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### THE EFFECT OF MULTIPLE REPRESENTATIONS IN TEACHING MATHEMATICAL CONCEPTS IN MATHEMATICS LITERACY AMONG INTERMEDIATE LEVEL STUDENTS

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**Keywords: Multiple Representations, Teaching, Mathematical Concepts, Mathematics Literacy, Intermediate Level Students.**

#### **ABSTRACT**

The aim of the research is to know the effect of using multiple representation in the Mathematics Literacy of female students in the first intermediate class, and to achieve the goal of the research, the experimental approach was adopted and the design of equivalence groups with dimensional testing of the two groups (experimental and control) was chosen. A random sample was chosen consisting of (57) female students from the first intermediate class, by (32) students for the experimental group that studied mathematics according to multiple representation, and (25) students for the control group that studied mathematics according to the usual way, parity was conducted between two groups in the variables (intelligence, chronological age, previous achievement in mathematics, Mathematics Literacy). In addition, Mathematics Literacy test was constructed of (27) items divided into three axes (concepts, principles and basic skills- mathematical thinking- the nature of mathematics and the history of its development). The test was applied at the end of the experiment to the two groups of the study sample and after statistically processing the results; it was found that there was a statistically significant difference in favor of the experimental group in the Mathematics Literacy as a whole and in each of its axes. Key words: Multiple Representation, Mathematics Literacy.

#### **INTRODUCTION**

Research problem: From the researcher's experience in the teaching methods of mathematics and its continuous discussions with math teachers and educational supervisors and from the results of the achievement of students of

basic education low in the subject of mathematics, all this called the researcher to explore the views of mathematics teachers in the extent to which their students have an appropriate amount of mathematical knowledge and thinking skills and culture related to the history of mathematics. The number of teachers and teachers (20) who have experience of at least (5) years. This indicates that the organization of ideas and the building of mathematical knowledge in a meaningful way were weak, leading to the inappropriate and inaccurate employment of mathematics in life and in societal attitudes, as well as the weakness and low information of students regarding the history of mathematics indicates the weakness and decline of the formation of positive trends towards mathematics and towards the mathematicians who contributed to its development, which reflects negatively on the achievement of the objectives of education in the preparation of the individual scientifically enlightened and effective in his society. On the other hand, there are many local studies that agreed in their results on the weak level of scientific enlightenment among physics teachers such as the study (Al-Musawi, 2018), biology teachers such as (Al-Mady, 2011) and science teachers such as (Al-Badrawi, 2012) and the low level of technological literacy such as the study (Tharthar, 2018) and the low level of physical literacy among middle school students such as (Najafi, 2013), and the presence of a level of sports literacy acceptable to students of the fourth stage - Department of Mathematics in the College of Education / Ibn Al-Haytham and students of the College of Basic Education at Al-Mustansiriya University, such as studying (Jawad, 2018), and because sports enlightenment is part of the scientific enlightenment and complements the technological enlightenment, and the close relationship known between teachers and their students confirms that a low or weak level of enlightenment for teachers means a low or weak level of enlightenment for their students, all of the above leads the researcher to suspect the level of Sports enlightenment among middle school students in Iraq. Based on the foregoing, the research problem can be determined by answering the following question: Does the use of multiple representations in the teaching of mathematical concepts impact on sports literacy among middle school students?

The importance of research: Mathematics was and still is the basis of all sound and accurate scientific thinking, and it is the field of creative research in meeting the social and economic needs of society as well as it has its daily uses in all fields and the dependence of many sciences and technology on it (Afana, 2012) Mathematics is also a continuous and complementary entity of scientific knowledge as well as an intellectual approach that develops mental capabilities and contributes to scientific and technological progress. (Qasem & Meeaad, 2019) And students differ in terms of their learning methods, preparations, directions, values, and personalities, as they differ in terms of their intelligence as well, and this was confirmed by the scientist Gardner in his theory of multiple intelligence, as he sees that each individual does not possess one intelligence, but several intelligence, and that it is the duty of educational systems to guide students towards areas that are appropriate to their competencies and natural talent and develop them by using teaching

