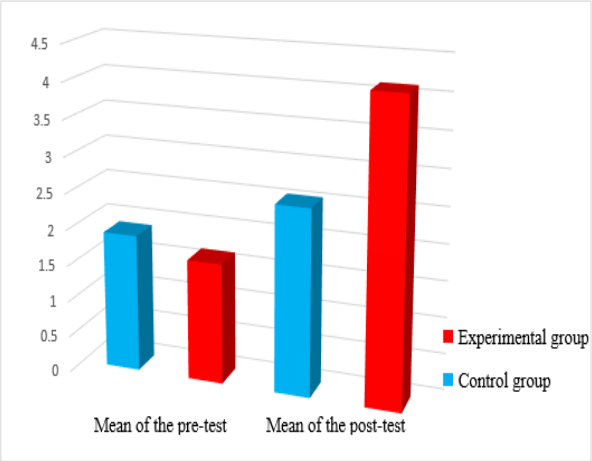

Figure 2-The difference between the mean scores of pre-test and post-test in the experiential and control groups in the academic achievement

Testing the Sub-questions

Sub-question 1: Does the use of the scholar-made multimedia software have a positive effect on learning the experiential science course in the cognitive field and at the "Knowledge" level?

Since the significance level of Levene's statistic in Table (4-6) is less than 0.05, the data of the second line of this table should be used. Therefore, because on the one hand, the calculated T is equal to 0.629 and less than the table critical t (1.98) with a freedom degree of 58, and on the other hand, the significance level of the t-test is more than 0.05, it is concluded that the means' difference between the two experiential and control groups is not significant. Therefore, the null question is confirmed and the sub-question is rejected. In other words, applying the scholar-made multimedia software did not have a significant effect on learning the experiential science course in the cognitive field and at the "Knowledge" level. In fact, the learning rate of the experiential science course did not ameliorate in the experimental group after using this multimedia software. These changes are clearly shown in Figure (4-2).

Table 9- Frequency, mean and standard deviation of "Knowledge" component in the groups related to the first sub-question

Statistical indexes – construct's name	Groups	Numbers	Mean of pre-test	Mean of post-test	Mean difference between pre-test and post-test	Standard deviation
Main questions of academic achievement	Experimental group	30	2.56	2.46	-0.1	1.82
	Control group	30	2.46	2.26	0.00	1.72

Table 10-Independent t-test assumptions for the first sub-question

Index	Levene's test for variance equivalence		(t test for mean equivalence)			
First sub-question ("Knowledge" component)	Levene's F	Significance level of Levene's F	Calculated T	Table critical T	Freedom degree	Significance level of T
The variance is assumed to be equal	0.007	0.300	0.629	1.98	58	0.532
The variance is assumed to be unequal			0.629	1.98	57.93	0.532

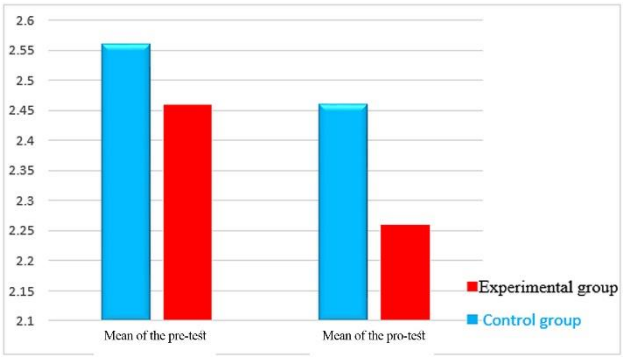

Figure 3- The difference between the mean scores of pre-test and post-test in the experiential and control groups in the "Knowledge" component

Sub-question 2: Does the use of the scholar-made multimedia software have a positive effect on learning the experiential science course in the cognitive field and at the "Comprehension" level?

Since the significance level of Levene's statistic in Table (4-8) is more than 0.05 (5%), the data of the second line of this table should be used. Therefore, because on the one hand, the calculated t is equal to 2.281 and more than the table critical t (1.98) with a freedom degree of 58, and on the other hand, the significance level of the t-test is less than 0.05, it is concluded that the means' difference between the two experiential and control groups is significant. Therefore, the null question is rejected and the sub-question is confirmed. In other words, applying the scholar-made multimedia software did not have a significant effect on learning the experiential science course in the cognitive field and at the "Comprehension" level. In fact, the learning rate of the experiential science course improved in the cognitive field and at the "Comprehension" level in the experimental group after using this multimedia software. These changes are clearly shown in Figure (4-3).

