
Multiple Mathematical Representations According to the (Lesh) Model of High School Students and Its Relationship to Their Mathematical Ability

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Abstract: The Research aim is to determine the essence of the relationship between students' mathematical representations in high school and their mathematical ability.

The following null hypotheses were established in order to achieve the research objectives:

1. There is no statistically significant difference at the level of (0.05) between the average true performance and the average hypothetical performance of third-grade intermediate students in the General Directorate of Education in Baghdad / Rusafa 1/, Al-Rashdiyah district, on the multiple mathematical representations test prepared for the aforementioned purpose and according to the gender variable.
2. There is no statistically significant difference at the level of (0.05) between the average true performance and the average hypothetical performance of third-grade intermediate students in the General Directorate of Education in Baghdad / Rusafa 1/, Al-Rashdiyah district, on the mathematical ability test prepared for the aforementioned purpose, according to the gender variable.
3. There is no correlation relationship at the level of significance (0.05) between Multiple mathematical representations and Mathematics ability among third-grade middle school students in the General Directorate of Education in Baghdad / Rusafa 1/ district AL-Rashidiya, according to the gender variable.

After identifying the research community, which represented high school students in the General Directorate of Education in Baghdad /Rusafa 1/, Al-Rashidiya district, third-grade intermediate students were determined in order to conduct the field study. Thus, the size of the research sample reached (269) male and female students (134) male and (135) female students. For the purpose of collecting data for this research, two tests were constructed:

1. Test of multiple mathematical representations according to the Lesh model (Lesh): in its finalized form of (25) A test paragraph with (21) of the objective type and (4) of the Essay type.
2. Mathematical Ability Test: It consists of (28) test items of the objective type.

Then, appropriate statistical analyzes were conducted for the two test items, and to verify the psychometric properties of them. After adopting the statistical tools for analyzing the results of applying the two tests, the results reached showed that:

1. The third-grade intermediate students have the research sample of multiple mathematical representations.
2. The superiority of females over males in the multiple mathematical representations test.
3. Third-grade students possessing the average of the research sample, the mathematical ability.
4. Females surpass males in the mathematical ability test.
5. There is a positive and strong correlational relationship among students between multiple mathematical representations and ability. They have a positive relationship.

In light of the research results, several recommendations were made, including:

1. Curriculum designers in the Ministry of Education must emphasize the multiple mathematical representations of students when building and developing mathematics curricula, as well as adding exercises and heritage activities that develop their mathematical abilities.
2. Exposing students to various practical and life situations that require them to use mathematical representations and to employ their mathematical abilities.

3. Raising the awareness of mathematics teachers of the importance of multiple mathematical representations and the mathematical ability of students as one of the important goals of teaching mathematics advocated by the National Council of Mathematics Teachers(NCTM, 2000).

According to the results, several proposals were suggested, including:

1. Conduct a similar study for the elementary and preparatory stages, to see if they possess Multiple mathematical representations and types of Mathematical ability.
2. Conduct a similar analysis in other governorates for the same grade and compare the findings.
3. Conduct experimental studies to employ some software to employ various mathematical representations that will help students improve their mathematical abilities.

Keywords: Mathematical representations, Lesh model, Mathematical ability.

