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The Effectiveness of the Hologram in Developing Achievement in Science among Middle School Students in the State of Kuwait

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Abstract

The study aimed to reveal the effectiveness of the hologram in the development of achievement in science among middle school students in the State of Kuwait, and to achieve the objectives of the study, the experimental approach was adopted, and the achievement test was prepared from (20) paragraphs, and its validity and stability were confirmed, and the study sample consisted of (60) students who were randomly selected from the sixth grade students for the academic year 2023/202 4 The first semester, the study members were divided into two groups, one of which was experimental, consisting of (30) students who learned using hologram technology, and the control group consisted of (30) students who learned in the usual way, and the results of the study showed that there were statistically significant differences at the level of significance (0.05= α) between the experimental and control groups in performance on the test and for the benefit of the experimental group that learned with hologram technology, and in the light of the results of the study recommended the use of hologram technology in teaching science in particular and for other courses to make learning more interesting and interactive, and to increase knowledge gain and improve achievement among students, as well as to allow the teacher to adapt learning and evaluation methods.

Keywords: Hologram, Achievement, Science.

Introduction

The curriculum is an effective tool in building the personality of learners and seeks to meet the hopes of future generations. Teaching is witnessing clear progress at the global level to keep pace with the scientific and technological developments that have taken place. This progress derives from the nature of science, and science has its structure that distinguishes it from other branches. Holo-technology is one of the modern technological developments that can play an important role in enhancing the learning experience. HoloCRM provides a unique

interactive environment, which contributes to simplifying the learning process and embodying the information in three dimensions, which leads to improving interaction and enhancing students' understanding. This research reviews its effectiveness in enhancing the learning experience and improving academic achievement.

The information and communication technology revolution has led to the development of strategies and methods for the educational-learning process that rely on integrating technology into education to improve it, develop the learning environment, and increase its efficiency. As result, those with an interest regarding education in light of the scientific and technological development witnessed in this era, and the accompanying knowledge explosion, face many challenges that are entrusted with all aspects of education. One way to address these challenges is to stay up to date with changes that occur in the field of education, particularly in the areas of curricula and teaching methods (Ahmad & Al-Assaf, 2020)

Technological developments and their environments, such as virtual reality, are key factors in enhancing learning processes. These tools are an effective way to simulate traditional learning environments innovatively and sophisticatedly, regardless of their circumstances or complexity. These technologies allow the creation of diverse learning environments that imitate reality, where environments that the learner cannot access, or experience can be embodied in everyday life. For example, it is difficult for students to realistically experience the space environment within the school (Al-Khatatbah et al., 2020)

In this context, the role of the three-dimensional virtual learning environment comes to form a learning environment that approaches ordinary reality and enables the individual to interact with it as if in the natural environment. Modern hologram technology is one of the applications of these technologies, as it stands out for its ability to create three-dimensional images that appear in space in a way that illusions reality. The basic distinction between holograms and other VR technologies is that holograms appear in space realistically, while in other VR technologies the images are on walls or objects. Thus, the importance of using these techniques is shown in enriching and facilitating the learning process and enabling students to understand concepts more deeply through their realistic interaction with the educational environment (Gawish & Hashem, 2019)

In this context, (Noghani et al.,2020) stressed the importance of employing hologram technology in the educational process, as it works to meet the educational needs of learners, achieve their desires and motivate them towards learning and creativity by simplifying the educational material in the form of an interesting presentation, and makes an impact of learning in the mind of the student, which motivates him to participate and interact, and to be able to face, solve and overcome all challenges, through the development of thinking and its patterns in general.

Khan et al (2020) stated that hologram technology can support the learning process so that students have the advantage of seeing a component in three dimensions using holographic technology. It enables a 360-degree hologram to be displayed allowing students to walk around the scene. The hologram also adds depth and a sense of reality to enhance the learning process. Holography has the potential to reproduce reality and is a great way to motivate students.