Table 11- Frequency, mean and standard deviation of "Comprehension" component in the groups related to the second sub-question

Statistical indexes – construct's name	Groups	Numbers	Mean of pre-test	Mean of post-test	Mean difference between pre-test and post-test	Standard deviation
Main questions of academic achievement	Experimental group	30	2.44	3.26	0.82	1.46
	Control group	30	2.63	2.56	-0.07	1.38

Table 12- Independent t-test assumptions for the second sub-question

Index	Levene's test for variance equivalence		(t test for mean equivalence)			
Second sub-question ("Comprehension" component)	Levene's F	Significance level of Levene's F	Calculated T	Table critical T	Freedom degree	Significance level of T
The variance is assumed to be equal	0.027	0.869	2/281	1.98	58	0.03
The variance is assumed to be unequal			2/281	1.98	57.414	0.03

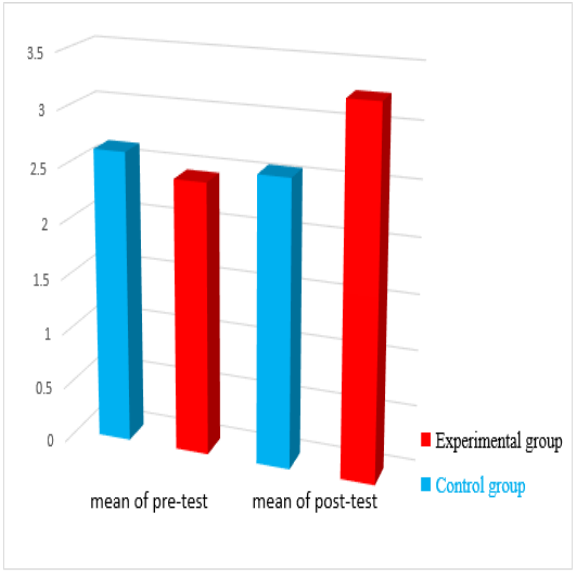

Figure 4- The difference between the mean scores of pre-test and post-test in the experiential and control groups in the "Comprehension" component

Sub-question 3: Does the use of the scholar-made multimedia software have a positive effect on learning the experiential science course in the cognitive field and at the "Application" level?

Since the significance level of Levene's statistic in Table (4-10) is more than 0.05 (5%), the data of the first line of this table should be used. Therefore, because on the one hand, the calculated t is equal to 3.928 and more than the table critical t (1.98) with a freedom degree of 58, and on the other hand, the significance level of the t-test is less than 0.05, it is concluded that the means' difference between the two experiential and control groups is significant. Therefore, the null question is rejected and the sub-question is confirmed. In other words, applying the scholar-made multimedia software had a significant effect on learning the experiential science course in the cognitive field and at the "Application" level. In fact, the learning rate of the experiential science course improved in the cognitive field and at the "Application" level in the experimental group after using this

multimedia software. These changes are clearly shown in Figure (4-4).

Table 13-Frequency, mean and standard deviation of "Knowledge" component in the groups related to the third sub-question

Statistical indexes – construct's name	Groups	Numbers	Mean of pre-test	Mean of post-test	Mean difference between pre-test and post-test	Standard deviation
Main questions of academic achievement	Experimental group	30	2.86	3.86	1.00	1.30
	Control group	30	2.63	3.00	0.37	1.55

Table 14- Independent t-test assumptions for the third sub-question

Index	Levene's test for variance equivalence		(t test for mean equivalence)			
Third sub-question ("Application" component)	Levene's F	Significance level of Levene's F	Calculated T	Table critical T	Freedom degree	Significance level of T
The variance is assumed to be equal	0.020	0.888	3.928	1.98	58	0.000
The variance is assumed to be unequal			3.914	1.98	56.029	0.000