Research Problem

The importance of mathematical representations has emerged with the rise of mathematics pedagogical interest in learning for comprehension rather than deaf memorization And to memorize mathematical ideas and concepts, as many educational institutions and educational centers have emerged, including the American National Council of Mathematics Teachers (NCMT), Who emphasized mathematical representation as a vital and effective topic in the document "Principles and Standards" issued in 2000, representations are related to the embodiment of mathematical ideas and concepts and make them more clear, and it means using something to represent something else. It is a tool for understanding in terms of making the learner focus on the main features of the mathematical state and an easy way to think and solve mathematical problems. The development of students' mental abilities and the reinforcement of positive behaviors in them is considered a social and educational necessity imposed by society's demands for progress, As it became the duty of education to pay attention and search for means and methods that develop the mental capabilities of students, and this interest was evident through educational seminars and conferences, including the International Parliamentary Conference held in Paris during the period from June 3- 6 of 1996, Which recommended, in cooperation with (UNESCO), investment in enhancing human capabilities and creativity, knowledge production, acquisition, transfer and sharing, and the necessity of capacity development and support (Freeh, 2011: 1), Mathematical ability is one of those mental abilities that should be developed among students, as its importance appears in the fact that it is concerned with formulating and preserving the relationships between numerical symbols and lies behind any cognitive activity issued by the learner to overcome any problem he faces, regardless of its formula, From the researcher's experience over the course of (16) years in teaching mathematics for the third intermediate grade and the importance of multiple mathematical representations according to the Lesh model and the mathematical ability in the process of teaching and learning and achieving success in mathematics, the researcher decided to study the correlational relationship between them among secondary school students. .In addition to the importance of these two variables, what motivated the researcher to do so was the fact that no study had been found that dealt with their studies together to the best of the researcher's knowledge, and also because of the importance of the secondary stage, as it is one of the key stages in the development of the learner's personality, in which his aptitudes and mental acuity are formed. Accordingly, the research problem was determined by answering the following question: Is there a correlation between high school students' multiple mathematical representations according to the (Lesh) model and their mathematical ability? What kind is it?

The importance of research

The importance of research can manifest in two aspects, one theoretical and the other practical, as follows:

Theoretical importance

1. Highlight the importance of multiple mathematical representations according to the Lesh model in the educational process and make them a direct and main goal that the teacher seeks to achieve by training students on how to use them and giving them opportunities to choose the representation that they see suitable for their mathematical ability.
2. Building mathematics curricula so that the content includes paragraphs that achieve multiple mathematical representations according to the Lesh model in terms of using different forms for them to help clarify different aspects of mathematical knowledge and develop students' mathematical ability.
3. It sheds light on one of the mathematics teaching standards related to the construction and teaching of mathematics curriculum content.

4. It is a scientific addition to mathematics teaching and learning strategies, especially in the area of dealing with multiple mathematical representations according to the Lesh model and its relationship to mathematical ability.
5. Can be consistent with modern trends in evaluating educational curricula and their content based on international standards.

Application importance

1. Provide a test for multiple mathematical representations according to the Lesh model for the third intermediate level.
2. Providing a test of mathematical ability in its four branches for the third intermediate level.
3. Ensure that high school students in the General Directorate of Education in Baghdad Al-Rusafa 1 / Al-Rashidiya district possess multiple mathematical representations according to the Lesh model and provide tests to measure their multiple mathematical representations.
4. Ensure that female secondary school students in the General Directorate of Education in Baghdad / Rusafa 1 possess mathematical ability, and provide tests that measure abilities (memory, numerical, spatial, and inferential) a.
5. Identify the nature and direction of the correlative relationship between the multiple mathematical representations according to the Lesh model and their mathematical ability.

The Aim Of The Research

Research aims to identify

1. Identify the multiple mathematical representations according to the Lesh model that high school students have.
2. Identify the types of mathematical ability they have.
3. Standing on the nature of the correlation between the multiple mathematical representations according to the Lesh model and the mathematical ability and direction of high school students.

$$H_0: \bar{X}_1 = \bar{X}_2$$

$$H_1: \bar{X}_1 \neq \bar{X}_2$$

2. There is no statistically significant difference at the level of significance (0.05) between the average real performance and the average hypothetical performance of the third-grade intermediate students in the General Directorate of Education in Baghdad / Rusafa Al-Rashidiya district on the mathematical ability test prepared for the aforementioned purpose.

$$H_0: \bar{X}_1 = \bar{X}_2$$

$$H_1: \bar{X}_1 \neq \bar{X}_2$$

3. There is no correlation at the level of significance (0.05) between the multiple mathematical representations according to the Lesh model and the mathematical ability of the third intermediate grade female students in the General Directorate of Education in Baghdad / Rusafa Al-Rashidiya district.

$$H_0: \bar{X}_1 = \bar{X}_2$$

$$H_1: \bar{X}_1 \neq \bar{X}_2$$

Research limits

The current research included:

- Female intermediate third grade students from the General Directorate of Education in Baghdad / Rusafa 1, Al Rashidiya District.
- Multiple mathematical representations according to the Lesh model with its components (spoken language, written symbols, pictures and shapes, models and solids, life situations).