methods that are appropriate to these capabilities, because success in life Needs multiple intelligence. (Al-Dulaimi, 2009) But the different educational systems and the education system in Iraq, especially in the teaching of mathematics, were and still provide educational, written, logical and educational activities dominated by symbolic editorial representation away from any visual, spatial, planning, or verbal representation, and thus students of logical intelligence benefited because they obtained Education appropriate to their intelligence, and students with other intelligence, they face great difficulties with the current teaching methods. The importance of the current research can be illustrated in the following: It may help teachers know the patterns and steps of multiple representations. Also; it may benefit researchers to address new approaches related to strategies appropriate to modern educational trends. Researchers and teachers can benefit from the sports literacy test that will be built and approved in this research. At the end of the research, a set of wills will be presented that can help even a little in improving the learning and teaching process if it is adopted. At the end of the research, a set of proposals will be presented that could benefit researchers in the future in conducting other studies to complete the current research process. The scarcity of studies dealing with multiple representations and its effect on sports enlightenment among middle school students in Iraq, which makes this attempt one of the pioneering attempts in this field

Research hypotheses: To achieve the research goal, the following zero hypothesis will be tested: 1) There is no statistically significant difference at the level of significance (0.05) between the average scores of students of the experimental group (who studied mathematics according to multiple representation) and the degrees of students of the control group (who studied mathematics according to the usual method) In the post-total sports enlightenment test. 2) There is no statistically significant difference at the level of significance (0.05) between the mean scores of students of the experimental group (who studied mathematics according to multiple representation) and the degrees of students of the control group (who studied mathematics according to the usual method) In each axis of the mathematical enlightenment: (basic concepts, principles and skills, mathematical thinking, the nature of mathematics and the history of mathematics)

Multiple Representations: 1) Defined as a mathematical embodiment of mathematical ideas and concepts to give the same information in more than one form (Asli, 2001) 2) defined as ideas in the learner's mind that are communicated to others through four forms or patterns: written, illustrated, tabular and oral. (Sign, 2002) 3) Defined as a multifaceted idea of a relationship or mathematical concept aimed at achieving a better understanding. (Chandra, 2002) 4) Defined as patterns and methods that describe and explain mathematical construction and are used to understand and develop certain mathematical properties as well as to link between those properties, which are the tools of thinking through which mathematical achievement is achieved. They are of various types, including: graphs, charts, tables, grids, formulas, symbols, words, gestures, videos, concrete patterns,

virtual bodily movements, images and sounds. (**Goldin, 2014**) Theoretical definition: it is a method in displaying mathematical concepts according to patterns (oral - written - physical - symbol - tables - technological) to enhance student understanding of the content and improve its participation and achievement inside and outside the class. Procedural definition: It is a set of structured procedures consisting of six patterns: (oral - written - physical - symbol - tables - technological) by which mathematics subjects are presented for the first semester of the first intermediate grade so that they are sequenced according to situations Educational plans for teaching for this purpose vary in the sequence of representation patterns in different situations.

Mathematics Literacy: 1) defined as the necessary amount of mathematical knowledge and its related processes, the ability to use mathematical thinking methods to solve problems in addition to the historical development of mathematics and the contributions of Arab and Muslim scholars to this development (**Badr, 2010**) 2) defined as literacy in mathematics and it means basic mathematics that can be applied in daily life, as it is the individual ability to define and understand the role of mathematics in the world and how to meet the needs of that individual in the current life Futures and make them more efficient (**Bobby, 2011**) 3) defined as the individual's ability to formulate, employ, and interpret mathematics in a variety of contexts, and includes mathematical reasoning and the use of mathematical concepts, skills, and facts to describe, explain, and anticipate phenomena, In a way that helps individuals realize the role of mathematics in building an individual and an effective society. (**Jablonka, 2014**) Theoretical definition: It is a set of mathematical knowledge and associated thinking processes and another set of knowledge about the history and development of mathematics. This information can grow and develop through effective learning, which gives the individual an appropriate amount of adaptation, positivity and employment of mathematics in life and society. Procedural definition: It is the extent of mathematical knowledge, thinking skills, and history of development of the student (the research sample), which helps her to understand the mutual relationship between mathematics and society and is measured by the degree obtained in the mathematical literacy test that was built for the purposes of this research.

