The Effect of Brain-Based Learning on Mathematical Power for Intermediate First Grade Students

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ABSTRACT

The aim of the research is to identify brain-based learning in mathematical power among female students of the first intermediate grade. The experiment was applied to a sample of (62) students, the experimental group (31) students, and the control group (31) female students of the first intermediate grade in secondary school (Al-Zariat for Girls). For the academic year (2020-2021), the two groups were equivalent in the variables (chronological age of female students calculated in months, intelligence test, previous achievement in mathematics, test of previous knowledge in mathematics), and the research tools represented in (mathematical strength test) were built. The test consisted of (30) objective items, and the validity of the test was verified and the reliability factor was acceptable, and the difficulty factor, discrimination and effectiveness of the wrong alternatives to the test items were good, and after the end of the experiment, the mathematical strength test was applied to each of the two groups (experimental and control). The t-test has been used to process the data. The results of the research showed that there is a statistically significant difference at the level of significance (0.05) between the mean scores of the students of the experimental group and the scores of the control group students in mathematical strength and in favor of the experimental group.

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RESEARCH PROBLEM

Mathematics is of great importance as a science among other sciences because of its contributions to the development of cognitive fields, the study of human and psychological sciences, and it can express reality and understand facts effectively as it is a reference for the credibility of other sciences and can be judged on some life problems. With the possibility of employing it in daily life, so that the learner realizes its importance in his life, which requires preparing the student well and providing him with sufficient mathematical knowledge that can conduct his affairs in various fields of life, and because the current era is characterized by rapid changes and successive discoveries, and a wealth of knowledge that includes all fields Which requires preparing individuals who possess the ability to think properly and information necessary to face the challenges of great knowledge and technical progress. (Al-Husna and Al-Dulaimi, p. 172, 20112).

Therefore, it is important for these changes and discoveries to be accompanied by an evolution in preparing teachers and a diversification in teaching methods, models and strategies to suit their developmental characteristics, constituencies, mental levels and methods of suspense and push them to search for information, which will reflect positively on the educational process as a whole. The researcher believes, through her review of previous studies, that the methods used in teaching mathematics are still standard and characterized by weak diversity, which made the learners passive recipients of information and their achievement is low in mathematics. This is confirmed by many studies, including the study (Al-Fatlawi, 2016). (Al-Obaidi, 2017). Despite the efforts made by mathematics teachers towards their students, there is a weakness in the level of mathematical strength in all stages of education, this is what was indicated (Al-Sidawi, 2012). In addition to the answers (20) of the subject teachers to the questionnaire of opinion poll prepared by the researcher who confirmed (%) 85) They have a weak use of mathematical strength as well as a weak interest in mathematical strength skills and a lack of keeping up with modern methods and strategies for most of them due to factors related to the curriculum Factors related to the family, and factors related to the educational environment, as well as the usual teaching methods

and for all stages of education; This in itself is a problem that must be sought to find a solution.

What is the effect of brain-based learning on mathematical strength among first-grade intermediate students?

Research importance

The concept of education is the growth that the individual obtains in the various mental, social, physical and emotional fields. It is also known as the process of adaptation between the learner and his environment. In this sense, it means growth and change in the human being, so that he can face the environmental conditions and factors and be able to deal with them in a way that serves him and the members of his community, and is also known as a science that aims to form the individual for himself, and to awaken his many inclinations (Al-Afoun, p. 19, 2011). Since the middle stage is a link between the elementary stage and the middle school stage, it is an important stage in which the performance of various kinds of skills and intellectual and mental abilities appears. Which is taught in various subjects, including mathematics that helps the learner how to think, not how to memorize and help him to employ information in practical life and assimilate knowledge skills (Fakhro, p. 102, 2001). As a result of development efforts in learning and teaching mathematics, new concepts emerged, the most important of which is the concept of mathematical power. Where it has become a major goal of teaching mathematics, as each (Paul & Thiessen, p. 35, 1999). asserted that mathematical strength represents the basic criterion for teaching mathematics, and aims to form correct attitudes and beliefs about the structure and importance of mathematics with a sense of its beauty, and this is shown by thinking of the student mathematically and employing that thinking in facing his life problems that can only be implemented with the presence of an experienced teacher.

Research objective

(NCTM, 1989) As "the maximum amount of mathematical knowledge that students can employ in thinking, communicating mathematically and in life."

The researcher defined it operationally

The abilities of the first-grade intermediate students in collecting and employing

Theoretical background

Brain -Based Learning

In the third millennium, new theories emerged in the psychology of learning and education, such as the theory of brain-based learning, and the authors of this theory (Cain & Cain) showed that the brain is inherently equipped with a set of potential abilities: such as the ability to self-regulate, the ability to analyze evidence, self-reflection and the ability to not Extreme

Accordingly, the research problem was identified in answering the following two questions:

The research aims to identify the effect of brain-based learning on mathematical strength among first-intermediate grade female students.