Mathematical ability with its four components (memory ability, numerical ability, spatial ability, and inferential ability) - The first semester of the academic year 2020-2021.

Search terms

Multiple Mathematical Representations According to the (Lesh) Model

Lesh (1987) defined it as: a teaching model that links different representational stages, namely: the stage of symbols and language, the stage of images and shapes, the stage of manual work and the real situations, so that it is possible to move from one stage to another through a coherent representational system consisting of manual work, mathematical language and symbols. Real life situations, different images and representations "(Lesh, 1987: 180).

It defines it procedurally as "the pictures, shapes, written symbols, verbal language, models, representations, and life situations that high school students use in their representation of the position or mathematical idea to answer the items of the aforementioned test, measured by the degrees they obtain as a result of their answers to the multiple mathematical representations test items according to the Lesh model)).

Mathematical ability

(Syed, 1979) defined it as: "a cognitive quality underlying a group of methods of cognitive activity aimed at thinking about arithmetic relations, algebraic equations, and spatial relationships" (Sid, 1979: 19).

And it defines it procedurally: "The ability of female intermediate third-grade students to employ their remembering, numerical, spatial and inferential abilities measured by the degrees they obtain as a result of their answers to the items of the mathematical ability test prepared for the aforementioned purpose.

THEORETICAL BACKGROUND

Mathematical representations

Mathematical representations are the embodiment of mathematical ideas and concepts, enabling students to identify common mathematical elements of different situations, and it is one of the processes that transfer mathematical content from its first form to various other formulas that include, for example, symbols, shapes, tables, variables, etc., and it has a prominent importance in communicating ideas And the mathematical concepts of learners, as well as the conduct of operations on them, and this importance became clear when the National Council of Mathematics Teachers (NCTM, 2000) called for the representation process in the document "Principles and Standards" for school mathematics as these standards emphasized that education programs from kindergarten to the twelfth grade To allow students to:

1. Building Mathematical representation and its use by students in order to organize sports ideas, record them and transmit them to others.
2. Selecting and applying mathematical representations and translating between them in order to solve mathematical problems.
3. Using representations to model and explain physical, social and mathematical phenomena (NCTM, 2000: 67-71).

It is the heart of the body when it comes to studying mathematics. Students can develop and deepen their understanding of mathematical ideas and concepts, when they create, compare and use various forms of representations such as shapes, pictures, tables, maps, charts, symbolic processing and translation, and all these representations help students to continue their mathematical thinking (Afifi , 2008: 38), It is also considered a skill through which the learner changes the form of knowledge coming to him from the external environment by establishing relationships between the specified elements, or giving verbal information or a problem so that it is easy to represent it in the form of a graph, schematic, or in the form of a table, and it is a special case of The skill of analyzing relationships, The learner, through representations, identifies the parts, and expresses them differently through the presence of a specific goal for him, and after that he reaches an understanding of new capabilities as a result of the reformulation that he performed through the process of representation (Al-Absi, 2009: 231-230).

That deep knowledge in mathematics, and increasing students' ability to solve mathematical problems in creative ways, relying on positive thinking, is achieved through the use of multiple representations (Ibrahim, 2016: 12).), As it is considered a way to represent mathematical ideas about how people understand these ideas and use them in their daily lives, and the term representation includes the process and the results, in other words the process of expressing a mathematical concept or relationship in some way, so the mathematical operations are those that occur internally in the minds of those who deal with mathematics, As for the results, they are those that are observed externally (Al-Zuhairi and Al-Naeli, 2016: 768).

Lesh model for multiple mathematical representations

The Lesh model of multiple mathematical representations can be considered an expansion of Bruner's theory of three representations (practical and kinesthetic representations, figurative and imaginary representations, symbolic representations). Lesh, Post and Behr, 1987 developed a model for multiple representations after they added the representation by life situations and the representation in the spoken language to the Brunner model to consist of five components representing the components of the Lesh model of multiple mathematical representations and the relationship between them. This model assumes that ideas, concepts, or Mathematical relationships or generalizations can be represented in five different forms, namely (spoken language is a means by which we express an idea, concept, relationship, or mathematical generalization by speech, for example, pronouncing a language that the student understands, written symbols represent any means of expressing an idea, concept, relationship or generalization of mathematics By writing it and related to all mathematical symbols and written words, and both are related to the other, pictures and shapes are an educational tool that contains pictures or drawings that the student can see with his own eyes, whether those drawn by the teacher or those in the textbook or those that the student draws with his hand, the models and models represent the student's ability to see the models Three-dimensional, and life situations represent situations and situations related to the student's real life and are related to mathematical concepts, relationships and generalizations given to the student)(Shaheen, 2011: 17), and with this addition, this model became more comprehensive and specialized than Bruner's model and is suitable for the primary and intermediate stages, as he emphasized that