## LITERATURE REVIEW

### *Multiple representations*

The American National Council (NCTM, 2000) recommended facilitating the learning process with mathematical representations of mathematics teachers, which it showed as an independent standard, due to its importance in teaching mathematics. Expectations for the standard sports representation include: 1) Build and use mathematical representations to organize, record and communicate mathematical ideas. 2) Select and apply representations and translation between them to solve mathematical problems. 3) Use representations to model and understand natural, social and mathematical

phenomena. (NCTM, 2000) The Council (NCTM, 2000) also recommended for grades 5--8 the need to increase attention to: verbal, numerical, graphic, engineering, and symbolic attitudes representation, exploring relationships between different representations and processes, developing and using tables to describe different situations, giving Explanations between different sports representations and the use of appropriate technology in different activities (Ubaid, 2010) Lesh model is the best and most well-known model in mathematical representations, as it consists of: 1) Spoken language: It represents any means of expressing ideas with the understandable words of the student. 2) Written symbols: It represents any means for expressing ideas in writing, whether using the Arabic or English language or the language of numbers and symbols. 3) Pictures and shapes: It represents any way of expressing ideas visually using pictures, drawings, tables and graphs. 4) Models and solids: They represent any means of expressing ideas sensually and financially, using stereotypes and patterns. 5) Life situations: It represents any way of expressing ideas using educational situations and mathematical environmental problems that apply the concept. (Lesh, 1987) And that representation of lines, shapes and images of a mathematical concept aims to convert verbal content into symbolic content or a visual embodiment of concepts and processes on them in a functional way in order to improve the process of mental awareness and visual representation of learners. (Ubaid, 1998) And representation in this way makes mathematical ideas more clear and can be contemplated and identify common elements among them through multiple representations of drawings, oral language, written language, symbols, models and real situations, as it works to enhance awareness of concepts, relationships and processes associated with them and employ them in similar procedures where it can The student has to distinguish between mathematical concepts and convey what is understood between the different representations of the same idea. (Fennel, 2001)

### *Mathematics literacy*

Literacy and learning to read and write the most important thing that makes the individual educated and enlightened and able to coexist with the members of his community, this is very similar to what is referred to as the term sports enlightenment, it is erasing the mathematical literacy and it is learning to use the correct way to read and write mathematical symbols and understand their vocabulary and language and express their ideas by means Multiple for the purpose of communicating with the community and achieving better growth, the student needs to know the meanings of abstract mathematical terms as well as need to read data in a table or in a graph or an equation that includes a visual representation of the data, he must also learn to write and use it optimally To convey and express ideas. Because mathematics is the most important subject that contributes to filling a large number of individual and societal needs by virtue of it being the main factor and aide in studying a large number of other methodological subjects, it has entered into achieving various educational goals such as solving problems of development in society, and developing social responsibility of the individual, providing Society with