The hypothesisof the research

There is no statistically significant difference at the level of the function (0.05) between the average scores of the experimental group students who will study mathematics according to brain-based learning and the average scores of the control group students who will study the same subject according to the usual method in the mathematical strength test as a whole.

Research limits

The search is limited to:

1) Female students of the first intermediate grade in the morning middle schools for girls affiliated to the General Directorate of Diyala Education.

2) The content of three chapters of thetextbook to be taught to students of the first intermediate grade, the first part (integers, relative numbers, polynomials)

3) The dimensions of mathematical strength (mathematical communication, mathematical correlation, mathematical reasoning).

4) The first semester of the academic year (2020-2021).

Determining research terms

Brain - based learning

(Caine & Caine, 1994) The ability of the learner to learn is not implemented. Every healthy human brain, regardless of age, gender, nationality or cultural background is innately equipped with a set of latent abilities, including the ability to explore patterns, the ability to self-correct, and learn from experience through analysis. External data and self-reflection.

Mathematical Power

mathematical knowledge in its three dimensions (conceptual, procedural, and problematic) in which the subject of research is linked and the mathematical ideas of mathematical content with other mathematical content or with other contentideas in another subject related to what the student studies in mathematics.

creativity (Nofal, p. 66, 2008). This theory is based on the brain, structure and function, and this theory is based on the facts reached by neuroscientists who have shown that studying the brain is the only way to understand the causes of behavior and that the nervous system is the physical basis for the process of human learning, as well as the nerve cell learns and the brain is able to generate neural networks according to the complexity Learning (Sweidan and Al-Zuhairi, p. 308, 20188).

The theory of brain-based learning goes back to both Cain and Cain (1997), who define it as a theory that includes knowing the rules of the brain for meaningful learning, and organizing education with those rules in the brain correctly and effectively (Cain & Cain, p. 77, 1997). Brain-based learning has several stages, namely:

1.Preparation of learning

This step provides a framework for new learning and equips the learner's brain with possible connections. This stage includes a general idea of the topic and a mental perception of related topics.

2.Orchestrated immersion

This step emphasizes the importance of forming neural connections or communicating nerves with each other, and from sources of acquisition: competition, lecture, visual tools, environmental stimuli and experiences everywhere.

Relaxed Alertness

This step reveals the interconnectedness of topics and supports deepening understanding. It gives the brain an opportunity to classify, select, analyze, test and deepen learning by integrating students into classroom activities for deeper understanding and feedback.

3.Active Processing and Memory Formation

This step aims to strengthen learning and better information retrieval

Expanding of Brain Capacity

This step is concerned with using the new learning in order to enhance it further, expand it and add to it. In this way, the new learning becomes robust, deep, and easy because of the tremendously branched neural connections between neurons (Al-Salti, p. 103-106, 2004).

Mathematical Power

The ability of learners to use mathematical knowledge (perceptual understanding and procedural knowledge in solving illogical problems, making logical inference, communicating with mathematics and the coherence of its ideas). (Massad, p. 71, 2003).

Mathematical strength skills

Mathematical Communication

Mathematical communication is defined as the learner's ability to use the language of mathematics, including the symbols, terms and expressions it contains, to express ideas and relationships, understand them and explain them to others (Badawi, p. 2, 2003).

mathematical communication patterns.

There are many patterns and forms of mathematical communication in the classroom, including (reading - writing - discussion and speaking - listening - acting)

Mathematical Connection

Mathematical interconnectedness is defined as highlighting the relationship between the elements of mathematical content within the same field, and the relationships between the different fields in a manner that illustrates the coordinated and interconnected structure of mathematics, as well as showing mathematical applications in other sciences and in life matters. (Abu Al-Ajin, p. 11, 2011).

Types of mathematicalassociations

Two types of mathematical associations can be distinguished as described below (House, p. 513, 19903).

1- Internal interconnections: it is meant to make mathematics a whole coherent and not isolated branches.

2- External interconnections: it means linking mathematics with its applications in life situations.

Mathematical Reasoning

Mathematics is, in its essence, of an inferential nature, whereby true results can be derived from a given introductionthat show their truthfulness, by walking in deductive steps, governed by the laws of logic and mathematics, so using the inferential approach in deriving their theories and results, somathematics is considered to be an inferential construct whose issues are abstract. (Obaid, p. 26, 2000).

The subject of inference was also linked to the memory, because the inference directs the memory of the subject, so if the subject succeeded in constructing a correct inference, the retrieval process would be correct, and vice versa, the wrong inference leads to a false retrieval, so searching in the details of the material during its study would be useful because it would facilitate the inference process. (Al-Mansour, p. 118, 2012).

previous studies

First: Previous studies dealt with brain-based learning.

