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THE EFFECTIVENESS OF USING INTERACTIVE GEOMETRY PROGRAMS IN VISUAL-SPATIAL INTELLIGENCE AMONG MIDDLE SCHOOL STUDENTS IN MATHEMATICS

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Abstract:

The current research aims to recognize the effectiveness of interactive engineering programs in spatial visual intelligence in the middle stage of mathematics and to achieve the research objective. The researchers adopted the experimental design with the dimensional test of two groups (Experimental Group - Control Group) with partial control, as the research community is made up of middle first grade students in government daytime middle and high schools affiliated to the Directorate of Education of the Holy Province of Karbala/District of the Center, and the research sample was deliberately selected from middle first grade students in (Medium martyr Abu Ma 'ali for Boys) of the Directorate of Education of Karbala Governorate/District of the Center, where the two researchers conducted parity in some variables: (Previous academic achievement - Previous knowledge test - Smart test - Time life), In order to achieve the research objective, the two researchers analyzed Chapter V and VI of the Mathematics Book of the First Grade Intermediate to Measure Visual-Spatial Intelligence. Having ascertained the indications of validity and consistency of the test and statistical analysis of its vertebrae, the test constant coefficient prepared (0.79), which is a good constant coefficient, After completing the teaching of the content of the research subject according to the time set for the experiment and for the two research groups applied the spatial visual intelligence test on 25/4/2024, where the result of the research was shown (The students of the experimental group who studied according to the interactive engineering programs outperformed their peers in the control group who studied according to the usual route in the visual intelligence test from my place) In the light of the research's findings and conclusions, the two researchers presented a set of recommendations and suggestions.

Keywords: Interactive engineering programs, visual spatial intelligence, mathematics material

First: Problem of research:

Despite the evolution of modern teaching strategies that emphasize the activation of all senses, especially the sense of vision, because of their role in education through the use of images, colors and maps in their multiple forms, objects and graphic formats, However, the teaching methods used in our schools still adopt the verbal aspect without the other aspects and emphasize the theoretical aspects based on conservation, indoctrination and retrieval rather than thinking, creativity and innovation resulting in the neglect of other non-verbal mental abilities. It also does not help to develop the intelligence of the learner, especially the visual-spatial intelligence, which is an important intelligence. It is necessary to pay attention to the visual effects of teaching because mathematics science just needs to teach knowledge using tools and means to bring the image of this knowledge closer, as confirmed by the American National Council of Mathematics Teachers. (NCTM,2000) Some pupils find it difficult to find the flat picture of three-dimensional forms and represent them in the bilateral dimension because of their inability to visualize the invisible aspects of the forms (Ateef, 2012, p.23), because of the advancement in education technology, it has become easy to use modern methods and techniques that increase the effectiveness of students and gain them multiple skills and better use their senses from observing, verifying, actively participating and highlighting the skills they possess and helping to make learning more efficient and effective to achieve better education in the shortest possible time and less effort because it promotes them

to discover the diverse concepts, universalization and application of mathematics. (NCTM) is the largest international sports educators' body to develop mathematics education and learning on (Technical principle) and the need to use technology to teach and learn mathematics because it has a great impact on improving students' learning. Several studies have also pointed to the use of interactive software in engineering teaching to address the difficulty of learning engineering, which may be a direct reason for students' low achievement (Papadopoulos & Dagdilelis, 2008) and Erbas & Yenmez, 2011). From this logic arose the idea of research aimed at identifying (what is the effectiveness of using interactive engineering programs in visual spatial intelligence in middle-level students in mathematics).