Hologram technology and science teaching can be intertwined in several ways, as holographic technology can be used as an innovative teaching tool to improve the student learning experience in different fields of science. Here are some possible relationships between hologram technology and science teaching:

- Clarifying difficult concepts: Holograms can be used to better illustrate complex scientific concepts, such as the molecular structure of chemical compounds or physical phenomena such as clouds and precipitation in Earth science.
- Real-life interaction experience: Holograms can be used to create 3D models of scientific interactions and processes, allowing students to better understand the depths of these processes by interacting with models in a realistic way.
- Virtual Trips: Hologram technology can provide virtual trips to important scientific sites, planets, or organisms, allowing students to explore new worlds without having to physically leave the classroom.
- Better data analysis: Holograms can represent scientific data in a tangible way, making analysis and understanding processes easier and clearer for students.
- Stimulate curiosity and exploration: Hologram technology can inspire students and encourage them to explore more of the field of science in an interactive and engaging way.
- Enhancing student interaction: Holograms can be used as a tool for group learning where students can interact with holographic models together, fostering interaction and collaboration in the classroom. Cerezo (2019) confirmed that the hologram technique exposes the learner to objects in a realistic form and in a3D image, by relying on light waves.

Problem Study

The past few years have witnessed a dramatic development in all areas of knowledge, so that the progress of countries is measured not only by the information they possess, but also by what they can organize and use from this information to serve their human society. This can be achieved through an interest in the educational process. Part of this concern is to improve students ' learning outcomes to stimulate them to learn and to develop all kinds of thinking. The problem of research arises through the work of researchers as a teacher of the basic stages, who have noticed a decline in the general level of their learning products and their thinking about the learning of science. In addition, teachers have complained about the difficulty of delivering such complex scientific information to students.

The researcher based this on previous studies, which recommended that technology should be integrated into the educational process in general and that its techniques should be diversified to suit students ' needs, as recommended by the cook ' s studies (2020); Hoon (2019), that the hologram technique should be applied in learning environments and in classroom teaching, since it had a positive effect on boosting motivation and improving achievement, and that a study Fativity & Age (2021) should use the hologram technique to develop thinking skills in general and thinking in particular. The study Fuzhan & Shamri (2021) recommended the importance of holograms in the educational process by adding the element of thrill and pleasure in education.

The First Rhodes Conference (2020) also recommended emphasizing interaction in the virtual learning process and strengthening feedback based on the teacher ' s role in designing and facilitating learning as a partner in the learning process.

Study Questions

- The effectiveness of the hologram in developing achievement in science among middle school students in the State of Kuwait?

Study Importance

The importance of this study stems from two aspects: theoretical and practical, as follows:
The theoretical importance of the study lies in:
The results of the study may help to improve the visual thinking of students through hologram technology.
This study may contribute to raising teachers ' awareness of the need to use technology and its innovations in the educational process to overcome the challenges faced by students in understanding and understanding the educational content.

Increased knowledge of hologram technology and its impact on thinking processes, particularly visual thinking.

- Enriching the Arab Library with studies on the application of hologram technology and the development of visual thinking skills.

The practical importance of the study is as follows:

The importance of the study also comes from the paucity of Arab research in the use of hologram technology to develop visual thinking skills among students in the basic stage.

The study provides a measure of visual thinking skills that may assist researchers in similar studies**.** This study responds to recent trends in education and focuses on thinking skills.

The Limits of the Study

Spatial Boundaries: Saada Bint Auf Intermediate School for Girls /Capital.
Objective Boundaries: The first unit of living organisms was selected from the book of science for the sixth grade, chapter one.

Terms of the Study and its Procedural Definitions

Hologram Technique
He et al (2020) defines it as a technique that allows the reconfiguration of the holographic image in its dimensions and depth to convey a complete picture of it as a three-dimensional object that appears to float in the air as a result of an educational presentation that is similar to the transfer of objects to real reality in front of the eyes of the learners.

