

The Effect of the Lesh Model on Mathematical Communication Skills and Visual Thinking Among The Fifth Grade Primary Students

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Abstract

The current research aims to know "the effect of the Lesh model on the mathematical communication skills and visual thinking of fifth-grade primary students". The research sample consisted of (40) students distributed to two groups, one is experimental and the other control, where each division includes (20) students. Furthermore, the two groups were rewarded in time age, intelligence test, previous knowledge test and the general average for the previous school year. Two tests were prepared, the first one was for the mathematical communication skills, and the second for visual thinking, by (18) objective items for each test, and face validity was performed for them, and the reliability coefficient of the two tests was calculated using the (test and re-test method) and for both variables. Moreover, the validity value for the first test reached (0.88), while the validity value for the second test reached (0.91), while the statistical package for social sciences (SPSS) was used to analyze the results. Finally, the research results showed that there were statistically significant differences at the level of (0.05) between the average scores of the experimental group that studied by the Lesh model, and the control group for the experimental group.

Keywords: Lesh model, mathematical communication, skills visual thinking

Article Received: 10 August 2020, Revised: 25 October 2020, Accepted: 18 November 2020

• Introduction

It can be observed that traditional methods still constitute a large presence among the methods used by the teacher in the classroom, and the role of learners is negative in the process of learning and teaching, which leads the teacher to present his lessons in an uninteresting manner this, causes the learner to be uninterested in learning. As well as, it can be observed that traditional methods of teaching do not emphasize the mathematical communication on the one hand and visual thinking on the other. Therefore, the current research problem is the existence of an urgent need to develop methods and models used in teaching mathematics to improve mathematical communication skills and visual thinking to keep pace with developments in the world, including our Arab and Islamic society in general and Iraqi society in particular. However, the educational-educational models available today are traditional and this encouraged the authors to think in another way to teach the students. Thus, they chose the Lesh model, because the structure of mathematics does not resemble the rest of the subjects for being regular parts and topics are arranged in a hierarchical

format, to know its effect on mathematical communication skills and visual thinking. Accordingly, the current research problem lies in answering the following question: What is the effect of the Lesh model on mathematical communication skills and visual thinking among fifth-grade primary school students? The importance of the current research is determined by the use of Lesh model for mathematical representations is important in developing the activities teachers need to teach mathematical content, and the model assists learners in communicating with other learners, and rebuilding and organizing their knowledge and information (Al-Rawajiyah and Al-Obaidi, 2017: 85-86). Besides, the using Lesh model for mathematical representations is an effective technique that makes mathematical ideas harder, as it supports these ideas by helping learners understand the main advantages of mathematics (Rowan and fennel, 2001: 143). Furthermore, the Lesh Model is one of the models that make mathematical ideas more clear, and enhances the understanding of learners by giving them representations as a means of great importance in mathematical communication, visual thinking,

and increased interest in mathematical activities that make learners the focus of the educational process. However, (Al- Jaban, 2017) believes that communication works to exchange human heritage between peoples, and transfer it from one generation to another, as it is the backbone of the research, educational process, which is transmitted through information, science, experiences, values, trends and beliefs among the sons of one generation (Al- Jaban, 2019: 21). Mathematical communication is the essence of class activities and a tool if the teacher possesses it helps him to facilitate his tasks. As well as improving the visual thinking of learners and building their personality, positive class interaction is the main pillar in the educational learning process and is a primary objective to achieve the desired goals in learning mathematics (Al-Farra, 2004: 5). Mathematical communication plays an important role in helping learners to establish necessary and important connections in physical, visual, graphic, verbal, and intellectual representations of mathematical ideas. (Badawi, 2019: 364). Several research studies in the field of teaching and learning have demonstrated the importance of visual thinking, as the learner and teacher all have a necessary need for visual thinking processes, and the liaison between the learner and the teacher is achieved in the teamwork team. (Taha, 2018: 17). Finally, the research aims to investigate the effect of the Lesh model on mathematical communication skills for fifth-grade primary students, and the effect of the Lesh model on visual thinking among fifth-grade primary students.