Second: The importance of research:

1- Technical and technological advances in the educational process
2- Helps develop the educational process in line with modern educational trends that seek to use modern teaching methods and strategies (to improve its quality and quality of education)
3- Encourage teachers to use interactive engineering programs (software) in teaching mathematics through visual spatial intelligence
4- Research results may help develop technology-based teaching methods as an alternative to the traditional method
5- Lack of an Iraqi study by researchers on the effectiveness of interactive engineering programs in visual spatial intelligence in middle-level students in mathematics

Third: Research Objective:
The research aims to recognize the effectiveness of interactive engineering programs in visual spatial intelligence at the middle level in mathematics

Fourth Research hypotheses:
To achieve the research objective, the following zero hypothesis was formulated:

1- There is no statistically significant difference at an indicative level (0.05) between the average grades of the pilot group students studied using the interactive engineering programs and the average scores of the control group students studied using the usual method in the spatial visual intelligence test

Fifth: Limits of research:
THE RESEARCH WAS LIMITED TO:
1- Spatial Limits/Middle First Grade Students in Karbala Holy Governorate Education Directorate
2- Time limits/second semester of the school year 2023-2024
3- The limits of the article/subjects of the two chapters (Chapter V - Engineering) and (Chapter VI - Measurement, Spaces and Sizes) of the math book for the first middle grade, I 6, 2023 AD, to be taught by the Ministry of Education
4- Interactive engineering software (GeoGebra, Cabri 3D, Geometers Sketch Pad (G.S.P).

Sixth: efinition of terms:
1- Interactive engineering programmes: known by the French National Centre for Science (CNRS,2005) as: -
"A dynamic computer interactive environment through which two and three-dimensional shapes and objects can be created and displayed and seen from more than one side and the characteristics of the shapes and relationships between them are explored" (Sophie & Rene, 2005, p5).
2- Visual spatial intelligence: Cardener,1983 knew it: -
"The ability to see the visual world accurately and to transform or renew the manifestations of this world and to realize the visual and spatial information and the ability to perceive internal images and intellectual fantasies and to think about the movement and positions of things in a vacuum. Sensitivity includes colors, lines, shapes, space and relationships between these elements, as well as the ability to visually visualize ideas of a visual or spatial nature as well as self-orientation "(Youssef, 2010, p. 38).
The researchers know the visual-spatial intelligence: the degree to which the research sample students receive by answering the paragraphs of the visual-spatial intelligence test prepared for this purpose when applied at the end of the research period

Background Theory and Previous Studies
First: theoretical background -
First Axis: Interactive Engineering Programs
First: His concept:
The United States National Council of Mathematics Teachers (NCTM) through the use of technology was invited to develop some strategies that specialize in teaching mathematics in the form of computer and its various interactive software so that all students can receive high-level mathematics educational programs. By visually reflecting mathematical ideas and facilitating the organization and analysis of data and the accurate and efficient implementation of calculations of technology support for students' learning (NCTM, 2000).

Louis Cohen describes interactive engineering programs as one of the teaching techniques used in teaching and practice on basic skills. Where it can more control their learning process, it is effective in improving students' learning speed. Whether it is related to the planning and implementation of math classes efficiently by the teacher or the development of mathematical concepts and diverse thinking skills of students, As well as the use of such software at the level of self-learning or group learning within the classroom (Sroor, 2009, p. 371).
"Shehta, 2020" means engineering interactive programs as the set of programs available via the web (Internet) Through which students can create and draw two-dimensional and three-dimensional engineering forms and view them from more than one side and conduct engineering operations in an easy way through the tools provided by the program to reach the educational goals to be achieved. Such programs are characterized by the availability of elements of excitement and attractiveness through colors, movement, enthusiasm and desire to continue learning (shehata, 2020, p. 389).