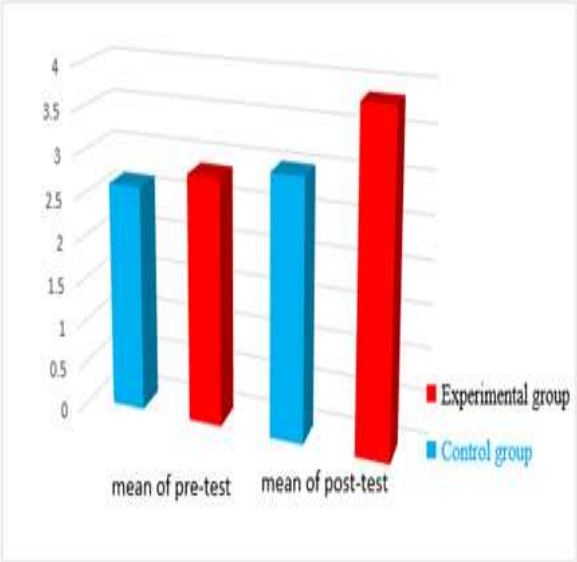

Figure 5- The difference between the mean scores of pre-test and post-test in the experiential and control groups in the "Application" component.

Sub-question 4: Does the use of the scholar-made multimedia software have a positive effect on learning the experiential science course in the cognitive field and at the "Analysis" level? Since the significance level of Levene's statistic in Table (4-12) is more than 0.05 (5%), the data of the first line of this table should be used. Therefore, because on the one hand, the calculated t is equal to 2.701and more than the table critical t (1.98) with a freedom degree of 58, and on the other hand, the significance level of the t-test is less than 0.05, it is concluded that the means' difference between the two experiential and control groups is significant. Therefore, the null question is rejected and the sub-question is confirmed. In other words, applying the scholar-made multimedia software had a significant effect on learning the experiential science course in the cognitive field and at the "Analysis" level. In fact, the learning rate of the experiential science course improved in the cognitive field and at the "Analysis" level in the experimental group after using this multimedia software. These changes are clearly shown in Figure (4-5).

Table 15- Frequency, mean and standard deviation of "Knowledge" component in the groups related to the fourth sub-question

Statistical indexes – construct's name	Groups	Numbers	Mean of pre-test	Mean of post-test	Mean difference between pre-test and post-test	Standard deviation
Third sub-question ("Analysis" component)	Experimental group	30	2.70	2.95	0.25	1.51
	Control group	30	2.40	2.60	0.2	1.56

Table 16- Independent t-test assumptions for the fourth sub-question

Index	Levene's test for variance equivalence		(t test for mean equivalence)			
Fourth sub-question ("Analysis" component)	Levene's F	Significance level of Levene's F	Calculated T	Table critical T	Freedom degree	Significance level of T
The variance is assumed to be equal	3.593	0.063	2.701	1.98	58	0.009
The variance is assumed to be unequal			2.676	1.98	51.842	0.010

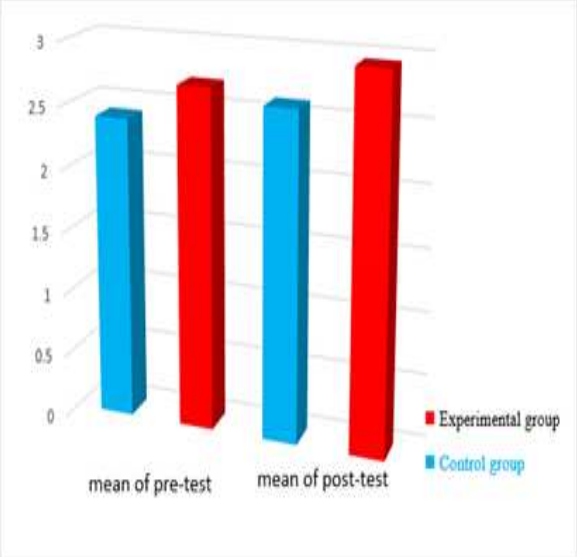

Figure 6- The difference between the mean scores of pre-test and post-test in the experiential and control groups in the "Analysis" component.

Sub-question 5: Does the use of the scholar-made multimedia software have a positive effect on learning the experiential science course in the cognitive field and at the "Composition" level?