- **Research hypotheses, limits, and Concepts**
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In order to verify the research objectives, the following two hypotheses have been formulated. As there is no statistically significant difference at the significance level (0.05) between the average scores of the experimental group students that were studied with Lesh model, and the average score of the control group students that were studied with the normal method in the mathematical communication skills. Moreover, there is no statistically significant difference at the significance level (0.05) between the average score of the experimental group students that were studied the Lesh model and the average score of the control group students that were studied with the normal method in the visual thinking test. The current research is limited to the fifth-grade

primary students in the General Directorate of Education for the first Rusafa / the academic year (2018-2019). As well as, chapter seven to chapter twelfth of the Mathematics book for the fifth-grade primary, fifth edition, 2014AD, during the second semester of the academic year (2018-2019). (Qatami and Qatami, 1998:36) define the model as the strategies that the teacher employs in the educational situation, to achieve educational outcomes for learners, based on the assumptions presented by the model and including the role of the teacher and learners and the method of presentation, evaluation, and treatment. Additionally, (Qatami and Naiqa, 2000:171) define it as a plan that can be used in organizing the teacher for his tasks of educational and teaching materials and experiences. (Abu Al-Ajin, 2011:43) defines Lesh Model as the use of images for verbal representation such as symbols, or non-verbal representation of drawings, pictures, shapes, lines, tables, as well as calculated materials to express elements of mathematical content. While the using words, lines, graphics, tables, data, images, symbols, and using some representations on the computer to express a mathematical idea or concept, and it consists of five elements that represent the elements of the Lesh model for multiple representations and the relation between them: spoken language, written symbols, pictures and shapes, models and figures, and life situations. (Abu Hilal, 2012: 13). The theoretical definition of the Lesh Model includes the ability to use symbols, words, tables, drawings, mathematical relations, and concrete materials to express a mathematical idea to reach the maximum level of understanding among learners. Besides, it consists of five elements that represent the elements of the Lesh model for multiple representations, namely: representation with written symbols, verbal representation, representation of images and shapes, representation of models and figures and the representation of life situations. Furthermore, the Procedural definition of the Lesh Model is a set of procedures and activities that the researchers plan to help fifth-grade primary students (experimental group) that are based on five elements representing symbol representation, verbal representation, formal representation, forms, representation of models and models, and representation of life situations in teaching. Besides, (Ali and Muhammad, 2012:12) define Mathematical Communication as the process of transmitting mathematical information and ideas using symbols, words, and drawings (Ali and Muhammad, 2012: 12). While (Abu Atherah,

2012:94) defines it as the ability of learners to use the language of symbols, signs, and ideas to exchange information or any other material that serves as a language of understanding between learners. The Theoretical definition of mathematical communication: means the learner's ability to use symbols, graphics, operations, and mathematical relations. It includes five skills: acting, reading, listening, speaking and writing. The procedural definition of mathematical communication refers to the score obtained by the fifth-grade primary students in the General Directorate of Education for the first Rusafa by answering the items of the mathematical communication test prepared for this research. (Tariq, Ehab, 2016) defines it as The learner's ability to deal with the concrete materials and distinguish them visually, so that he has the ability to realizing spatial relations and mathematical information interpretation and analysis, as well as an explanation of ambiguity and the conclusion of meaning represents the definition of Visual Thinking according to: (Tariq and Ihab, 2016: 50). Otherwise, the learner can access knowledge through the awareness of the visual elements and the situation analysis in it mainly based on his capabilities and previous experiences (Suwaidan and Al-Zuhairi, 2018: 331). The Theoretical definition of visual thinking defined as the learner's mental ability that helps him translate what he deems of visual stimuli, shapes, and engineering drawings into verbal indications in describing geometric shapes and realizing the relations between them to achieve objectives. Finally, the procedural definition of visual thinking means the score that fifth-grade primary students obtain in the General Directorate of Education for the first Rusafa by answering the items of the visual thinking test prepared for this research.