Second: Characteristics of interactive engineering programmes

1- Availability: interactive software is available in more than one image and includes many visual thrills
2- Capacity: Interactive engineering programs constitute a large amount of information
3- Interactive: The learner's ability to use internal links to navigate between programmes and receive feedback
4- Multiplicity, diversity and complementarity: Interactive engineering programs include many audiovisual thrills
5- Individual: The interactive programs are based on their individual learning design, i.e. the learner's ability to learn according to his mental abilities, abilities and aptitudes
6- Easy navigation: User can easily navigate and access information within interactive engineering programs
7- Stirring and attracting the attention of learners: due to the interactive engineering programs' interaction, freedom of movement and feedback (marei, 2009, p. 49-53)

Third: Types of interactive engineering programs used to teach mathematics:

There are some educational programs that are used to teach sports subjects that include both engineering, algebrator and measurement (Autograph, GeoGebra,Cabri3D, G.S.P, Minitab, Advanced Grapher, Algebrator, Math X-pert) and online interactive programs that include (Phet, Evlm, interactive mathematics, interactive visual, interactive visual, interactive
Below will be some interactive engineering programs that will be used and applied in teaching the content of mathematics subjects, among the most prominent (GeoGebra,Cabri3D, G.S.P)

1- GeoGebra

A dynamic multi-window mathematics program that combines engineering, algebra and calculus software GeoGebra was designed by Markous Hohenwarter in 2001 as a master's degree project at Salzburg University in Austria. The name was introduced by combining the words Gebra and Geometry and was then published electronically as a result of the World Teaching Program in 2002. The software can also be installed on many tablets and personal computers and can be installed on mobile devices in addition to the clear information it gives through numbers and charts that are essential in understanding mathematical concepts (Hohenwarter & Lavicza, 2007, p. 22). GeoGebra returns from interactive programs based on global standards of mathematics in support of the curriculum to be taught and approved by the Ministry of Education, It also represents a set of tools that contribute to the student's acquisition of sports skills. The program includes all the necessary aids to make the learning process easy and interesting. The student constantly builds his new learning on his previous learning. The programme covers most of the themes identified by the National Council of Mathematics Teachers (NCTM) for content in addition to verbal issues and as it covers the axes of engineering, algebra and measurement is a program designed to enable the student to understand theories and facts through practical application and the discovery of concepts himself (Al Jaser, 2011, p. 73).
There are three main scientific possibilities for GeoGebra's mathematics education and learning programme:
1- Representation and presentation tool: geometric representation, algebraic representation, numerical representation, dynamic representation and linking representations
2- Modeling tool: dynamic buildings and learning through discovery and experience
3- Written Instrument: Building and Participating in Materials through the Online Community and Scientific Research for Learning and Teaching (Al-Kubaisi and Al-Manazi, 2016, p. 6).

2- Cabri 3D software:

A Cabri3D programme was established in the research laboratory in France, called the National Centre for Scientific Research (CNRS) in collaboration with the University (Joseph Fourier) in the city of Grenoble in 1985 when Jane-Marie Labord set out to make two-dimensional engineering easier to learn and more fun to teach (Sophie & Rene, 2005, p5) (Kosa & Karakus, 2010) sees Cabri3D of the first approved programs produced from dynamic engineering programs through the presentation, creation and treatment of three-dimensional geometric forms (Kosa & Karakus, 2010, p1386). (alblowi,2012) describes the program Cabri3D as the first approved program produced from dynamic or mobile engineering programs specializing in the teaching of level engineering and is also the most common and used program.

Some studies and global research have confirmed the efficiency of this program in teaching engineering and mathematical proof in many countries of the world because of the enormous potential it enjoys. The Cabri3D program also provides students with an engineering environment through which they can establish engineering forms and perform various measurements. The dynamic nature of the drag feature is the most important distinction this program distinguishes from other non-dynamic engineering programs because it enables the student to see mathematics as a moving system and also enable him to view geometric representations as if they are models viewed from different sides (Omar, 2014, p. 20-21).

2.1- Characteristics of the Cabri3D Program:

1- Interactive and dynamic: The student discovers engineering in an active and interactive manner. The engineering form becomes mobile on the screen and can be changed and rotated in all directions
2- Saving time: The program helps to create engineering formats at the lowest time and thus saves longer time to learn and teach the characteristics of the formats
3- Simplicity: Software tools provide the possibility of simply drawing, building and drawing engineering constructions
4- Stability and accuracy: structured engineering forms and measurements are characterized by health and accuracy
5- Ease of Use: The program interacts with the user at each step so that the program guides the user during the implementation through short messages (Harrsia, 2008, p. 19).