Since the significance level of Levene's statistic in Table (4-14) is less than 0.05 (5%), the data of the second line of this table should be used. Therefore, because on the one hand, the calculated t is equal to 0.123 and less than the table critical t (1.98) with a freedom degree of 58, and on the other hand, the significance level of the t-test is more than 0.05, it is concluded that the means' difference between the two experiential and control groups is not significant. Therefore, the null question is accepted and the sub-question is rejected. In other words, applying the scholar-made multimedia software did not have a significant effect on learning the experiential science course in the cognitive field and at the "Composition" level. In fact, the learning rate of the experiential science course did not improved in the cognitive field and at the "Composition" level in the experimental group after using this multimedia software. These changes are clearly shown in Figure (4-6).

Table 17- Frequency, mean and standard deviation of "Knowledge" component in the groups related to the fifth sub-question

Statistical indexes – construct's name	Groups	Numbers	Mean of pre-test	Mean of post-test	Mean difference between pre-test and post-test	Standard deviation
Main questions of academic achievement	Experimental group	30	2.46	2.41	-0.05	1.43
	Control group	30	2.63	2.42	-0.21	1.98

Table 18- Independent t-test assumptions for the fifth sub-question

Index	Levene's test for variance equivalence		(t test for mean equivalence)			
Third sub-question ("Composition" component)	Levene's F	Significance level of Levene's F	Calculated T	Table critical T	Freedom degree	Significance level of T
The variance is assumed to be equal	1.51	0.000	0.123	1.98	58	0.123
The variance is assumed to be unequal			0.124	1.98	43.27	0.124

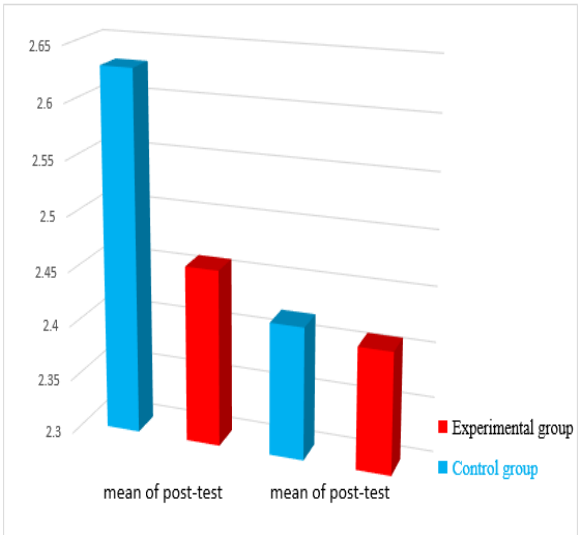

Figure 7- The difference between the mean scores of pre-test and post-test in the experiential and control groups in the "Composition" component

Sub-question 6: Does the use of the scholar-made multimedia software have a positive effect on learning the experiential science course in the cognitive field and at the "Evaluation" level?

Since the significance level of Levene's statistic in Table (4-16) is more than 0.05 (5%), the data of the first line of this table should be used. Therefore, because on the one hand, the calculated t is equal to 3.788 and more than the table critical t (1.98) with a freedom degree of 58, and on the other hand, the significance level of the t-test is less than 0.05, it is concluded that the means' difference between the two experiential and control groups is significant. Therefore, the null question is rejected and the sub-question is confirmed. In other words, applying the scholar-made multimedia software had a significant effect on learning the experiential science course in the cognitive field and at the "Evaluation" level. In fact, the learning rate of the experiential science course improved in the cognitive field and at the "Evaluation" level in the experimental group after using this

multimedia software. These changes are clearly shown in Figure (4-7).

Table 19- Frequency, mean and standard deviation of "Knowledge" component in the groups related to the third sub-question

Statistical indexes – construct's name	Groups	Numbers	Mean of pre-test	Mean of post-test	Mean difference between pre-test and post-test	Standard deviation
Main questions of academic achievement	Experimental group	30	1.66	4.13	2.47	1.44
	Control group	30	1.90	2.56	0.66	1.86

Table 20- Independent t-test assumptions for the sixth sub-question

Index	Levene's test for variance equivalence		(t test for mean equivalence)			
Third sub-question ("Evaluation" component)	Levene's F	Significance level of Levene's F	Calculated T	Table critical T	Freedom degree	Significance level of T
The variance is assumed to be equal	5.717	0.20	3.788	1.98	58	0.00
The variance is assumed to be unequal			3.788	1.98	51.27	0.00