- **Previous Theoretical Background and Studies:**

Bruner sees that for representation three elements: sensory representation, formal representation, and

symbolic representation of the representation of mathematical ideas and principles among learners, and he emphasized that these elements are in a linear chronological order. However, this logic has become true for several decades, but the issue is more difficult and complicated than what Bruner referred to, he emphasizes that it includes additional non-linear stages (Post, T and Ceamer, K, 1989). (Lesh, 1979) added in his model two representations: the representation of language and the representation of life situations, and emphasizes the interactive nature of these different elements of representation, and each of (Lesh, Post, T. & Beher, 1987) emphasized to name this model as the Lesh model for mathematical representations. This model consists of five components representing the multiple representations elements and the mathematical relations between them (Lesh, Post, T. & Beher 1987: 34). However, these five representations are the representation of written symbols, which means the representation of any means of expressing a mathematical concept, such as writing with symbols, writing in numbers and using the language. As well as, the verbal representation that means representing any means of expressing the mathematical concept with verbally and words and this is important in formulating verbal problems, and communicating the solution correctly to mathematical problems, and facilitates the connection between mathematics, principles and other scientific fields. Furthermore, Representation with pictures and shapes means representing any learning method that contains drawings, pictures, shapes or tables used to illustrate and provide a clear picture through looking. Also, representation by models and figures, which means a representation of any means that the learner can hold with his, hands, and plays with it like cubes and others. Finally, the Representation in life situations means representing life situations that are appropriate for life issues and that are consistent with the mathematical concept or position (Murshid, 2011: 14-15).

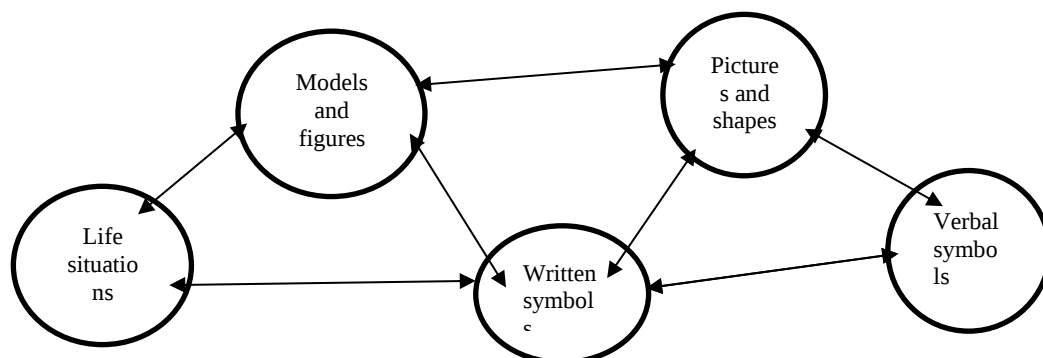


Figure (1) shows the Lesh model for multiple mathematical representations (Authors)

The Lesh model suggests that mathematics in the primary stage can be expressed in five different elements of representations: language, symbols, handicrafts, images, and life situations and it can reflect the ability to represent mathematical ideas and principles in several ways, in addition to the ability to transmit within one type of representations. This is what indicates the internal arrows present in the model, and believes that the transformations that make mathematical ideas have a meaning for learners. The strength of the Lesh model can indicate multiple uses including it can be

It can be used as an evaluation model, and the model can be considered as an auxiliary model to decide on the school curriculum. Furthermore, it can be used as a model for curriculum development, from which mathematics teachers can benefit from how to implement the curricula and determine the mathematical activities that enrich the curriculum (Murshid, 2011 :18). The using of the Lesh Model makes it easier for learners to understand scientific concepts and ideas through the processes of communication between mathematical situations and principles, and the use of mathematical representations may facilitate in clarifying mathematical ideas or situations to work with different levels of learners (Al-Balasy and Areej, 2010: 4). (Fennel & Rowan, 2001) points out the importance of mathematical representations as through helps the learner to learn mathematical ideas through the educational situation. Also, assist the teachers when moving from concrete to abstract or between different mathematical representations and it is used as a tool to think and to bring mathematical ideas closer to reality (Fennel & Rowan, 2001: 289). The importance of the Lesh model includes developing the activities that teachers need to teach mathematical content, and representative shapes allow learners to think on as many solutions as possible to a single problem. As well as, the model helps learners communicate with others (Al-Rawajya and Al-Obaidi, 2017: 86-85). The teacher is used this model to explain the mathematical ideas, principles, and facts in reading, writing, listening and speaking and adding them to teaching (NCTM, 2000: 1), and it gives learners opportunities to translate mathematical ideas into many activities (Salkind, 2007: 11). The mathematical representations classification by function can be classified by function into external