individuals who specialize in solving scientific problems and improving methods for overcoming natural phenomena and harnessing them for the benefit of man and other ends (**Al-Sharif, 1996**) Therefore, the mathematics curriculum can contribute to developing mathematical literacy when it is built on the understanding of basic concepts, principles and skills, providing students with knowledge based on understanding and using mathematical thinking to reach mathematical relationships and generalizations and apply them in life. (**Abu Zina, 2010**) In this sense, mathematical enlightenment becomes the individual's ability to read and write mathematical language, use its vocabulary properly, and formulate and interpret its words in various patterns that include mathematical thinking, decision-making, problem solving, and the use of concepts, relationships, and processes on them to describe and anticipate phenomena and life problems. There are several categories of fields and axes for sports enlightenment, including: 1- Classification of Al-Mufti, et al, where they identified three axes: basic concepts, principles and skills - methods of mathematical thinking - the nature of mathematics and the history of its development (**Al-Mufti, 1990**) 2- Classification of Bakkre & others, where they identified six axes: the nature of mathematics - basic mathematical concepts - mathematical operations - values - mathematics and society - tendencies. (**Bakkre, 2005**) 3- Classification of Badr, where I identified two axes: mathematical knowledge - the nature of mathematics and the history of its development. (**Badr, 2010**) The researcher adopted the classification of Mufti in building the passages of the sport literacy test to achieve the goals of the research.

Some points to a number of indicators as skills in students' sporting literacy: 1 - Create a mathematical model in itself, such as creating mathematical equations, writing number patterns and the like. 2 - Writing answers such as performing calculations consistently. 3- Use model images, tables, and the like to help find answers. 4- Choose and compare strategies to find answers. 5 - Inference by linking information about the subject to the real life situation. 6 - Use and manipulate formulas or the specific mathematical procedure for answers (**Siti, 2017**) The South African Mathematics Curriculum Authority has indicated that mathematical literacy for levels 10-12 has multiple benefits for the individual and society, including: 1- Using mathematical procedural skills to define, present and solve problems in an innovative and critical manner. 2- Working cooperatively in teams and groups to enhance mathematical understanding. 3- Organizing, interpreting and managing authentic activities in fundamental mathematical ways that demonstrate responsibility towards society. 4- Collecting, analyzing and organizing quantitative data to evaluate and conclude the results. 5- Communicate appropriately using descriptions in words, diagrams, symbols and tables. 6- Using sport literacy in a critical and effective way to ensure the application of science and technology. 7- Show that mathematics knowledge helps to understand the interconnectedness of systems and how they affect each other. 8- Using a variety of individual and cooperative strategies in learning mathematics. (**NCSG, 2010**)

### *Previous studies dealing with multiple representation*

1- Study (**Al-Balasy, 2010**) The study aimed to know the effect of using multiple mathematical representations on a student's acquisition of mathematical concepts and their ability to solve verbal issues in the unit of relationships and associations for eighth grade students in Jordan, and the results showed that there were statistically significant differences in acquiring mathematical concepts and their ability to solve the mathematical issue for Pilot group.

2- Study (**Abu Hilal, 2012**) The study aimed to know the effect of mathematical representations on the acquisition of concepts and the inclination towards mathematics among students of the sixth basic class in the city of Khan Yunis, and to achieve the goals of the study the teacher's guide was prepared in the activities of mathematical representations to teach the units of proportion, proportion and percentage, and test the acquisition of mathematical concepts, and a scale Tendency towards mathematics, and the results were in favor of the experimental group in the two variables.

3- Study (**Abbas, 2015**) The problem of the study emerged with the following question: Is the achievement of mathematics and the retention of learning different among the first intermediate grade students when teaching mathematics according to mathematical representations compared to the traditional method, and after applying the experiment and collecting data and statistically analyzing the result was the superiority of the experimental group over the control group in the achievement test And keeping learning, and in light of the results reached, the researcher put his conclusions, recommendations and proposals.

4- Study (**Abu Al-Rob, 2016**) the study was conducted in Palestine, aimed at knowing the effect of multiple representation on teaching fractions in achievement and attitudes for fifth-graders in the city of Nablus. The results were in favor of the experimental group in the achievement and trend variables, and the results did not show any differences between the two groups in relation to the sex variables and the interaction between the teaching method and gender.

5- Study (**Mariann, 2004**) It is an International Student Assessment Program (PISA) in an international system of assessments that measures the ability of children aged 15 years to read, write, literacy in mathematics and scientific literacy every 3 years. PISA was first implemented in 2000 and implemented outside the Organization for Economic Cooperation and Development (OECD), an intergovernmental organization for industrialized countries. She assessed achievement in every field in addition to the main areas of literacy, reading, writing and mathematics (scientific literacy).