3- Geometers Sketch Pad (G.S.P):

Geometers Sketch Pad was first introduced in the United States in 1991 by its designer Nicholas Jackiw and was based on the idea of the need to employ and use computer technology in education, where the program was developed as part of a visual engineering project (Visual Geometry Project), where Nicholas Jackiw made serious programming until he arrived at the initial version of it and returned the copyright of the program to the American company Key Curriculum Press (Faraj, 2017, p. 38-42).
Geometers Sketch Pad is a modern engineering program that develops thinking and problem solving among students and contributes to better mathematics learning. It is also described as an open electronic learning environment that enables the user to draw geometric shapes with high accuracy and helps represent some geometric ideas using geometric tools available in the toollist. It is also characterized by its automatic retractable in all screen deferrals and whenever shape attributes change, (mersal,2020 p249)

3.1- Functions provided by Geometers Sketch Pad:

1- Accuracy of construction: It is the exact origin of any construction, whether in shapes or measurements. It provides accuracy in fees. It retains the same features of the shape when moved from one place to another with accuracy of measurements.
2- Perception: The dynamic of the program helps to know what is meant in fact, the perception itself is a powerful tool for solving problems, where it allows to verify the similarity and difference without intermediary between them
3- Exploration: Definitions, theories and evidence are given in traditional engineering and problems to be proven, but this program is well suited to explore and discover relationships easily
4- Remittances: The program provides direct visual transfers in front of the learner
5- Logic: G.S.P has the advantage of tracking the location of any object to show how it was created it is easy and straightforward to describe a point and move it while it was difficult for the student to imagine it
6- Simulation: The engineering program provides simulation of the original shape and imitation through drag and animation (Drawsha, 2014, p. 19-20).

The researchers used GeoGebra, Geometers Sketch Pad in the current study for the following reasons:

1- Availability and ease of loading and downloading software on tablets, computers and telephones in school and at home
2- Suitability of Programmes Objective of study
3- Easy Software Handling
4- The absence of a study within Iraq on the effectiveness of the programs on visual spatial intelligence

Second axis: Visual spatial intelligence.

First: His concept: -

Gardner indicates that intelligence is built or synthesized and has a scope that expresses organized activities within a culture, Where the range can be identified by using some type of intelligence, He also pointed out to intelligence that it represents a capacity with a content of processes that can be inferred by differentiating between the term "intelligence" and the style pattern, that is, by observing the situation in which an individual passes through or evaluates it. Gardner describes intelligence as the ability to solve problems and create productions with values in a culture or other cultures as different in terms of their orientation, values and personalities (faris,2006 p4)
Spatial visual intelligence is one of the multiple types of intelligence that Gardner has worked on and evolved and Gardner knows that it is the ability to accurately perceive the world of spatial visual, as in the case of a mentor and a hunter, to make transfers based on those realizations, as in the case of an interior designer, architect and artist, and

so an intelligence that requires sensitivity to color, line, field, nature and space They are understood in pictures (Pumping, 2017, p. 33).
(Jurisprudence, 2012) Visual spatial intelligence(alfakhi,2012) at its simplest level is defined as the ability to recognize and respond to different colors and shapes and also involves moving from one place to another and also describing it in its complex level as the ability to reproduce and produce subjects and scenes through the drawing, sculpture, imaging and reading of certain tasks Different and specific mapping to determine a particular path or encode certain places and create artworks and understand abstract graphics or spatial images such as engineering drawings and understand and produce complex visual-spatial relationships between forms (jurisprudence, 2012, p. 66).