representations, which is a collection of mathematical forms and ideas that are presented to learners such as spoken language and manipulatives, pictures, drawings, tables, charts, and statistical data. As well as, Inner representations are represented by mental images that learners show for a mathematical idea or mathematical concept. As the representations were classified according to the information includes descriptive patterns, which they are used to organize facts or characteristics of learners or places or things. Descriptive patterns are used to arrange and form information, and the sequence patterns, where the facts are organized, and in chronological order. Additionally, circular patterns represent the information arranging in terms of organization and supporting it with several examples. In addition, Concept patterns that means the arrangement and organization of classes, objects, or general categories and events under the concept patterns (Zaytoon, 2005: 603). Finally, the representations can be classified according to the figure through written representations, which they are the words that a learner can formulate and express in terms of a mathematical idea, and oral representations: what is spoken verbally. Furthermore, Representations with symbols, where These include symbolic expressions that facilitate dealing with the concept and expressing it, and representations with pictures and graphics that include drawing shapes, figures, diagrams, and others. As well as, concrete representation: It includes activities that the learner engages in to communicate to the concept, and computer representation: the computer has become one of the best devices through which to display many, whether it is a photo, drawing or display of many examples.

- **Mathematical Communication Skills,**

Mathematical communication includes five skills, firstly the Mathematical representation skill, where it indicates the ability of the learner through which to change the form of information received by him from the external environment by establishing relations between the specific elements, to reach the appropriate solution to the mathematical situation (Abu Gado, 2010: 93). Example: Let $X = \{\text{Hoda, Hassan, Maryam}\}$ a group of superior

students in mathematics, and $Y = \{\text{Hoda, Ahmed, Hassan, Mustafa}\}$ a group of superior students in science. Who are the students who superior in math and science together? Which need to represent the matter with a sketch is represented as follows: $X \cap Y$ as shown in Figure 2

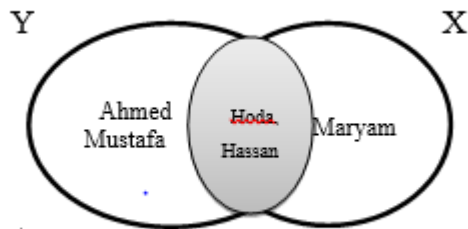


Figure 2 Mathematical representation skill

Mathematical reading is considered one of the basic skills that modern systems focus on, and it is considered one of the most important factors and elements of education for mathematics well, and because it helps learners to feel and procedures. In addition to realizing the communication between mathematics and life, and an aiding factor in evaluating and understanding the scientific ideas presented in the mathematical text, which includes the learner can read mathematical symbols and terms, relations, graphs, mathematical Tables, and figures. When explaining the group, its symbols, and operations on it, we emphasize on the learner how to read mathematical symbols (Al-Jandali, 2007: 123) as shown in the following examples:

The symbol $\exists$ is the symbol of affiliation and reads (belongs to)

The symbol $\nexists$ is the non-affiliation symbol and reads (does not belong to)

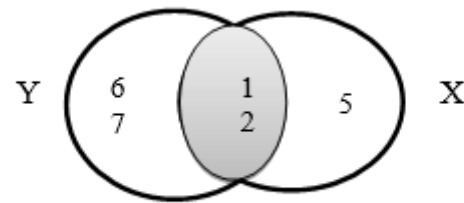
The symbol $\cap$ means the intersection and reads (the intersection)

The symbol $\cup$ means union and reads (union)

The symbol $\{\}$ or $\emptyset$ means empty set and is the set that does not contain any element

Example / Let $x = \{1, 2, 5\}$, $y = \{1, 2, 6, 7\}$ Find $x \cup y$ with the graph.

They are represented as follows: $x \cup y = \{1, 2, 5, 6, 7\}$.