6- Study (**Ellen, 2011**) The study made recommendations for educators in the field of literacy or enlightenment in mathematics during the design and

implementation of effective professional development and support for secondary school mathematics teachers to integrate literacy into their education, and researchers provide an annotated list of articles explaining the effective use of literacy strategies for teaching mathematics.

7- Study (**Jawad, 2018**) The study aimed to know the level of sports literacy among teachers of the College of Education at the University of Baghdad and the College of Basic Education at Al-Mustansiriya University and to know its level among students and the relationship between sports enlightenment among professors and its level among students in both colleges, and the results showed: there is a good level of enlightenment among professors And a level acceptable to students, and the relationship was direct between them.

### METHODOLOGY

Variables	The Group	Sample Number	Arithmetic Mean	Standard Deviation	Degree of Freedom	t-test Calculated	t-test Tabular	Significance level 0.05)
Intelligence	Experimental	32	18.3750	6.37409	55	0.482	2	Not statistically significant
	Control	25	19.1200	4.94402				
Mathematics Literacy	Experimental	32	10.5938	3.64434	55	1.103	2	Not statistically significant
	Control	25	9.5600	3.33017				
Age in months	Experimental	32	157.425	4.06011	55	0.80	2	Not statistically significant
	Control	25	157.248	3.12692				
Previous Achievement	Experimental	32	94.6563	2.25202	55	0.831	2	Not statistically significant
	Control	25	94.0400	3.33517				

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A. Research Society: The current research community has been identified with middle-grade first-graders in the General Directorate of Education in Baghdad / Rusafa Third Schools, for the academic year 2019-2020.

B- The research sample: The selection of the research sample was random, as it consisted of (57) female students from the first intermediate class students, by (32) students for the experimental group that was studied according to multiple representation, and (25) students for the control group that studied according to the usual way.

### *Sports enlightenment test*

The Sports Enlightenment Test was built as the test building process passed the following stages: A) Determine the goal of the test: The aim of the test is to measure the level of sports literacy among students of both groups of the research sample (experimental and control). B) Access to books and previous studies: To formulate the paragraphs of the test, a group of books and previous studies were examined that dealt with sports enlightenment. C) Determine the test axes: The scale includes three axes of enlightenment, namely (basic concepts, principles and skills, mathematical thinking, the nature of mathematics and the history of its development). D) Formulation of the test paragraphs: The test paragraphs were formulated, and it consisted in its primary form of (27) paragraphs, as it represented the axis of basic concepts, principles and skills with eight paragraphs and the axis of mathematical thinking in eleven paragraphs and the axis of the nature of mathematics and the history of its development with eight paragraphs and all were objective questions Multiple choice type. E) Virtual honesty: After completing the construction of the test, it was presented in its initial form to a group of experts specialized in the field of mathematics teaching methods to ensure its sincerity and the validity of its paragraphs, where a number of paragraphs were reformulated in the light of opinions and observations and depending on the percentage of the agreement (80%) or more, and thus the apparent validity of the test was achieved to be ready for application to the reconnaissance sample. F) The clarity of the instructions, the test items, and the time taken: The test was applied to a first exploratory sample consisting of (20) female students from the first intermediate class in the chastity medium for girls on Thursday, 3/10/2020, where the paragraphs were clear. The answer time to the scale has also been calculated by finding the arithmetic mean of the time taken by all students of the exploratory sample, as it was found that the time required for the answer is (40) minutes. G) Statistical analysis of the test items: For the purpose of conducting the statistical analysis of the scale paragraphs, it was applied to an exploratory sample consisting of (100) students from medium female students, voluntarily, on Sunday, 6/10/2020. H) Performing statistical analyzes of the test: 1) Validity of the test: To find out the validity of the scale, the apparent honesty was approved after presenting it to the experts and the validity of the construction, where the correlation coefficient was calculated for the degree of each paragraph in the total degree of the axis that you are developing in the test, as the correlation coefficient was calculated between