Second: Optical spatial intelligence skills: -

1- Optical Shape Recognition: Optical Shape Recognition, Nature Determination, Dimension and Differentiation from Other Forms and Visual Shape whether Symbol, Image, Graphic or Maps
2- Linking relationships in optical form: the ability to link optical shape relationships and describe them in a vacuum and study bilateral and three-dimensional forms
3- Visual Shape Analysis: The ability to focus and pay attention to the details and removal of shapes and elements and to see the relationships between these shapes as a total structure and the fragmentation of the visual shape into its basic components
4- Optical shape interpretation: ability to interpret, analyze and understand each optical shape molecule
5- Extract meanings: the ability to come up with new concepts, principles and meanings through visual form (Ahmed, 2015, p. 17-18).

II: Previous studies: -

1- Interactive Engineering Programs: According to the researcher's knowledge, there are no previous studies on interactive engineering programs in mathematics locally (within Iraq)
2- Sahad Abdulnabi Salman Sahwa Study (2019): Teaching Mathematics with Brain-Based Learning Strategy and its Impact on Spatial Visual Intelligence in Applied Scientific Fifth Graders and their Cognitive Motivation
3- wejdan Abd Al-Amir Al-Nashi Study (2020): Spatial Visual Intelligence in Middle First Grade Students

Research methodology and procedures

First: Experimental Design: -

The two researchers adopted the experimental dimensional test design of two groups (experimental group, control group) with partial adjustment as shown in Table (1).

Table (1) Experimental design for research

Dependent variable	Independent variable	Parity of the two groups	Group
Spatial Visual Intelligence Test	Interactive Engineering Programs	- Previous educational achievement -Test previous knowledge -The test of intelligence Timespan-	**Experimental**
	Usual way		**Control**

Second: Research society and sample: -

1- Research community: The research community represents all the 8,681 middle and high school students in the government daytime schools of Karbala Holy Governorate Education Directorate for the academic year 2023-2024.
2- Research sample: The research sample was selected in the intentional way from middle first graders in a school (Shaheed Abu al-Ma 'ali Boys Medium) under the Directorate of Education of Karbala Holy Governorate/District of the Centre to provide an integrated computer laboratory and continuous electrical power in the school where the school includes (6) People for the first middle grade, two of which were selected at random: (a.d) The Division (a) was selected as the control group of 40 students and Division (a) as the pilot group of 42 students.

Third: Procedures for seizure: -

1- Internal safety of experimental design: Before embarking on the experiment, some extraneous variables affecting the subordinate variable other than the autonomous variable were adjusted as the two researchers performed parity between the two research groups statistically in some variables that they anticipate may affect the safety of the experiment and the variables are (Previous academic achievement, previous knowledge test, IQ test, time age), test used The T-Test was used to calculate differences between the two groups' calculations.
By observing the quantitative values calculated for all variables, they show that they are smaller (less) than the tabular quantitative value at the indicative level (0.05). This means that there is no statistically significant difference between

the averages of the experimental and control groups, and the value of the test indication (Levenes Test) of the variables is greater than (0.05), indicating the parity of the research groups in all the mentioned variables.
2- External safety of experimental design:
Specimen selection
2-1: Members of the experimental and control groups were selected by random selection method
2-2 the confidentiality of the research experience: the confidentiality of the experiment was maintained in agreement with the school administration
2-3 Experimental breakdown: No students from the experimental and control groups have been separated or left from the school
2-4 impact of experimental procedures:
Duration
2-4-1: The duration of the experiment was equal for the experimental and control research groups starting on Sunday 18/2/2024 ending on Thursday 30/4/2024
Teacher's
2-4-2: Two research groups (one of the two researchers) were taught at the school itself
School building
2-4-3: The experiment was applied in similar conditions in one school and one building
2-4-4 number of classes scheduled: (5) attendance classes for each of the research groups Course
2-4-5: Chapter 5 and 6 of the Math Book for the First Middle Grade to be taught to the academic worker 2023-2024 the sixth edition
2-4-6 Educational Means: The two researchers used both computer, smart display screen and interactive engineering software (GeoGebra, Cabri 3D, Geometers Sketch Pad and holograms (wooden or plastic, engineering tools, cartoon papers and colored pens)