First: Hologram Technology

The idea of hologram technology originated in 1947 when holography was reached by Dr. Dinnis Gabour during his work at Thomson-Houston Company, where the main idea was to take three-dimensional photographic images and not only from a distance and one, as happens in ordinary photography, but the application of this idea was delayed until the discovery of laser light in 1960. As a result of his continuous research on the use of lasers in three-dimensional photography, he achieved commercial success so that this technology became a commodity to be traded (Al-Tabbakh & Abdel Ati, 2020)

Hologram technology simplifies and acquires information among students in an easy way and contributes to the embodiment of data and information that are difficult to perceive among students, as this confirmed (Al-Qahtani & Saad,2016) that the hologram has a set of characteristics, including the visibility of the body from all directions, and the clarity of the details of the object.

It also allows the viewer to see the movement of the object or shape and its transformation from one shape to another. It also displays several holograms on a board without overlap between the displayed objects and stores a huge amount of information. This means that it is difficult to lose data as the data of the missing part is retrieved from other parts. (Nawaiseh et al.,2023)

indicates that the hologram has interactive motor and auditory properties, as each hologram cell works to analyze light in the direction of the viewer's eye. Whenever the viewer moves and adjusts his viewing angles, he receives a new set of holograms. Virtual reality can be used in various fields such as scientific education, technical education, general education, and training education. It can be used in multiple fields such as medicine, engineering, and applied sciences. One of the most important modern technologies for virtual reality is holograms that simulate and even surpass real reality, which prompted educators to take advantage of this in the field of science teaching (Al-Hujaili& Ahmed, 2019)

Al-Lahani and Al-Otaibi (2020) conducted a study aimed at identifying the importance of hologram technology in teaching secondary school students in Makkah schools in the Kingdom of Saudi Arabia considering the Kingdom's Vision 2030. To achieve that goal, the study used the descriptive analytical approach, based on a questionnaire consisting of 12 paragraphs, distributed to a sample of 68 secondary school teachers in Makkah schools. One of the most important results of the study was that the importance of hologram technology in teaching secondary school students in Makkah schools considering the Kingdom's Vision 2030 came to a large degree and an arithmetic mean of 4.14 and a percentage of 82.77% from the point of view of secondary school teachers.

The results also revealed that there are statistically significant differences between the estimation of female teachers' grades for the importance of hologram technology in teaching secondary school students attributed to years of experience, and in favor of highly experienced teachers, who have more than 10 years of experience, while there were no statistically significant differences between the estimation of female teachers' grades for the importance of hologram technology in teaching secondary school students attributed to a changing scientific qualification.

Comment on Previous Studies (Gap Table)

After reviewing studies on holograms in education conducted in different environments with different goals, variables and results, the present study is in line with some previous studies in terms of the methodology used. The study is in line with the study of engagement and age (2021) and the study of chef (2020) of fazon and chimney (2021) Abu Odeh (2020) and differs from those in the sample and application environment of the study. The study will take place in Jordan-Crack. The present study also differs in terms of objectives. Some previous studies have aimed at measuring the impact of holograms on the skills of reflection thinking. Some other studies have aimed at measuring the orientations of both teacher and learner towards the application of holograms in some of the curricula. Some of these studies have been used to determine students ' trends, ideas and proposals, such as the study of semanism (2020),

the study of Turk (2021) and the study of the present study in terms of the study of Abode and Akhron (2020) and the study of Hoon (2019) in terms of the study tools used: the present study has been different in its use of visual thinking.

In her knowledge and knowledge, the researcher observed that earlier studies used hologram technology in scientific subjects such as chemistry and biology because they contained purely scientific concepts, which prompted the researcher to use this technique to design a scientific study and simplify its concepts. Previous studies conducted in Jordan, in the knowledge and knowledge of the researcher, noted that the impact of hologram technology had been tested and measured at a higher age, but that its impact on the basic stage had not been measured. The researcher therefore decided to apply this study to the basic stage, particularly the second grade.

Method and Procedures

Methodology of the Study

Based on the nature of the study, the researcher used the experimental approach to suit it for the purposes of the study.

