

Active mathematical operations in the brain included in the mathematics book for the scientific fourth grade

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Abstract

The aim of the current research is to identify (the active mathematical processes in the brain included in the mathematics book for the fourth scientific grade) and in order to achieve the objectives of the research, the research community was identified and it is from the mathematics book for the fourth scientific grade ((12th ed , 2019), The book's sample size was (145 out of 156 pages), a list of effective mathematical operations for each side of the brain was identified, and the indicators were placed on them. The content of the book was analyzed according to the prepared list and its indicators, after it was presented to a group of arbitrators in the methods of teaching mathematics and psychology. The appropriate statistical analyzes were conducted to analyze the content (using Holstey equation) and the results showed that the percentage of active mathematical operations in the brain for the left side was (78%) and for the right side was (2%) and for both sides it was only (20%) and accordingly the researcher recommended:

Directing the attention of the employees of the General Directorate of Curricula to the necessity of following the modern global educational trends and emphasizing the book-writing committees to include in the content of mathematics books the active mathematical operations of the brain. It is very important to conduct the development processes of the scientific content in accordance with new research and studies to keep pace with modernity in the world.

To complement the current research, the researcher suggested:

1. Conducting more studies related to the active mathematical operations of the brain in the different school stages (primary, intermediate, preparatory).

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2. Conducting a study on the active mathematical operations in the brain, according to the gender variable, to compare the results.

Research problem:

Based on what the current era is witnessing of great and qualitative leaps, rapid changes in all fields, a competition was born between societies and nations in the knowledge and technical frameworks, which requires bridging the gaps between our country Iraq and the countries of the developed world and reducing the time required by reconsidering the educational curricula in terms of goals, content, planning and development, And the emergence of modern technologies provided opportunities for scientists to identify areas of the brain that have long been based on guesswork, and no study has been able to stimulate the interest of scientists more than searching in the two hemispheres of the brain. This is because each hemisphere of the brain works in a different way. As the results of the latest research related to the hemispheres of the brain and neuroscience have found that each person has two different methods of processing information, but they are complementary. This discovery motivated educators and generated a strong desire to explore the applications of brain research in the classroom, so this research came to provide accurate information to educational leaders so that they can make their decisions about defining their strategy for improvement, renewal and development of the textbook, which is an important educational tool in the hands of teacher and student, Therefore, the two researchers directed an exploratory questionnaire to a number of mathematics teachers in Kirkuk governorate about the active mathematical operations in the brain, The results of the questionnaire indicated that most of them do not have knowledge about the mechanism of distributing the active mathematical operations on both sides of the brain, This is what prompted the two researchers to conduct an analytical study of the content of the mathematics book for the fourth scientific class in the light of the active mathematical operations in the brain. Note that there are no previous studies to include all the active mathematical operations in the brain in the mathematics book for the fourth scientific grade, accordingly the problem of the current research can be summarized by answering the following question:

What are the active mathematical operations in the brain that are included in the mathematics book for the fourth scientific class?

Research Importance :

1- Determine the availability of active mathematical operations and the indicators emanating from them in the mathematics book for the fourth scientific grade.

2- The importance of the textbook because it works to clarify the educational goals that educational institutions seek to achieve and works to provide students with basic knowledge of educational materials at the level of the grade prepared for them.

3- Academic material is an essential part of the curriculum, the teacher's ability to organize the sum of knowledge and abilities in a way that helps him achieve the required goals is enhanced by its analysis. Because the teaching process proceeds according to organized steps, and the analysis guides the work of the teacher and is useful in preparing various activities that fit the elements of the content, and helps us in building achievement tests effectively.

4- This is the first research (to the knowledge of the two researchers) in Iraq and the Arab world, as the mathematics book for the fourth grade has not been analyzed in the light of the active mathematical processes in the brain and the indicators emanating from it.

5- It can help researchers interested in this field to conduct a number of studies that require the analysis of mathematics for other stages according to the active mathematical operations and the indicators emanating from them.

6- The current study contributes to the development of a model for examining the content of mathematics books in Iraq, as curricula must be continually improved in order to fulfil the demands of students.

Research goal:

Determining the active mathematical operations for each side of the brain and for both sides available in the mathematics book for the fourth scientific grade.

Research limits :

The research is determined by: The content of the mathematics book for the scientific fourth grade, written by a committee from the Iraqi Ministry of Education, 12th edition, in 2019, issued by the Ministry of Education / General Directorate of Curricula, after excluding the cover, introduction, chapter interfaces, and indexes.

Research terms:

active mathematical operations have been defined by (Mahmoud, 2015) as: “It is the way the two hemispheres of the brain process mathematical information from visualizing, writing, reading and analyzing, realizing relationships, and performing calculations in order to achieve a specific goal” (Mahmoud, 2015: 72).

The researchers define it procedurally as a set of mental processes in the brain that students master after studying scientific content, whether they are on the left or right side of the brain or both sides combined, and are measured.