Mathematical writing is considered to express the language of mathematics by organized writing, an important communication tool helps the teacher to attract learners with written experiences and solutions to problems. As learners use them to record their ideas and responses in learning situations and open channels of mathematical communication between the learner and his other colleagues, and it also transmits mathematical ideas regularly and more accuracy, effectiveness, and help students able to think about the mathematical task. The learner should learn to correct and orderly express when solving and putting numerical and algebraic symbols, arrangement, distinction, and equal sign in problems and Mathematical operations (Al-Saeed, 2005: 36). Additionally, Speaking skill is one of the most important fields of mathematical communication and it is a process of communication between the teacher and the learner or between the learners themselves, through which the communication skills, opinions and mathematical questions that are used to stimulate discussion and encourage each learner to participate in the discussion are always linked to a high level and develop the skills of conclusion, thinking, and criticism (NCTM, 2014: 33). Finally, the mathematical listening skill is the important language skill that the learner acquires, because we communicate acoustically before we are born and we do not use our eyes until after we are born. It is an important form of mathematical communication for both the teacher and learners, Learners may benefit from listening to other people's opinions and ideas in developing strategies for dealing with math activities. Besides, listening to mathematical words pronounced correctly works to develop the process of mathematical discussion and develop the ability of learners to correct pronounce mathematical terms clearly, and helps the teacher to develop remedial programs and test the learning method suited to the level of learners and their thinking (Morgan, 1999: 141). Stages of the listening process includes receive message codes by hearing, and the

transmission of these symbols to the center of thinking in the recipient's brain, the interpretation of speech and the response to this interpretation, and the evaluation of the content that we are listening to (Ali and Muhammad, 2012: 49). The teacher's role in the mathematical communication process refers to the teacher that is the main pillar of the educational process, who leads it to achieve its objectives correctly. As well as, create an effective learning and teaching environment, make it vibrant and energetic. However, education objectives can only be achieved by a successful teacher, who has teaching skills, many educators and specialists have emphasized that the success or failure of schools in achieving their goals is primarily due to their teachers and what they have of skills, experience and teaching proficiency (Fouad, 1990 24 :) Mathematical communication features refers to the symbolism of communication, the communication method is the exchange of symbols and roles in a mathematical context, and an interconnected, interrelated process that results in learners interacting, dynamic, ever-changing dynamic process (Toubasi, 31: 2019). Mathematical communication can serve many functions, as the learner allows to justifying guessing and translating the problem, and asked the learner to write a summary explaining a difficult concept to his absent colleague. (Sajdeya, 2013: 26). Moreover, Communication helps a learner improve and enhance their understanding of mathematics, improve learners' ability to learn mathematics, help the teacher gain insight into the thinking of learners and helps him direct the direction of learning, generate an appropriate learning environment (Badawi, 365: 2019).

- **Visual Thinking:**

The senses that God Almighty has given to man represent the entrance to receive knowledge of the surrounding world and which indicates the sense of sight, the eye is a camera for a person that takes pictures of what is around him and the mind interacts with what it enters to it according to its nature. Visual thinking represents a system of processes that translate the learner's ability to read the visual form and converting the visual language

that the shape carries into verbal language and extracting meaning from it (Tariq and Ihab, 49-48: 2016). The advantages of visual thinking refer to attract the interaction between learners and improves the quality of learning, and it improves learning attitude management and increases commitment among learners. In addition, it develops problem-solving skills for learners and supports new methods of exchanging ideas, and achieves the objectives of science such as interpretation, prediction, description. As well as, it helps to solve math and physical problems and supports learners' problem-solving skills, acquire self-learning ability, help learners, deepen thinking, and expand the new system, contributes to various science processes such as conclusion, analysis, interpretation, and observation (Suwaidan, Al-Zuhairi, 2018: 331). Visual thinking depends on two processes vision and imagery; the vision means the using the sense of sight to distinguish, locate and accommodate objects, and direct the learner to his surroundings in the surrounding world, while imagery refers the process of creating new images by recycling and reusing previous experiences and mental imaginations. Visual thinking skills include visual reading skills, which means the ability to determine the dimensions and the shape natural, symbols or images, while the optical recognition skill refers to the learner's ability to recognize the visual image of a shape and distinguish it from other displayed forms. Besides, spatial perception skill indicates the learner's ability to explain, interpret, recognize and place things in a space, and Information analysis skill represents the learner's ability to divide the visual form into the basic components. Finally, the conclusion of meaning skill is the learner's ability to extract new meanings and ideas and reach principles and concepts and taking into account the previous steps (Tariq and Ihab, 88-87: 2016).