Fourth: Research requirements: -

1- Determination of the scientific subject: The scientific material taught has been defined since the two chapters include Chapter V (Engineering) and Chapter VI (Measurements, Spaces and Sizes) of the Mathematics Book for the first middle grade of the second semester and for the academic year 2023-2024
2- Formulation of behavioral purposes: The two researchers formulated (186) behavioral targets according to the Meral classification within the cognitive field of the three levels (remembrance-application-discovery) with (63) behavioral purposes for remembrance, (63) behavioral purposes for application and (60) behavioral purposes for discovery.
3- Preparation of teaching plans: The researchers prepared two types of teaching plans The first type is suitable for teaching the experimental group according to the (interactive engineering programs) and type II is suitable for teaching control group according to (routine route) The number of daily teaching plans for the two research groups has reached (40) Two plans per week for each group and for a study duration (40) minutes Some of the teaching plans with study subjects have been presented to a group of experts to benefit from their experiences and opinions and have been amended to read and suggested

Fifth: Research Tools: Building a Spatial Visual Intelligence Test

1- Determining the objective of the test: The objective of the test is to know the level of visual-spatial intelligence in students in the first grade of the two research groups in order to compare them to study the effectiveness of the independent variable in it
2- Previous studies: The researchers learned about the literature and previous studies on visual-spatial intelligence. The use of these studies was demonstrated in the identification of visual-spatial intelligence skills and the drafting of test paragraphs
3- Spatial Visual Intelligence Skills: The conceptual aspect of the concept of spatial visual intelligence was identified in Chapter I and Chapter II of this research where spatial visual intelligence skills were defined by (6) Main skill (visual reading - visual discrimination - perception of spatial relationships - interpretation of information - analysis of information - conclusion of meaning) The test is measured by the average first graders for (24) sub-skill
4- Formulation of test paragraphs in the light of specific areas: Based on the distribution in the test map, the researchers drafted optical spatial intelligence test paragraphs in the light of the specific skills and the test was comprised of (24) multiple selection type paragraph
5- Presentation of the test to the arbitrators: the specific skills with the 24-paragraph test paragraphs were presented to a group of arbitrators and specialists in the teaching methods of mathematics and psychology. Some paragraphs were amended in the light of their opinions and observations by an agreement (85%), and more than the arbitrators' opinions
6- Preparation of test instructions:
6.1- Answer Instructions: Test instructions for students have been placed at the front of the test and how to answer it and some instructions have been developed as not to leave any paragraph unanswered and not to choose more than one alternative.
Correction instruction