the student's understanding is reflected in his ability to represent ideas, concepts, relationships and mathematical generalizations in a variety of ways, as illustrated by Figure (1) Lesh et al., 1987: 34 (Figure 1) that shows the elements of the Lesh model of multiple mathematical representations and the relationship between them.

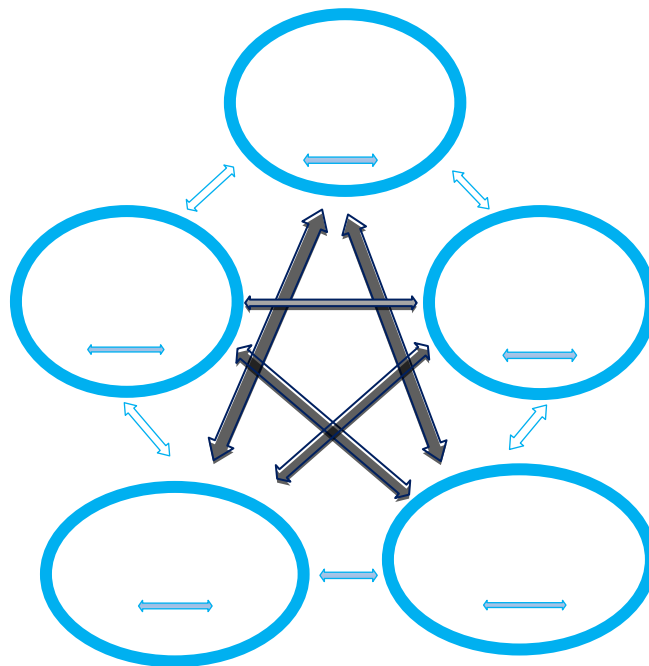


Fig.1: Lesh model of multiple mathematical representations (Lesh et al, 1987: 34)

Mathematical ability

Mathematical ability in its composition is a complex mental ability and it is not simple like that of general abilities, but at the same time it is considered a sub-ability that belongs to a more general and comprehensive ability called the practical ability to distinguish it from the linguistic ability (Moawad, 1983: 24), Thurston called it in his enumeration of primary abilities and acknowledged the existence of a special factor called number (Mahmoud, 1985: 96-97), It can be considered one of the mental processes characterized by an innovative nature, and Hardnair confirms this, It is believed that the difference between the one who succeeds in solving problems in algebra and geometry or other branches of mathematics and the inventor is a difference only in degree and not a difference in the quality of thinking (Al-Qabati, 1993: 3) Early research of mathematical ability confirmed the idea of its differentiation from other complex abilities, and then proceeded thereafter to study its components and determine the sub-capabilities that enter into its composition (Al-Sheikh, 1990: 320), This is due to its importance that appears in overcoming unfamiliar problems that may be in numerical, mathematical or symbolic form. Also, the individual who is characterized by mathematical ability has a great ability in dealing with numbers and performing various arithmetic operations (Al-Toudary, 1999: 3), (Syed, 1979) states that the components of mathematical ability are:

1. Memory ability: the ability to directly retrieve or identify words, symbols, drawings, or numbers.
2. Numerical ability: numerical ability relates to every mental activity characterized by ease in performing basic numerical operations that are summarized in addition, subtraction, multiplication and division, meaning the numerical ease, and the largest operations saturated with this ability are the process of addition and the process of multiplication.
3. Spatial ability: This ability appears in every cognitive activity that is characterized by a visual visualization of the movement of flat and three-dimensional shapes. (Sid, 1979: 19-20)
4. Inferential ability: a logical mental process that includes a set of sub-skills that appear in every cognitive mental activity characterized by extrapolating a base from its particles and deducing the part from the whole as it leads the individual from known facts or validly recognized issues to knowledge of the unknown mentally ". (Al-Atibi, 2001: 5).