- **Research procedures:**

The research experimental design includes an independent variable and two dependent variables, and the two researchers adopted experimental design with two equivalents groups (experimental group and control group) with partial control, as shown in Table 1.

Table (1) Experimental design for research

Seq.	Group	Equivalence of the two groups	Independent variable	Dependent variables	Dependent variable test
1	Experimental	1. Lifetime. 2. Intelligence. 3. Previous information 4. Achievement in mathematics for the previous year	Model Lesh	- Mathematical communication - Visual thinking	- Mathematical communication - Visual thinking
2	Control		Normal method		

The identification of the original community is a necessary necessity for the correct selection of the representative sample, so the current research community consisted of fifth-grade primary students in the Directorate of Education / First Rusafa for the academic year (2019-2018). Al-Aquli Primary Boys School was chosen to implement the experiment after obtaining official approval, with coordination with the school

administration. As it includes the number of fifth graders (40) students divided into two divisions by (20) pupils for each division, and was chosen by random assignment, division (B) to represent the experimental group that will be taught by the Lesh model, and division (A) to represent the control group to be taught by normal method, and Table 2 illustrates this.

Table (2) Distribution the individuals of the research sample to two research groups

Group	Division	Pupils number
Experimental	B	20
Control	A	20
Total		40

The researchers rewarded the two groups statistically for the variables (the previous knowledge test, the time age, the intelligence test, and the general average for the previous school year) as shown in Table 3 illustrates this.

Table (3) Arithmetic mean, standard deviations and calculated T values for the four variables

Variables	Experimental group 20 students		Control group 20 students		Degree of freedom	T value		Significance level 0.05
	Arithmetic mean	Standard deviation	Arithmetic mean	Standard deviation		Calculated	Tabulated	
Previous knowledge test	9.75	2.489	8.25	1.803	38	0.727	2.021	N.S
Time age	126.70	2.993	129.25	3.567	38	2.449	2.021	S
Intelligence test	10.60	2.664	9.80	2.505	38	0.979	2.021	N.S
General average for the previous school year	8.80	1.777	7.70	1.838	38	0.525	2.021	N.S

The scientific subject that includes the math textbook for the fifth-grade primary students for the year (2018-2019) was written by Dr. (Tariq Shaaban Rajab et al., 2014), and included (Chapter Seven to Chapter Twelfth), where (106) a behavioral objective was formulated by researchers, and they adopted, in their formulation, a Bloom taxonomy of cognitive objectives at its first three levels that consists of (remembering, understanding, applying). The researchers prepared two types of teaching plans: the first plan is taught with the Lesh model for the experimental group, and the second plan is taught in the normal method for the control group. The researchers followed the following steps in presenting the research tools through the Preparation of the research tools and Validity of the two tests. Two tests were prepared, the first on mathematical communication, and the second on visual thinking, and the two researchers relied on mathematics books, literature, and

previous studies. The researchers used the face validity, as the skills and items of the two tests were presented to the arbitrators (Dr. Riyadh Fakhher Hamid Al-Shara et al.,) and specialists in mathematics and methods of teaching them. However, skills demonstrate with items for the test of mathematical communication skills to arbitrators, in light of the arbitrator's directives and observations, two basic skills were deleted, and three skills were retained, including its subdivisions. The researchers formulated (18) multiple-choice item, and it was presented in its final form to the arbitrators and some teachers to know their views on the consistency of the items with the specific skills covered in the test and the validity extent of the item formulation, and its validity to measure the level of mathematical communication skills. As all of them had an agreement of (82%) of the opinions of the arbitrators, as shown in Table 4.

Table (4) Distribution of mathematical communication skills test items in final form

Mathematical communication skills	Mathematical communication skills questions
1- Acting skill	1 , 2 , 3 , 4 , 5 , 6
2- Mathematical reading	7 , 8 , 9 , 10 , 11 , 12
3- Speaking skill	13 , 14 , 15 , 16 , 17 , 18

In the light of the arbitrators' directives and observations, all the basic skills of visual thinking were retained, which are five basic skills. The researchers formulated (18) multiple-choice item in the light of the specific fields, it was presented to the arbitrators and some teachers in final form to know their opinions and observations on the consistency of the items with the specific skills covered in the test. Also, the validity extent of the item formulation, and its validity to measure the level of visual thinking skills all had an agreement more than (84%) of the arbitrators' opinions. Furthermore, the two tests were applied to the first pilot sample of (20) students from the fifth-grade primary students in the Karbala Primary School /