6.2- The two researchers put the test patch key where (1 degree) the correct answer and (0) the wrong and abandoned answer was allocated for which more than one alternative was chosen. The total test score was (24) degree for (24) objective paragraph multiple choice
7- Exploratory application: First reconnaissance sample
7-1 (information sample): The researchers conducted the test on a first reconnaissance sample consisting of (35) Middle First Grade Student (Middle House for Boys) Subordinate to the Directorate of Education of the Holy Governorate of Karbala/District of the Centre for the purpose of ascertaining the clarity of test paragraphs and answer instructions, drafting test paragraphs and adjusting the time taken to answer. This was done on Sunday 23/4/2024. (45 - 69) minutes after calculation of the calculation of the average calculation of time (57) minutes, which is the time needed to answer Survey Sample II (Statistical Analysis Sample) 7-2: In order to find out the ease and difficulty of the paragraphs and to stabilize them, the researchers applied the test to a second survey sample of (100) students from the middle first graders in (Ammar Ben Yasser Boys) of the Directorate of Education of the Holy Province of Karbala/District on Tuesday 25/4/2024
8- Statistical analysis of test paragraphs: Test papers corrected according to the correction criterion (0) for the wrong paragraph and (1) for the correct paragraph. Test scores were arranged in descending order and then took the highest percentage (27%) of students' scores to represent the upper and lower group (27%) of students to represent the lower group for statistical analysis
8.1- of the difficulty factor of the test paragraphs: The difficulty factor of the test paragraph has been calculated and has been shown to range from (0.63-0.35) and is a good and acceptable paragraph if the difficulty factor ranges from (0.80-0.20) depending on (Al-Azawi, 2007, p. 82)
Test paragraph differentiation coefficient
8.2- The test paragraph differentiation coefficient has been calculated and found to be between (0.58-0.31) and is a good and acceptable paragraph as indicated (Ebel, 1972, p. 269) if the force of its distinction is between (0.20-0.80).
8.3- the effectiveness of alternatives: The effectiveness of erroneous alternatives to objective paragraphs was calculated to test visual spatial intelligence and all their transactions were found to be negative. This indicates their effectiveness
9- Test stability: The two researchers used the Quder-Richardson 20 equation to find the stability of the optical spatial intelligence test that gives accurate results in objective tests and found the constant coefficient (0.79) which is a good constant coefficient as indicated (Al-Nabhan, 2013, p. 237) that the values of stabilization coefficients above (0.67) are good and acceptable.

Sixth: Application of the test:

After the completion of teaching the content of the mathematics subject according to the time set for the experiment and for the two research groups (experimental and control) applied the spatial visual intelligence test on Sunday 30/4/2024 after informing students of the exam date a week before its date.

Presentation and interpretation of results

First: Results related to spatial visual intelligence: -

Results related to zero hypothesis (no statistically significant difference at an indicative level (0.05) between the average scores of pilot group students studied using interactive engineering programs and the average scores of control group students studied using the usual method of testing visual spatial intelligence) After conducting the spatial visual intelligence test of the two groups (experimental and control) and to know the statistical description of the data of the individuals of the research sample, the statistical program (SPSS) was used and the results were obtained as shown in table (2)

Table (2) Statistical Description of Data (Two Research Groups) in Test (Visual Spatial Intelligence)

confidence %95 period for average arithmetic		Standard arithmetic average error	Standard deviations	Average arithmetic	Number of students	Group
Maximum	Minimum					
10.557	4.139	0.994	6.573	35.53	42	Experimental
10.537	4.139	0.112	8.833	29.44	40	Control

The Levenes Test has been applied for two independent samples to determine the difference between the different grades of the two research groups' students. (experimental and control) where the value (F) (1.879) was at an indicative level (0.164). This level is greater than the approved indicator level (0.05). This indicates that the two research groups are uniform in the spatial optical intelligence variable, and when applying the T test T-Test for two independent samples

to determine the difference between the two research groups' average scores (experimental and control) where the calculated T (4.118) is at an indicative level (0.000) and this level is below the approved indicator level (0.05) and to a degree of freedom (80), this indicates that the students of the experimental group who studied according to the interactive engineering programs outperformed the students of the control group who studied according to the traditional method in the spatial visual intelligence test as shown in the table (3)

Table (3) Values (F) and (t) for the two research groups (experimental and control) in the optical-spatial intelligence variable

Statistical indicator at level (0.05)	of Degree freedom at schedule value (2.00)	to equal the ((T-Test) average calculated value		(Levenes Test) For equal variation		Variable
		Significance level between the parties	T	Significance	F	
Function	80	0.000	4.118	0.164	1.879	Visual Spatial intelligence

The results point to the rejection of the zero hypothesis and the acceptance of the alternative hypothesis that states (there is a statistically significant difference at an indicative level (0.05) between the average grades of the pilot group students studied using interactive engineering programmes and the average grades of the control group students studied using the usual method of testing visual spatial intelligence) and for the benefit of the experimental group
Impact Size: To see the impact of interactive engineering programs on visual spatial intelligence as shown in Table (4)