Mathematical ability can be seen from several aspects, it may be represented in the student's ability to face a new problem in the context of old content or an old problem in new content, and when he tries to find a solution to the problem at the beginning and fails to do so, he re-examines the information contained in the problem and addresses it again and then re-checks employing and applying them in situations more effectively, Therefore, the

mathematical ability is a function of the student's knowledge, previous experience, and his ability to relate his knowledge in effective ways and in contexts of unfamiliar situations (Al-Mutreb and Bayoumi, 2012: 211). Badawi confirms that the components of mathematical abilities cannot be separated from each other, as they do not represent separate factors for the individual's ways of thinking in mathematical situations, but these abilities describe the ways through which learned knowledge is built to some extent, and the ways through which students can deal with their mathematical ideas, thinking about them and communicating with them (Badawi, 2019: 217).

The second axis / previous studies

The two researchers reviewed a number of previous studies (Arab, local, foreign) that dealt with the two research variables (multiple mathematical representations according to the Lesh model, the mathematical ability) as the two researchers were unable to obtain any study that dealt with the two research variables together (as far as they know). Table (1) illustrates this:

Table 1: previous studies

No	Author name and country	The objective of the study	Education level	Sample type	Curriculum type	Subject	Results
1	Al-Harbi, 2014 Saudi Arabia	Examining the relationship between multiple mathematical representations and solving verbal problems	primary	150 male	descriptive	Maths	The decline in the level of mathematical representations with words in a way greater than the representations using drawings, tables, or symbols. It also showed that there is a strong correlation between the multiple representations and the ability to solve verbal problems.
2	Johnson, 2017 United States of America	The investigation of the possibility of using technology to apply Lesh representations to teach concepts in its components verbal language, written symbols, life situations, images and shapes, and concrete representations.	Elementary teachers	3 males	descriptive	Maths	It provided educators with an opportunity with a wealth of technological applications to extend the Lesh model to include moving pictures using technology for future studies.
3	Kattou et al., 2012 Cyprus	It aimed to find out whether there is a relationship that exists between athletic creativity and athletic ability.	primary	359 males	descriptive	Maths	There is a positive correlation between mathematical creativity and mathematical ability, and that creativity is a sub-component of mathematical ability. The results also revealed that groups of students that differ in mathematical ability differ in mathematical creativity as well.
4	Abdullah, 2018 Iraq	And it aimed to know the nature of the correlational	Preparatory and middle	males and females	descriptive	Maths	The existence of non-statistically significant differences, and

		relationship between the mathematical ability of mathematics teachers (male and female) for the preparatory stage and the creative thinking of their students in Babil	school teachersy	519 61			statistically significant differences in favor of males in comparison between the mean averages of their scores, and the existence of a positive and strong correlation between the mathematical ability of mathematics teachers (males and females) and creative thinking, which is positive.
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RESEARCH METHODOLOGY AND PROCEDURES

Research methodology

The research relied on the descriptive research method that seeks to define the current situation of the studied phenomenon and then describe it. It depends mainly on studying the reality or the phenomenon as it exists in reality as an accurate description.

The research community

Included all students of the third intermediate grade in the schools affiliated to the General Directorate of Education in Baghdad / Rusafa 1, Rashidiya district, morning studies for the academic year (2020-2021), of which (564 students were distributed in (9) middle and high schools and by (2)) an intermediate school And (7) secondary schools for morning study, according to the lists obtained from the Educational Planning Department in the General Directorate of Education in Baghdad / Rusafa 1

The research sample

In the current research, the sample was determined from the middle third grade female students who represent the original community of the schools, which numbered (9) schools, as the total sample size was (135) female students, and they represent (24%) of the size of the original community under study, and after determining the size of the sample From the original community, the selection was made randomly to ensure that any member of the research community had a chance to be part of the research sample..