Study Community

The study population consists of all second-grade students in government schools affiliated with the Capital Educational Plan for the academic year 2023-2024, the first semester, and an intentional sample was selected from Saada bunt Auf School due to the availability of appropriate conditions for the application of study tools, and the cooperation of the school administration and second grade teachers with the researcher. The study sample consisted of (60) students. The sample was divided into two experimental and control groups, by (30) students for the experimental group that was taught using hologram technology, and (30) students for the control group that was taught in the usual way.

3 Study Tool

To answer the study questions, the achievement test and the appropriate educational material for the hologram technique were prepared as follows:

Achievement Test

The achievement test was prepared in the unit of characteristics of living organisms and their qualities from the science book according to the teaching method using the hologram technique. The test consists of (20) paragraphs of the multiple-choice type, where the researcher chose the unit of living organisms and their qualities to conform to the period of application of the study, and then formulate the test paragraphs in the light of the educational results. It may be of (20) paragraphs of the multiple-choice type.

Validity of the Questionnaire

The visual thinking scale was presented in its initial form, which consisted of (20) paragraphs to ensure its validity on a group of arbitrators to consider the degree of appropriateness of the test paragraphs for the level of students, and to ensure that the paragraphs are linked to the educational objectives. Considering the observations, some paragraphs were modified in terms of reformulating some paragraphs and clarifying the phrases, and some of the images used were modified to be more appropriate for the age stage of the sample.

Difficulty and Discrimination Coefficients for Testing

An exploratory sample of twenty male and female students, drawn from outside the study sample, had their responses analyzed to determine the difficulty coefficients of the scale's paragraphs, which ranged from (0.30-0.75), and the distinction coefficient, which varied from (0.38-0.82) for each paragraph. The percentage of students who answered a given paragraph incorrectly was used to determine the difficulty coefficient for each scale paragraph, and the discrimination coefficient, which varied depending on the paragraph's coefficient of correlation with the overall score, was determined for each paragraph. The test-retest approach was used to confirm the stability of the study tool by administering the scale to a group of (20) students who were not part of the study sample and then reapplying it after two weeks. Pearson's correlation was then used to assess the stability of the study instrument.

Equivalence of Groups

To verify the parity of the groups, the arithmetic means, standard deviations of the dimensions and the total score of the students of the basic stage were extracted according to the group variable (experimental, control), and to indicate the statistical differences between the arithmetic means, the "T" test was used, and Table (1) shows this.

Table (1)

Arithmetic means, standard deviations, and the "C" test according to the group variable on dimensions and the total score of the test

	Group	NO	M	S D	Value	DF	sig
Knowledge	**Ex**	**30**	**1.67**	**844**	**158**	**58**	**875**
	Co	**30**	**1.70**	**.794**			
Understanding	**Ex**	**30**	**1.87**	**850.**	**.146**	**58**	**.885**
	Co	**30**	**1.83**	**.913**			
The application	**Ex**	**30**	**1.70**	**952**	**.743***	**58**	**460 / 18**
	Co	**30**	**1.53**	**.776**			
Analyze the	**Ex**	**30**	**1.30**	**.702**	**.000**	**58**	**1,000**
	Co	**30**	**1.30**	**750.**			
Composition	**Ex**	**30**	**1.90**	**960**	**148**	**58**	**.883**
	Co	**30**	**1.87**	**.776**			
Evaluation	**Ex**	**30**	**1.33**	**758**	**-338**	**58**	**737**
	Co	**30**	**1.40**	**770.**			
Total before	**Ex**	**30**	**9.77**	**3.350**	**155**	**58**	**878**
	Co	**30**	**9.63**	**3.327**			

Table (1) shows that there are no statistically significant differences (α=0.05) attributed to the group in all dimensions and in the total score of students on the pre-test, and this result indicates the equality of the groups.

Study Variables

The study consisted of a set of variables classified as follows:

1- Independent variable: It consists of one independent variable, which is the teaching strategy and has two levels.

- Teaching using hologram technology.
- Teaching using the usual method.

2- The dependent variable is the achievement test.