Table (4) Value (η^2), (d) and magnitude of impact in the optical-spatial intelligence of the two research groups

Volume of impact	Value (d)	η^2 Value	df	Value (t)	Dependent variable	Independent variable
Big	0.96	0.175	80	0.118	Visual Spatial Intelligence	Interactive Engineering Programs

Table 4 indicates that the magnitude of the impact of interactive engineering programs in spatial visual intelligence is large because the value (d) of 0.96 is greater (0.8). This indicates that the spatial visual intelligence variable in middle first graders is large and for the benefit of the experimental group who studied according to this variable.

Second. Interpretation of results:

The results of the research proved that the students of the experimental group who studied according to the interactive engineering programs outperformed their peers in the control group who studied according to the usual method in the spatial visual intelligence test in a statistical superiority and can be traced back to the following reasons:

1- The modernity of the method, questions and discussions that permeate the teaching situation have provoked students' interest and longing for math and increased their attention to the lesson, thereby increasing their attainment and intelligence

2- Computer-based interactive engineering programs offer educational material according to visual perceptions in attractive forms and images, which in turn integrate visual forms (non-verbal language) with educational content (verbal language)

3- Enabling the use of educational technology through interactive engineering programmes is a psychological environment free of threat and full of respect, exchange of views and respect for others' feelings

4- Interactive engineering programs deal with algebraic and geometric concepts at the same time making the process of understanding and assimilation easier

5- The programs used help to clarify geometric concepts that are difficult to clarify with the traditional fountain, especially the third dimension concepts, helped to paint geometric shapes more accurately and also helped students in many tasks such as finding measurements, spaces and oceans, etc.

6- Interactive engineering helps understand and embody concepts in a way that is closer to the sensor and connects mathematical ideas with each other and connects them to life

7- The software used helps to infer and deduct mathematical knowledge and to achieve the correlation between past and subsequent knowledge to make the learning process take a constructive curve approach

Conclusions: In the light of the research findings of the two researchers, we may draw the following

CONCLUSIONS:

1- The effectiveness of interactive engineering programs in increasing the visual-spatial intelligence of the students of the experimental group compared to the students of the control group studied according to the usual method in mathematics
2- The use of interactive engineering programs in teaching has the effect of raising the level of visual spatial intelligence in the students of the experimental group compared to the control group
3- The use of interactive engineering programs in teaching has the effect of linking previous information to subsequent information of the students of the experimental group compared to their peers of the control group's students
4- The magnitude of the impact of interactive engineering programs on spatial visual intelligence is significant

RECOMMENDATIONS:

In the light of the findings and conclusions, the following recommendations have been made:
1- Preparation of a training programme for teachers during the service to train how to employ interactive engineering programs and use them to teach mathematics to develop the required mathematical knowledge and visual and spatial intelligence
2- Using interactive engineering programs on a number of subjects, math teachers and teachers rely on a number of subjects because of their positive impact of great visual spatial intelligence according to the findings of the two researchers
3- Develop the Teacher's Manual for Mathematics Teaching to be based on the development of intelligence in general and visual spatial intelligence in particular
4- Reviewing the curriculum of mathematics and its content and presenting it in an interesting manner and enriching it with various activities that motivate students to research, experiment, move away from preservation and demonstration
5- Attention to modern teaching strategies using computer-based technology aimed at developing students' mental abilities
6- Activate the mathematics lab and provide it with computers, software and projectors for use by mathematics teachers

SUGGESTIONS:

To complement this study, the two researchers propose to undertake a number of the following scientific studies and research:
1- Similar study conducted in phases and other subjects
2- Conduct a similar study to recognize the effectiveness of interactive engineering programs in other subordinate variables such as (cognitive speed, calendar thinking, sports interconnectedness, engineering thinking, motivation of achievement)

SOURCES:

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