Research tools

In order to answer the research questions and verify its hypotheses, this necessitated building two tests, one of which is to measure multiple mathematical representations according to the "Lesh" model with its components (spoken or verbal language, written symbols, pictures and shapes, models and figures, and life situations) of the sample, and the second test to measure their mathematical ability Which included four sub-abilities (memory, numerical, spatial, and inferential), and in order to build the two aforementioned tests, the following procedures were followed: -

Multiple Mathematical Representations Test According to the "Lesh" Model

Each step is illustrated below The concept of multiple mathematical representations was determined according to the model "in line with the nature of the current research, The test consisted of (28) items with (24) of the objective type and (4) of the essay type, and the objective paragraphs were given a score of (1) if the answer was correct, As for the essay paragraphs, the degree of question No. (25) was (10) degrees, and Question No. (26) had a score of (15) degrees. As for the degree of both questions No. (27) and No. (28), it was (6) degrees, The test paragraphs and instructions for answering them were presented to a group of arbitrators to demonstrate their suitability and validity for the research sample and were approved by more than (80%) of the arbitrators. The test in its initial form consisted of (28) items. The test was applied to an exploratory sample consisting of (50) students chosen randomly from the research community and not from the sample for the purpose of determining the time of the test and it was (58) minutes, conducting statistical analyzes and confirming the psychometric properties, The test in its initial form consisted of (28) items. The test was applied to an exploratory sample consisting of (50) students chosen randomly from the research community and not from the sample for the purpose of determining the time of the test and it was (58) minutes, conducting statistical analyzes and confirming the psychometric properties,

Validity of the test

The test has an outward validity by presenting it to a group of arbitrators whose approval is 80% and above. As for the validity of the construct, the extraction of difficulty and distinction coefficients and the effectiveness of

alternatives to the items is an indication of the validity of the construction. Therefore, the test items have the validity of construction. And virtual honesty.

Stability of the test

The (Fakronbach) equation was adopted to calculate the stability of the test for multiple mathematical representations according to the Lesh model. It reached (0.804). This result is good, and the half-segmentation was also used to verify the stability of the test. The result of the calculated stability of the half-segmentation of the test after dividing its paragraphs into individual and even paragraphs was (0.758) and then corrected using the Spearman - Brown corrective equation, so the value of the reliability coefficient of the test became (0.862). It represents a good stability of the test, and after verifying the validity and reliability of the test and conducting appropriate statistical analyzes, the test is ready for the final application of measuring multiple mathematical representations according to the Lesh model for third-grade intermediate students.

Mathematical ability test

The following is an explanation of each step

1. The concept of mathematical ability was defined and types were adopted (remembering ability, numerical ability, spatial ability, inferential ability) in accordance with the nature of the research.
2. Repeat the test from 32 paragraphs of the objective type, with four alternatives.
3. Typical answers were developed for all the paragraphs as a score of 1) was given for the correct answer and 0 for the wrong answer, and the total score for the test was 32)) score.
4. The test paragraphs and instructions for answering them were presented to a group of arbitrators to demonstrate their suitability and validity for the research sample, and it received the approval of more than (80%) of the judges, and the test in its initial form consisted of (32) items of the objective type and four alternatives.
5. The test is applied to a sample consisting of (50) female students, who were randomly selected from the research community and not from the research sample, The purpose of this application was the statistical analysis of the test items and the determination of the test time, and (50) minutes was sufficient to perform it.
6. Appropriate statistical analyzes of the test items were carried out from the calculation of the factors of difficulty, discrimination, and effectiveness of alternatives after it was applied to a second survey sample and it was found that all the paragraphs were acceptable except for the paragraphs (19, 18, 17, 2) because they were omitted because their distinction coefficients were below the acceptable percentages and the final test items became (28) paragraph.

Validity of the test

The test has an outward validity by presenting it to a group of arbitrators whose approval is 80% or more from their opinions. As for the validity of the construct, the extraction of difficulty and distinction coefficients and the effectiveness of alternatives to the items is an indication of the validity of the construction. Therefore, the test items have validity. Construction and virtual honesty

Stability of the test

The formula (Fakronbach) was adopted to calculate the test stability of the mathematical ability, and it reached (0.718), which are good ratios as indicated by most sources. The half-segmentation was also used to verify the stability of the test, and the calculated stability result of the half-segmentation of the test after dividing its paragraphs into individual and even paragraphs was (0.605) and then corrected using the Spearman - Brown corrective equation, so the value of the stability factor of the test became (0.754). It represents an acceptable stability of the test, and after verifying the validity and reliability of the test and conducting appropriate statistical analyzes, the test is ready for the final application to measure the mathematical ability of students of the third intermediate grade.