Content analysis defined by (Badawi, 2019): “It is a method that aims to objectively and methodically describe the educational content, leading to the identification of the basic elements of learning” (Badawi, 2019: 92).

The researchers define it procedurally as: The process of analyzing the content of the mathematics textbook for scientific fourth grade students according to the active mathematical operations and the indicators emanating from them through the list prepared for this purpose.

The textbook defined by (Farajallah, 2011): as one of the means of implementing the school curricula and achieving its goals, and it is assumed that it has scientific and linguistic accuracy and logical sequence, as it satisfies the cognitive and psychological needs of learners and keeps pace with scientific developments. (Farajallah, 2011: 61).

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The researchers define it procedurally: it is all knowledge and information that contains all experiences and educational activities, pictures and geometric shapes that are included in the content of the mathematics book for the scientific fourth grade that is approved for the year 2019.

Theoretical Background:

What is the brain:

The brain is the center of the human mind that distinguishes man from the rest of living organisms, and that the human brain consists of two sides, right and left, and they are two parts that cannot be separated and work in an integrated and holistic manner together. The human being has one brain consisting of two hemispheres to process information in two different ways (Razouki, 2013:102)

The brain is a material machine for thinking and in it the human's ability to visualize, express, understand meanings and respond to instructions, and the person in itself is a thinking machine (Said, 2008: 179). The brain is an organ of a great deal of depth and complexity, and the anterior part of it is more spacious compared to the other parts of the nervous system. It is surrounded by three membranes that cover and protect it, and it is inside the cavity of the skull, and it works to increase the number of senses and needs the five senses mainly in order for learning to be effective. It has a degree of viscosity like soft gelatin, although the outer layer that covers it is called the gray matter, but its true color is (brown) and this color is due to the nerves of the brain that are not covered with a layer of myelin (Al-Saliti, 2008:13), (Abu Al-Sameed and Obeidat, 2007: 11).

Active math operations in the brain:

The two sides of the brain theory is concerned with highlighting the role of learners in the educational process, and this theory emphasizes the need to provide curricula that suit their abilities and needs. The arithmetic operations that take place in the brain usually use the learner's left lobe to accomplish the operations of addition and subtraction, However, mental arithmetic operations require the operations of the right and left hemispheres of the brain. Some operations are performed in the left hemisphere, and other operations are performed in the right hemisphere of the brain (Al-Ghouti, 2007: 33), Using both lobes is faster in completing arithmetic operations than using only one lobe, and there is no doubt that complex arithmetic operations in particular require planning, organizing, continuous listening, effective remembering, and monitoring progress in the solution and conclusion processes, and this in turn requires implementation management by monitoring Our actual and performance behavior, and Organizing the implementation steps to reach the desired solution (Mahmoud, 2015: 67).

The results of research and studies, in light of the functional integration between the two hemispheres, found that the brain, on the right and left sides, performs mathematical operations, but performs these operations based on the way they are displayed. If the presentation is in a spatial or parallel visual way, the right hemisphere processes it, but if it is presented in a verbal or sequential way, the left hemisphere of the brain processes it. Active mathematical operations are a set of applied procedures that learners take to accomplish a specific mathematical task, and they are effective when the learners master them when performing them at a rate of (60%) (Al-Saadi, 2017: 6).The mathematical operations are distributed on both sides of the brain as follows:

Table(1)

Describes the distribution of mathematical operations on both sides of the brain

Left side operations and their sub-indicators		
	Processes	Indicators
1	Math reading	<ul style="list-style-type: none"> - Translating mathematical symbols into a verbal form - Translating mathematical forms into a verbal form - Translating verbal formulas into symbols, mathematical forms and tables
2	Math writing	<ul style="list-style-type: none"> Expressing concepts and laws Mathematics in a mathematical form Expressing mathematical ideas, facts and relationships in a mathematical form Rewrite the verbal text in a symbolic form
3	Labels	<ul style="list-style-type: none"> Remember the names of the math formulas Remember the names of the math symbols Remember the names of the math concepts Remember the text of the mathematical circular
4	mathematical calculations	<ul style="list-style-type: none"> Use properties of basic operations on real numbers Use estimation and approximation to find a solution
5	Analysis	<ul style="list-style-type: none"> Determining the main ideas raised in the issue or topic at hand Determine the relationships between the elements of a mathematical question or problem
6	Logic	<ul style="list-style-type: none"> Proving the validity or invalidity of a given mathematical statement according to a logical rule Determining the accuracy and sequence of specific solution steps
7	Classification and ranking	<ul style="list-style-type: none"> Classifying and arranging mathematical concepts according to certain properties
8	sequence	<ul style="list-style-type: none"> Arranging items according to a specific criterion
9	Calendar	<ul style="list-style-type: none"> -Issuing a judgment on the reasonableness of the answer according to a specific test -Validation of solution
10	Mathematical thinking	<ul style="list-style-type: none"> Using generalizations to solve math problems Using induction to solve math problems Using deduction to solve math problems Solving math problems with proof
11	perceive the parts	<ul style="list-style-type: none"> -Defining partial mathematical concepts that are derived from a basic concept -Defining the mathematical concepts included in a mathematical generalization -Determining the sub-mathematics skills included in a complex