Directorate of first Rusafa Education to determine the time of the two tests and the clarity of the items, on Wednesday 3/4/2019. The period for the two tests was determined by (35) minutes to the mathematical communication skills test and (30) minutes for the visual thinking test. The two tests were conducted on the second pilot sample (the sample of statistical analysis), whose number is (100) students from the fifth-grade primary students of the Directorate of first Rusafa Education on Wednesday and Thursday on 10/4/2019 and 11 / 4/2019 to extract the discrimination index and difficulty as shown in Table 4.

Table (5) The school names and the number of their students

Seq.	School name	Students number
1	Safana Primary Mixed School	40
2	Bisan Primary Mixed School	35
3	Al Rawabi Primary Mixed School	25
Total		100

The researchers arranged the scores of the second pilot sample members in descending order to determine the percentage (27%) of the students who obtained the highest scores in the two tests. Then, determining the percentage (27%) of the students who obtained the lowest scores in the two tests, where the number of the upper group members reached (27) pupils and the lower group (27) pupils as a reasonable proportion for the comparison between two disparate groups (Ebel,

1972: 262). The following are the results of the statistical analysis of the items, where the researchers calculated the discrimination index for the mathematical communication skills test, and they found that it ranges between (0.26 - 0.78). While the discrimination index for the visual thinking test was found to be between (0.33 - 0.70), so all the items were retained and Table 6 shows that.

Table (6) Discrimination indexes for two items of the mathematical communication skills and visual thinking

Mathematical communication skills				Visual thinking			
Seq.	Discrimination index	Seq.	Discrimination index	Seq.	Discrimination index	Seq.	Discrimination index
1	0.55	10	0.26	1	0.66	10	0.44
2	0.44	11	0.59	2	0.48	11	0.33
3	0.33	12	0.30	3	0.66	12	0.70
4	0.59	13	0.70	4	0.66	13	0.33
5	0.52	14	0.48	5	0.56	14	0.44
6	0.41	15	0.59	6	0.63	15	0.48
7	0.48	16	0.26	7	0.41	16	0.70
8	0.59	17	0.59	8	0.44	17	0.59
9	0.78	18	0.59	9	0.33	18	0.52

Difficulty index for the two tests was found that it ranges between (0.43-0.76), while the visual thinking test items, the difficulty index ranges between (0.26-0.80), so all the items were kept as shown in Table 7

Table (7) Difficulty indexes for two items of the mathematical communication skills and visual thinking

Mathematical communication skills				Visual thinking			
Seq.	Discrimination index	Seq.	Discrimination index	Seq.	Discrimination index	Seq.	Discrimination index
1	0.46	10	0.50	1	0.59	10	0.67
2	0.52	11	0.48	2	0.69	11	0.80
3	0.43	12	0.67	3	0.63	12	0.46
4	0.67	13	0.65	4	0.63	13	0.43
5	0.63	14	0.65	5	0.65	14	0.78
6	0.76	15	0.59	6	0.46	15	0.76
7	0.57	16	0.72	7	0.80	16	0.54
8	0.48	17	0.44	8	0.48	17	0.63
9	0.61	18	0.44	9	0.72	18	0.26

correlation coefficient value for visual thinking was (0.91), and these two values are a good indicator of the stability of students' answers. The two tests were applied, the first was Mathematical Communication skills Test, which numbered (18) objective items (multiple-choice) with four alternatives. The second test was visual thinking Test, which reached numbered (18) objective items (multiple-choice) with four alternatives, and they were given instructions on how to answer the test

Furthermore, the two tests were applied on the second pilot sample, whose number is (100) pupils from the fifth-grade primary students of the Directorate of first Rusafa Education on Wednesday 24/4/2019, and using (the test and re-test method) for both variables and by calculating the Pearson correlation coefficient, between the test degrees in the first and second applications. As the correlation coefficient value for mathematical communication skills reached (0.88), while the

• Results and discussion:

The first hypothesis: There is no statistically significant difference at the significance level of (0.05) between the average score of the experimental group students that studied the Lesh model and the average score of the control group students that were studied in the normal method in the mathematical communication skills test.

and included some information about the students and give an idea for the objective of the two tests and the specific time to answer each test. Finally, one score was given for the correct answer for each item of the two test items, and zero for the wrong or abandoned answer or that carries more than one answer. Thus, the highest score for the answer of the mathematical communication skills test is (18) and the minimum score is (zero), while the visual thinking test, the highest score was (18), and the lower score is (zero).