The final application of the research sample

In order to answer the study questions and verify its hypotheses, and after the appropriate statistical treatments were performed for each of the multiple mathematical representations test according to the (Lesh) model, consisting of (25) final paragraphs, and the mathematical ability test consisting of (28) in its final form, the two tests were applied for a period of 1 / 2/2021 until 2/11/2021, as it was agreed with the school administrations on the date of applying the tests, and the application was carried out under appropriate environmental conditions, as well as the absence of any subject exam before or after the application of the two tests, and the study sample was asked to write their personal data then explained the way to answer the test items and inform them that the results obtained are counted for scientific research purposes only.

Presentation and interpretation of results

Results related to multiple mathematical representations according to the Lesh model

To find out the results related to multiple mathematical representations according to the Lesh model, the following hypothesis was tested:

The first hypothesis

From the observation of the grades obtained by the students of the research sample in the multiple mathematical representations test according to the (Lesh) model, as the mean average of the students' grades reached (33,156) score out of (58) score, which is equivalent to (57.166%) and by comparing the mean average of real performance For female students (33.156) with the hypothetical average (29), we note that the real performance outperforms the hypothesis.

To make sure and to support the above conclusion, the T-test was used for one independent sample to test the validity of the previous hypothesis, and the results were as in Table (2).

Table 2: The results of the T-test to measure the significance of the difference between the average real and hypothetical performance of the students of the research sample (multiple mathematical representations according to the Lesh model)

Sample gender	Sample volume	Average mean	std	Standard error	Hypothesized mean	t-test calculated	"T " Tabular
female	135	33.156	7.964	0.685	29	6.062	1.97

From the observation of Table (2) above that the calculated value of (t-test) (6.062) is greater than the value of the tabular "t" (1.97) and because the calculated value is higher than the tabular, the null hypothesis is rejected and the alternative hypothesis is accepted, meaning that there is a statistically significant difference at a level of significance (0.05) in favor of the true mean. The reason may be attributed to:

The representation process begins with students from a young age when they try to learn from the kindergarten stage, where teachers resort to representations in order to convey information to students in an attempt to bring the information to their minds in a simpler and clearer way and to get rid of individual differences between them, as the student grows and the process of representation continues with him in every stage, the primary school teacher, for example, resorts to representing fractions with fruits and vegetables, in explaining groups, and so on with other stages, and the reason may also be attributed to the fact that the research sample studied the curriculum developed from the first grade to the third intermediate grade, which gives special importance to the multiple mathematical representations that helped to achieve effective learning They have.

Results related to mathematical ability

From the observation of Table (3), we find that the arithmetic mean of the scores of the students of the research sample in the mathematical ability test is (17.985) score out of (28) score equivalent to (64.232%) and by comparing the mean average of the students' real performance (17.985) with the hypothetical average 14) We note that the real performance outperforms the hypothetical performance. To increase the certainty, the T-test was used for one independent sample to test the validity of the aforementioned hypothesis, and the results were as shown in Table (3).

Table 3: The results of the T-test to measure the significance of the difference between the average real and hypothetical performance of the research sample students (mathematical ability test)

Sample gender	Sample volume	average mean	std	Standard error	Hypothesized mean	t-test calculated	"T " Tabular
female	135	17.985	4.967	0.427	14	9.322	1.97

When observing Table (3) above, we find that the calculated "t" value (9.322) is greater than the tabular "t" value (1.97), and this leads us to reject the null hypothesis and accept the alternative hypothesis, meaning that there is a statistically significant difference at the level of significance (0.05) in favor of the female students , and the reason may be due to:

Mathematical ability is one of the cumulative mental abilities as it represents the outcome of what learners have acquired during their previous school stages, which enabled them to overcome any problem or mathematical situation facing them, and the reason may also be due to some teachers' use of modern teaching methods and methods that help to develop mathematical ability in the process of teaching and learning mathematics , The reason may also be due to the change that occurred in the content of mathematics curricula for the intermediate stage, as its vocabulary was developed so that it contains a number of paragraphs, including a thought

paragraph, a challenge paragraph, and a discovery error paragraph in addition to the multiple choice questions that are present at the end of each part of the first and second parts, whose solution requires thinking and experimentation to reach the correct solution, all of which are factors that helped develop mathematical ability I have female students.