the degree of each of the paragraphs The test of the overall degree of the axis using the Pearson correlation coefficient. The value of the indexed correlation coefficient was at the level of significance (0.05) and the degree of freedom (98). It was greater than the value of the correlation coefficient, where its values ranged between (0,197 - 0,802). 2) Paragraph discrimination factor: After correcting the answers of the students of the exploratory sample on the test and determining the final score obtained by each student, the grades were arranged in descending order, after which (27%) of the higher grades and (27%) of the lower grades were taken to represent The two extreme groups, and to test the significance of the difference between each of the paragraphs of the upper and lower groups at the significance level (0,05) and the degree of freedom (52), the T-test was approved for two independent samples, and when comparing the calculated T value for each paragraph With the value of the tabular T value of (2), it has been proven that there is a statistically significant difference between the degrees of the higher group and one The lower group, which means an acceptable discriminatory force for these paragraphs of the test. 3) Stability test: Stability can be verified when measured using the method of internal consistency by using certain statistical equations. Therefore, the stability of the test was calculated using the Alpha-Cronbach coefficient, and this equation depends on calculating the correlations between the degrees of the paragraphs, given that each paragraph is A stand-alone test, thus achieving the coefficient of persistence extracted for each axis of the sporting enlightenment as shown in the following table:

<b>Literacy Axis</b>	<b>Basic concepts, principles and skills</b>	<b>Mathematical thinking</b>	<b>Nature of Mathematics and its History</b>
<b>Stability of the test</b>	<b>0,87</b>	<b>0,77</b>	<b>0,80</b>

It indicates good stability coefficients.

### ***Procedures for applying the experiment***

The experiment procedures were started at the beginning of the first course for the academic year 2019-2020 specifically on Tuesday, 1/10/2019 and ended on Thursday, 26/1/2020, with five classes per week applied The six (\* Ghafran Jassem / Intermediate Chastity for Girls / Master in Methods of Teaching Mathematics) were trained on the steps of multiple representation, and educational plans were prepared by the researcher for each of the experimental group according to multiple representation, and the control group according to the usual method.

## **RESULTS**

### ***The first zero hypothesis***

#### ***Results of the t-test for both groups in the total sports enlightenment test***

Group	Sample number	Arithmetic mean	standard deviation	Degree of freedom	t-test Calculated	t-test Tabular	Significance 0.05
Experimental	32	17.6875	4.17703	55	5.032	2	significant
Control	25	12.3200	3.74967				

Thus, the null hypothesis is rejected, because there is a statistically significant difference at the significance level (0.05) between the mean scores of the students of the experimental group and the scores of the students of the control group in the dimensional total mathematical test.

*The second zero hypothesis*

*Results of the T-test for two research groups for each axis of the sport enlightenment*

Literacy Axis	the group	Sample number	Arithmetic mean	standard deviation	Degree of freedom	t-test Calculated	t-test Tabular	Significance 0.05
Basic concepts, principles and skills	Experimental	32	6.3750	1.28891	55	2.868	2	Statistically significant
	Control	25	5.2800	1.59478				
Mathematical thinking	Experimental	32	6.4375	2.72311	55	3.161	2	Statistically significant
	Control	25	4.4800	1.66132				
Nature of Mathematics and its History	Experimental	32	4.8750	1.40850	55	5.223	2	Statistically significant
	Control	25	2.5600	1.93821				

*Interpretation of the results of the first zero hypothesis*

Multiple representation in the teaching of mathematical concepts is characterized by the diversity of learning patterns in its steps being based on the theory of constructive learning, and this diversity has helped students of the experimental group to integrate into learning activities and observation and attention and awareness of information and processing it in various methods, which may have led to the superiority of students of the experimental group on The students of the control group in the post-test of mathematical enlightenment, and this result is identical to the results of all previous studies in this research, as the results were in favor of using multiple representation in many variables, including achievement, acquisition of concepts, and retention A reflection and other thinking.