Table (8) results of the mathematical communication skills test for the two research groups

Seq.	Group	Students Number	Arithmetic mean	Standard deviation	Degree of freedom	T value		Significance level
						Calculated	Tabulated	
1	Experimental	20	13.85	2.681	38	2.524	2.021	0.05
2	Control	20	11.45	3.300				

From Table (8), it can be observed that there were a statistically significant difference at (0.05) level between the experimental group which was studied by the Lesh model and the control group that studied by the normal method in the mathematical communication skills test. Besides a favor of the experimental group, and this result was consistent with (Al-Balasy and Areej, 2010; Al-Kubaisi and Al-Mashhadani, 2014) study, and the researchers attribute this result to several reasons including. Teaching according to the Lesh model helped the learners to increase interaction and activity in using mathematical representations to represent mathematical concepts and principles as a way to clarify the concept for learners, and this may lead to an increase in their understanding and awareness of mathematical content, which leads to an increase in mathematical communication skills. However, the use the Lesh model for mathematical representations in teaching leads to activity, vitality, and mutual interaction between the teacher and students on the one hand and between students on the other hand, which led to making learners a pivot in the educational process, and providing an

opportunity for each learner in the group to represent his ideas to the rest of the group members. This led learners to interaction while working as groups during the process of concrete representation, and it has increased the motivation of learners to learn mathematics on the one hand and increase mathematical communication skills on the other hand. Additionally, the use of the Lesh Model makes it easier for learners to understand scientific concepts and ideas through the processes of communication between mathematical situations and principles, and it may facilitate in clarifying scientific ideas or mathematical situations to work with different levels of pupils and can be used to increase students' levels on mathematical problems. The second hypothesis consist, there was no statistically significant difference at the significance level of (0.05) between the average score of the experimental group students that studied by the model Lesh and the average score of the control group students that studied by the normal method in the visual thinking test, and Table (9) shows this.

Table (9) Results of the visual thinking test for the two research groups

Seq.	Group	Students Number	Arithmetic mean	Standard deviation	Degree of freedom	T value		Significance level
						Calculated	Tabulated	
1	Experimental	20	14.45	2.417	38	2.741	2.021	0.05
2	Control	20	12.40	2.303				

From Table 9, it can be observed that there was a statistically significant difference at the significance level (0.05) between the experimental group that studied by the Lesh model and the control group that studied by the normal method in the visual thinking test in favor of the experimental group. This result was consistent with (Abu Dan, 2013) study, and the researchers attribute this result to some reasons, including:

- a. Teaching according to the Lesh model helped diversify the activation of visual thinking skills, which helps learners acquire a meaningful method, and makes learners understand and distinguish concepts and principles related to the mathematical subject matter, which leads to highlights in the results of the visual thinking test.
- b. Using the Lesh model is concerned with the visual sensory aspects, as there is a mutual organization between what the learner sees of drawings, geometrical shapes, and relationships, and between the merging and intellectual and mental products that depend on the vision and the images shown, which increases the impact of visual thinking.
- c. The feedback provided during the use of Lesh model enabled the learners to adjust the intellectual path towards the objective, through supporting the duties properly, and that the Lesh model is one of the modern methods among learners, which led to the desire of learners to learn with this model.

Conclusions, Recommendations, and Suggestions:

1. Teaching by using the Lesh Model has a positive effect on mathematical communication skills and visual thinking.
2. Teaching by using the Lesh Model, Mathematical Communication, and Visual Thinking requires a great effort from the math teacher.
3. Use modern teaching methods that help with mathematical communication skills and visual thinking.
4. linking mathematical communication skills with life and scientific applications which its idea is based on mathematical communication skills.
5. Conducting a similar study on different educational stages.
6. Conducting a study to know the relation between mathematical communication skills and visual thinking in mathematics.

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