Results related to the correlation between multiple mathematical representations according to the Lesh model and mathematical ability

The third hypothesis

He relied on the Pearson correlation coefficient to find the correlation coefficient between the scores of the students of the research sample on the multiple mathematical representations test according to the Lesh model and their scores on the mathematical ability test. To measure the significance of correlation, the T-test for correlation coefficients was used to test the validity of the aforementioned hypothesis, and the results were as shown in Table (4) as follows:

Table 4: The correlation coefficient between the mathematical representations according to the Lesh model and the mathematical ability and the significance of the correlation among the students of the research sample

Type of test Sample	Sample size	Average mean	Standard deviation	Standard error	Correlation coefficient value	T value of correlation indication
mathematical representations according to the Lesh model	135	33.156	7.964	0.685	0.949	18.779
mathematical ability	135	17.985	4.967	0.427		

Degree of Freedom (133)

By referring to Table (4), we find that the correlation coefficient computed between the multiple mathematical representations according to the Lesh model of the students of the research sample and their mathematical ability reached (0.949) and this is a strong and positive correlation coefficient, and that the T-value of the significance of the correlation coefficient is (18.779) which is greater than The tabular T value of (1.97) at a level of significance (0.05) and with a degree of freedom (133), which means rejecting the null hypothesis and accepting the alternative hypothesis, meaning that there is a strong correlation between these two variables, and the direction of the relationship is direct.

The reason may be due to the fact that the representation process includes the student's ability to interpret, construct and communicate effectively and that it uses physical, visual and symbolic models to improve her mathematical abilities (NCTM, 2000: 285). The use of multiple representations carries within it multiple strategies to represent the idea, concept, or mathematical generalization by more than one representation, for example when the student represents the idea, concept, or mathematical generalization in life situation, this represents one of the problem-solving strategies, which is the strategy of summoning a similar problem or representing it in a picture, table, or Diagrams or mathematical equations and other representations are all solving strategies and when they do that they have a sense of their mathematical ability.

CONCLUSIONS

In light of the results of the research, the following can be concluded:

1. Female third-grade intermediate students in the General Directorate of Education in Baghdad, Rusafa 1, possess multiple mathematical representations according to the Lesh model, and they possess mathematical ability.
2. The existence of a positive correlational relationship that is direct, i.e. whenever the students 'ability to multiple mathematical representations according to the Lesh model is high, the higher their mathematical abilities are, which is a direct relationship.
3. Increasing the enthusiasm and motivation of the students when applying the multiple mathematical representations test according to the Lesh model and the mathematical ability test away from the usual achievement tests.

RECOMMENDATIONS

In light of the results of the research, the following was recommended:

1. Curriculum designers should emphasize multiple mathematical representations according to the Lesh model for students and their importance when building and developing mathematics curricula.
2. Educating mathematics teachers of the importance of multiple mathematical representations according to the Lesh model and the mathematical ability of students as one of the important objectives of teaching mathematics advocated by the National Council of Mathematics Teachers (NCTM, 2000).
3. Training students to use multiple representations efficiently, as this relates to the development of their mathematical abilities, as it leads to a reduction in memorization and memorization of information and traditional thinking by realizing the mathematical idea in a variety of ways and communicating it to others and confirming the results.
4. Exposing female students to various practical and life situations that require them to use multiple mathematical representations according to the Lesh model, as well as employing their mathematical abilities.
5. Diversity in the educational methods used and encouraging students to self-learning in order to provide an educational environment for the use of multiple mathematical representations according to the Lesh model.

Proposals

In light of the results, the researcher suggests the following:

1. Conducting a similar study for the elementary and preparatory stages to find out their possession of multiple mathematical representations according to the Lesh model and the types of mathematical ability.
2. Conducting experimental studies to use some software in employing multiple mathematical representations according to the Lesh model, which would develop students' mathematical abilities.

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