### *Interpretation of the results of the second null hypothesis*

Results of the axis of basic concepts, principles and skills: The superiority of the experimental group over the control group in this axis and its development in the experimental group may be attributed to a higher level than the control group to the fact that the first was studied according to multiple representation which includes in some of its patterns activities that help in developing mathematical knowledge and its awareness of meaning A greater degree of its development can be done through traditional teaching methods. These patterns are (physical representation, oral and written representation, representation by pictures and symbols). Participation and interaction between the group, preparation of reports, discussions, and writing steps to solve an issue, from It is to develop mathematical knowledge and increase its understanding for the student, if the availability of these activities in the mentioned patterns may have helped the excellence of the students of the experimental group in this axis, and these results are consistent with the findings of the study of (**Abbas, 2015**) and (**Abu Al-Rab, 2016**).

Results of the Mathematical Thinking Hub: Multiple mathematical representation included multiple patterns, examples and activities (note and follow-up of representation from one pattern to another, dialogue and discussion, linking relationships and discovering results, participation in the representation process and reaching results) and these activities with the sequential logical presentation of the subject of the lesson And analyzing and clarifying the material, exploring a new article, performing mathematical operations, performing statistical analyzes, creating tables, classification, discussion, and solving perceived environmental problems. The availability of these activities may have helped the students of the experimental group to excel in this kind of sports enlightenment, and agree these results, along with the findings of a study by (**Al-Balasy, 2010**).

Results of the axis of the nature of mathematics and the history of its development: may provide patterns in multiple representation: such as providing visual presentations represented by the perceptible natural situations and the use of images, models and drawings, and access to websites are many opportunities for awareness of the nature of mathematics and knowledge of its

properties and components, as the participation of students in drawing and creating tables. And the follow-up of educational sites may have contributed to the formation of positive attitudes towards mathematics and the taste of aesthetic images in their structures, which gives an incentive for more knowledge of the nature of mathematics and the history of its development, and this has helped the students of the experimental group excel on this axis.

### **CONCLUSIONS**

1. The multiple mathematical representations influenced the sports enlightenment as a whole among first graders, average in mathematics compared to the usual method.
2. The multiple sports representation has an effect in each of the three axes of the sports enlightenment in favor of female students of the experimental group compared to the usual method.
3. The multiple mathematical representations has an impact on the axis of concepts, principles and basic skills for the sports literacy test in favor of students of the experimental group compared to the usual method, but to a much lesser degree than the other axes.
4. The use of multiple representations in teaching mathematical concepts helped achieve behavioral goals, sentimental goals, and skill goals to be accomplished in the lesson better than the usual method.

### **RECOMMENDATIONS**

1. The necessity of educating the teaching bodies about the importance of sports enlightenment for single-row students, which distinguishes every student from others in receiving information, and not being satisfied with success in achievement without employing this success in working life.
2. The necessity of training the teaching staff on how to integrate multiple representations in all its patterns within the steps of presenting lessons.
3. Educating parents about sports enlightenment and the importance of observing and developing it among their children, working to develop it, and encouraging them to use sports information to solve their individual and societal problems.
4. Directing male and female teachers of mathematics to use modern models and strategies in teaching and breaking the routine of traditional methods and methods that are no longer suitable for the current generation, which is open to the real and virtual world, with all the details of its cognitive and technological developments, as well as informing it via social media on modern teaching and learning methods used in Advanced countries.

### **PROPOSALS**

1. Conducting studies on the effect or effectiveness of multiple mathematical representation on other variables (complex thinking, levels of comprehension, information processing, trend toward mathematics, mathematical communication)

2. Conducting a study in which mathematical literacy is incorporated into a proposed strategy and know its effect on achievement and the direction towards mathematics.
3. Conducting a study on the relationship of each type of multiple representations to multiple intelligences.
4. Conducting a study similar to the current one on other subjects, such as physics and chemistry.

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