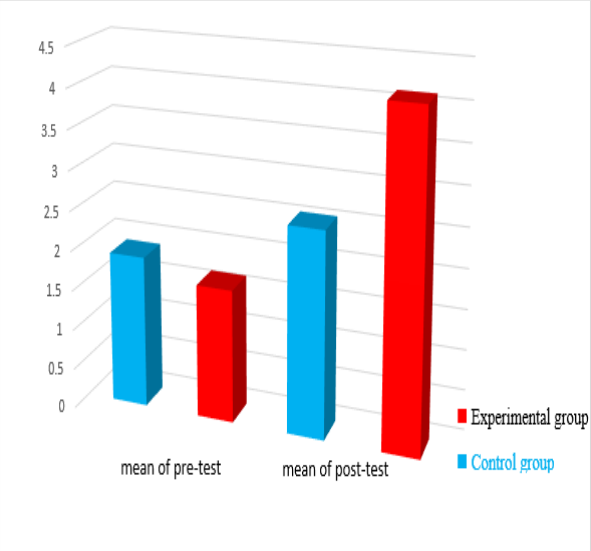

Figure 8- The difference between the mean scores of pre-test and post-test in the experiential and control groups in the "Evaluation" component.

Conclusion

The present study was conducted to investigate the effectiveness of the scholar-made multimedia software on the level of creativity and academic achievement of fifth-grade students in the experiential science course in Tarom schools. The findings confirmed positive outcomes of applying this software for improving students' creativity and academic achievement in the experiential science course.

1. It is not possible to directly compare the findings of the current study with previous ones since no study (as far as we know) has specifically examined the six cognitive levels of Bloom (knowledge, comprehension, application, analysis, composition, evaluation).
2. In all components (except "compositions"), the mean of post-test scores of students in the experimental group had increased more than the control group. Therefore, selecting and applying appropriate educational technology can play an effective role in improving educational quality and productivity. In fact, flourishing students' talents through applying appropriate technology besides traditional teaching methods ameliorate greater productivity though using less financial and human resources.
3. The lowest and highest values of mean difference were at the "Application" (0.25) "Analysis" level (2.47), respectively. Therefore, this newly-designed software has the most impact at the analysis level and the least impact at the application level.
4. Using this software had no effect on the students' learning at the "Composition" level.

These findings are in line with those of Zamani and Kardan (2010), Saffarian et al. (2010), and Heidari et al. (2010) who directly examined the impact of applying multimedia teaching methods on the academic achievement of various courses in different educational levels [8].

Findings of Shubiri and Rafati (2006), Guildford (2012), and Wang et al. (2011) also showed that the use of multimedia teaching methods as well as information and communication technology is beneficial for fortifying learning and academic achievement [9, 10]. In today's world, the importance of teaching science is evident. In fact, developed countries are those that besides having material facilities and modern technologies, benefit from an effective educational system that is successful at producing science by educating intelligent and creative students. Obviously, a functional way to achieve scientific and technical independence is to change and rebuild the educational system.

Previous research shows that teaching the experiential science course in Iran is worrying. The results of the Thames' international studies confirm this. The scholar's observations, during the training courses, as well as the interview results indicated that the students of the experimental groups had satisfactory academic achievement due to the use of this newly-

designed multimedia software. Finally, designing multimedia software has a very decisive role in improving students' learning quality and the success of educational systems. In general, considering the effectiveness of the currently-introduced software, it can be said that the necessity of using educational software is one of the necessities of today's education. Therefore, education officials are advised to:

- Provide in-service training classes for teachers and educators of all levels to learn working with computers and ICDL skills.
- Encouraged and Support teachers and schools that use modern teaching methods (including educational multimedia) or produce their own electronic and multimedia educational content.
- Provide necessary investment for the development and production of multimedia software and supplementary educational books with appropriate quality and in compliance with technical and educational principles and standards, for all educational and age-appropriate levels.
- Meet necessary infrastructure and equipment, including computers, tablets, and smart boards in schools to help them benefit from this newly-designed or other standard educational software.
- Attend the "Objectives of the Fundamental Transformation Document" in order to enforce teachers' and students' abilities, and hold educational competitions in smart schools and workshops and the best producers of electronic contents should be praised.
- Provide incentive regulations for teachers who produce and use educational software to transform their teaching methods especially in the experiential science course, and help to improve students' motivations and academic achievements.

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