Second: Previous studies dealt with mathematical power.

No	Study and country	Title of the study	Objective	Research methodology	Sample	Tools used	results
1	Pilten, 2010 Turkey	Evaluating the mathematical power of fifth grade primary students in Turkey	Identifying the mathematical power of fifth grade primary students in Turkey	The quasi-experimental curriculum	25 pupils	Questionnaire of the mathematical strength assessment	Students 'ability to make connections in mathematics but they are unable to use mathematical operations outside mathematics
2	El-Metwally, 2013 Egypt	The effectiveness of strategies based on the theory of multiple intelligences in the development of some aspects of mathematical strength among the first stage pupils of basic education	The development of some aspects of mathematical strength of the fifth grade pupils using strategies based on the theory of multiple intelligences	experimental approach	97 students	Mathematical strength test consisting of 33 items	there are statistically significant differences between the mean scores of the two study groups in the post application of the mathematical strength test with its three dimensions

3	El-Shazly 2018 Egypt	Development of the mathematics curriculum in light of international experiences and its impact on the development of mathematical strength for the primary school pupils	Building the development of mathematics curriculum in the light of global experiences and its impact on developing mathematical strength among primary school pupils	The semi-experimental curriculum	36 pupils	Mathematical strength scale consists of 25 items	there are statistically significant differences between the mean scores of the pre and post application in the mathematical strength test in favor of the experimental group

Research methodology: The researcher used the experimental method that is consistent with the research goal and hypothesis

First: Experimental Design:

Group	Equivalence variables	Independent variable	Dependent variable	Research tools
Experimental	- chronological age in months. -IQ test Previous achievement in mathematics.	Brain based learning	mathematical strength	Attainment mathematical strength test
Control	Examining previous knowledge of mathematics.	The usual way	Achievement	Achievement test in mathematics

Second: Research community

The research community represents all the female students of the first intermediate grade in the intermediate and secondary schools for girls of the General Directorate of Diyala Education for the academic year (2021-2020), so the total number of middle and high morning schools is (123) distributed in four sections of the directorate, while the total number of female students in the first intermediate grade is (85762).

Adjustment procedures

Table (2) results of parity variables

Equivalence elements	group		arithmetic mean	standard deviation	degree of freedom	value of (t-test))		statistical significance at the level of (0.05)
						calculated	tabular	
Chronological age	Experimental (a)	31	161.84	3.417	60	1.283	2	not a statistically significant
	Control (B)	31	160.74	3.316				
Intelligence	Experimental (a)	31	34.35	6.375	60	1.308	2	not a statistically significant

	Control (B)	31	32.29	6.51				
Previous knowledge	Experimental (a)	31	21.55	2.014	60	1.789	2	not a statistically significant
	Control (B)	31	20.68	1.81				
Previous achievement	Experimental (a)	31	79.58	31.251	60	1,092	2	not a statistically significant
	Control (B)	31	75.65	15.066				

Fifth: Research requirements

Identifying the educational material: Mathematics textbook for the first intermediate grade for the first course for the academic year (2020-2021), which are:

- Chapter One (Whole Numbers)
- Chapter Two (Relative Numbers)
- Chapter Three (Polynomial)

Table (3) Distribution of behavioral goals on (Bloom) levels for the cognitive domain

level / Content	remember	Accommodating	Implementation	analyzing	constructing	Evaluation	total
Correct numbers	17	5	13	3	2	1	41
Relative numbers	12	6	18	5	5	6	52
Polynomial	14	6	10	7	2	0	39
Total	43	17	41	15	9	7	132

Setting the research tool:

Mathematical strength test

Table (4) shows the relationship of each of the test items to the total score of the test

Items	The calculated R value	Tabular R value	Degree of freedom	Indication
1	0,278	0,19	98	Statistical function
2	0,275			Statistical function
3	0,268			Statistical function
4	0,330			Statistical function
5	0,210			Statistical function
6	0,345			Statistical function
7	0,259			Statistical function
8	0,259			Statistical function
9	0,347			Statistical function
10	0,385			Statistical function
11	0,216			Statistical function
12	0,335			Statistical function
13	0,249			Statistical function
14	0,244			Statistical function
15	0,223			Statistical function
16	0,278			Statistical function
17	0,227			Statistical function
18	0,305			Statistical function
19	0,250			Statistical function
20	0,265			Statistical function
22	0,256			Statistical

				function
22	0,285			Statistical function
23	0,283			Statistical function
24	0,228			Statistical function
25	0,200			Statistical function
26	0,306			Statistical function
27	0,199			Statistical function
28	0,249			Statistical function
29	0,329			Statistical function
30	0,261			Statistical function