Study Design

In the study, the researcher followed the quasi-experimental design based on the existence of an experimental group and a control group of pre-measurement and post-measurement.

Statistical Processing

The SPSS program was used after collecting data and unpacking the responses of the sample members to the pre and post measurements to answer the study question. **What is** the effectiveness of the **hologram in developing achievement in science among middle school students in the State of Kuwait?**

To answer this question, the arithmetic means and standard deviations of the grades of the students of the basic stage on the achievement test in the pre and post-test were calculated according to the group (experimental, control), as shown in Table No. (2):

Table (2)

Arithmetic means and standard deviations of the grades of the students of the basic stage on the achievement test - for the pre and post measurements according to the group (experimental, control)

		Pre-test		**post-test**	
HSA Group	No	M	SD	M	SD
Experimental	30	9.77	3.350	16.90	2.796
Control	30	9.63	3.327	11.37	899

It is clear from Table (2) that there are substantial differences between the computational circles of the grades of the students of the basic stage on the test in the pre- and post-measures according to the group (experimental, control). To find out whether these fundamental differences are statistically significant, the accompanying one-way analysis (One-way ANCOVA) was used for the post-measurement of the visual thinking skills scale according to the group (experimental, control) after neutralizing the impact of their pre-measurement. The following is a presentation of these results as shown in Table (3):

Table (3)

The results of the accompanying one-way analysis (One-way ANCOVA) for the post-measurement of the grades of the students of the basic stage on the test as a whole for the total after neutralizing the impact of the pre-measurement on them

Source of variance	Sum of squares	DF	SUM OF SQUARES MEAN	Value Feddan	Significance level	η^2
Pre-test	465	1	465	040	.843	.001
HSA Group	484	1	484	169	.000	407
Error	667	57	.705			
Nephrology	Nine-thirty-three.	59				

It is clear from Table (5) that there are statistically significant differences at the level of significance (α=0.05) in the grades of the students of the basic stage on the scale of visual thinking skills according to the group (experimental, control). The value of (F) reached (39.169) with a statistical significance of (0.000), which is a statistically significant value, which means that there is an effect for the group and to determine in favor of whom the differences are attributed, the adjusted arithmetic averages and standard errors were extracted according to the group, as shown in Table (4). The magnitude of the impact of the teaching method was significant; the value of the η^2 square explained (40.7%) of the interpreted (predicted) variation in the dependent variable, the test.

Table (4)

Adjusted arithmetic means and their standard errors for the total score of the test according to the group (experimental, control)

Group	Adjusted Dimensional Arithmetic Average	Standard error
Experimental	16.9	- 625.
regulator	11.4	- 625.

The results in Table (4) indicate that the differences were in favor of the experimental group who were exposed to the use of hologram technology compared to the members of the control group.

The results show that the superiority of the experimental group over the control group is attributed to the teaching method, which indicates the effectiveness of the hologram method in stimulating the motivation of students towards learning, by simplifying the information in terms of recognizing the displayed form, and the hologram technology provides an improved interaction between the learner and the content. Students can interact with 3D objects and difficult concepts more effectively, which contributes to deepening understanding and stimulating curiosity and exploration. Hologram technology has achieved a better level of performance in promoting recall and retrieval. This is confirmed by previous studies, including the study of (2019 Ramachandiran,) (Bani Ahmad,2024) that hologram technology can help improve retrieval and recall of educational content, as a result of unique interaction with 3D elements.

The study of (Al-Qudah, 2022) confirms the enhancement of motivation and pleasure levels in the learning process, where students live unique and exciting learning experiences. The

results also explain the importance of the interactive learning environment and its effectiveness in building knowledge and understanding the educational content in a simplified way that is easy for students to understand.

Recommendations

Considering the above discussion of the results, the researcher makes recommendations as follows:

- Employing the use of hologram technology in teaching science because of its effective role in the educational process.
- The importance of the use of means, tools and modern learning strategies by middle and high school teachers, in order to attract the attention of students and increase their interaction.

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