Table (5) the relation of the item to its domain

Item	Field	Calculated R value	Tabula R value	Degree of freedom	Significance
1	Communication	0,398	0.19	98	function
2	Communication	0,237	0.19	98	function
3	Communication	0,503	0.19	98	function
4	Communication	0,226	0.19	98	function
5	Communication	0,444	0.19	98	function
6	Communication	0,360	0.19	98	function
7	Communication	0,278	0.19	98	function
8	Communication	0,288	0.19	98	function
9	Communication	0,289	0.19	98	function
10	Communication	0,430	0.19	98	function
11	Interconnected	0,404	0.19	98	function
12	Interconnected	0,309	0.19	98	function
13	Interconnected	0,264	0.19	98	function
14	Interconnected	0,201	0.19	98	function
15	Interconnected	0,439	0.19	98	function
16	Interconnected	0,346	0.19	98	function
17	Interconnected	0,264	0.19	98	function

18	Interconnected	0,454	0.19	98	function
19	Interconnected	0,396	0.19	98	function
20	Interconnected	0,332	0.19	98	function
21	inference	0,294	0.19	98	function
22	inference	0,458	0.19	98	function
23	inference	0,274	0.19	98	function
24	inference	0,406	0.19	98	function
25	inference	0,274	0.19	98	function
26	inference	0,307	0.19	98	function
27	inference	0,441	0.19	98	function
28	inference	0,256	0.19	98	function
29	inference	0,258	0.19	98	function
30	inference	0,244	0.19	98	function

Table (6) the correlation between domains and the overall test

Item	Field	Calculated R value	Tabula R value	Degree of freedom	Significance
1	communication	0,632	0,19	98	function
2	interconnected	0,560	0,19	98	function
3	Inference	0,545	0,19	98	function

Statistical Means

Statistical indicators	Value
Arithmetic mean	15.36
Standard error	0.28267
mediator	15
Vein	15
standard deviation	2.82671
contrast	7.99
Kurtosis	-0.126
torsion	0.013
Term	14
The lowest value	8

highest value	22

The presentation of results

Table (3) the results of the T-test for the difference between the mean scores of the two research groups in the mathematical strength test

Field	group	Number of female students	SMA	standard deviation	degree of freedom	T-value		Statistical significance at the level 0.05
						calculated	tabula	
The total score of the test	experimental	31	17,52	4,44	60	2,234	2	Function in favor of the Experimental
	Control	31	15,23	3,58				

Table (4) a reference table to determine the size of the effect

The used tool	Effect size			
	Small	medium	big	Very big
D	0,2	0,5	0,8	1.1
η2	0,01	0,06	0,14	0.20

The values of (η^2) and (d) and the amount of influence for the two research groups (experimental and control) in the mathematical strength test

independent variable	dependent variable	The calculated T value	η value	d value	The amount of effect size
Brain-Based Learning	Mathematical Power	2.234	0.08	0.59	medium

The interpretation of the results

Interpretation of the results related to the first hypothesis concerning mathematical power

The presented results showed that the use of brain-based learning had a positive effect on mathematical power among first-grade intermediate students, and the researcher believes that this is due to the following reasons:

1- The positive role of female students, and the linking of new information with previous one in addition to developing their abilities in mathematical strength skills that lead to enhancing their new experiences and increasing their effective participation in the lesson. This is confirmed by the results of mathematical strength.

2- One of the brain-based learning procedures is acquisition, and among the sources of acquisition are competition, environmental stimuli, and experiences everywhere through the use of electronic tools, as they lead to the formation of associations on previous experience and increase the probability of the moment of discovery and insight, which has had a positive effect in raising the level of the experimental group students.

3- One of the brain-based learning procedures is to give classroom activities for a deeper understanding and feedback, and this in turn led to an increase in the levels of the experimental group students, as indicated by the current research results.

4- Teaching according to the stages and steps of brain-based learning helped the students to practice mental processes that would stimulate their thinking in general, making brain-based learning solid, deep and easy.

CONCLUSION

Based on the results of the current research, the researcher reached the following conclusions:

1-Teaching according to brain-based learning had a positive effect on the use of mathematical strength skills of first-grade intermediate students (mathematical communication, mathematical correlation, mathematical reasoning).

2- The effect of brain-based learning on the mathematical strength skills of the experimental group is large, which affected the increase in mathematical achievement of mathematics for the students of the experimental group.

RECOMMENDATIONS

In light of the current results of the research, the researcher recommends the following:

1-The use of brain-based learning in teaching mathematics in middle school because of its positive impact on achieving the goals of teaching mathematics in mathematical strength skills.

2-Preparing models for designing educational lessons according to brain-based learning for all academic stages.

Propositions

As a complement of this research, the researcher proposes to conduct the following studies:

1-Conducting a study which comparing brain-based learning with another strategy that does not depend on constructivist philosophy.

2- conducting researches and studies similar to the current research to find out the extent to which female students in different school stages possess mathematical strength skills.

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