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		mathematics skill
Right-side operations and their sub-indicators		
	Processes	Indications
1	creativity	-Introducing new, previously untouched solutions -Use different methods to find a solution
2	Perception of images and colors	-Determine the mathematical relationships and connections between graphs and figures -Identifying images and colors and linking them to their meanings
3	intuition	- Estimated answers -Choose correct answers from among the alternatives
4	imagination	-A mental visualization that uses a previous mathematical structure to obtain a new mental mathematical structure
5	Comprehension	-Formulating mathematical ideas in a new way - Understand the elements of a mathematical situation
6	Understand abstract patterns	-Finding a mathematical pattern using the information provided - Complete a mathematical pattern according to the data -Converting a mathematical pattern into a mathematical formula
7	constructivism	-Using previous mathematical experiences and linking them with the new experience to reach the solution Filling - the gaps that appear in the mathematical intellectual structure
8	Perceive spatial relationships using Pictures	-Determine the spatial relationships between shapes without changing their overall shape Determining the displacement and direction of shapes and images
9	Realizing it all together	Use of mathematical generalizations in their entirety Applying mathematical ideas without breaking them down
10	Exploring nonverbal reasoning	-Reaching conclusions by means of given facts about the issue in a nonverbal way

Content analysis concept.

Linguistically, analysis is defined as “returning a thing to its elements” (Al-Hashemi and Attia, 2009: 143), and analysis is defined as “the fragmentation of a thing into its basic components from which it is composed, which is based in detailed processing to its elements, Content analysis is one of the methods of scientific research and falls under the descriptive research method, and is used to describe and analyze the content of the curriculum in an objective, quantitative and systematic manner, and the orderly

classification of the elements of the material and its components that resulted in the analysis and the number of its frequency (Al-Mashhadani, 2011: 14).

text book for school

The textbook occupies a significant position in the educational system and is the most important educational resource. It covers the most of the specified educational curriculum, offers the most desired educational experiences, and is one of the most accessible scientific educational resources available to students in both public and private settings. Therefore, it must be carefully designed in terms of choosing its components, and organizing its educational experiences, So that it is both a form and a content production that adheres to the cognitive, psychological, educational, artistic, technical, and informational basis (Khawaldeh, 2011: 210), The textbook is one of the means used to implement vocabulary. It is the key tool and the central focus of scientific activity in the study material (Dames, 2010: 101).

The researchers believe that the theory of both sides of the brain is concerned with highlighting the role of the learner in the educational process and stresses the need to provide curricula that suit his abilities and needs. The arithmetic operations that take place in the brain to complete the operations of addition and subtraction are done on the left side and there are operations that are done on the right side, but using both sides together gives a speed of completion of arithmetic operations.

previous studies :

After searching for previous studies related to the topic of the research, the researchers were unable to obtain a study that directly addressed the research variables, and accordingly, the studies close to the subject of their research were referred to, and the following is a presentation of these studies as shown in the studies table and in chronological order:

Table (2)

Table (2)
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Studies that dealt with study variables

Name of researcher and country	Aim of the study	Educational level	Size and type of sample	Study method	Results
Gouti Palestine (2007)	The study aimed at the active mathematical operations on both sides of the brain among the ninth grade students in Gaza	Basic Ninth grade	346 male & female student	descriptive analytical method	The results showed the presence of active mathematical processes in the left side of the brain for both males and females, and these processes are:(Division - Multiplication - Subtraction - Convert the verbal phrase into an equation) The presence of effective mathematical operations in the right side of the brain for both males and females, and these operations They are (addition - union - intersection - comparison - finding similarities and ratio, relationships between shapes).
Issa (Jordan (2013)	The study aimed at the effect of an educational program based on mathematical operations related to both sides of the brain on the comprehension of mathematical concepts and the ability to solve mathematical problems among students of the upper basic stage .in Jordan	Basic Seventh grade	80 male students	experimental	The results showed that there were statistically significant differences at (0.05) between the two adjusted averages for the two groups in favor of the Experimental group.
Khudair Iraq (2014)	The study aimed to know the effect of a proposed instructional design according to brain-based learning on the active mathematical operations of the fourth graders of primary school	Primary 4 grade	70 female student	Experimental method	The results showed an effect of the instructional design according to brain-based learning on the active mathematical operations in favor of the . experimental group
Al-Saadi Iraq	The study aimed at the mathematical structure and its	Level 4	171 Male &	Descriptive Method	The students of the research sample possess active mathematical operations on both sides of the brain at

(2017)	relationship to the active mathematical operations on both sides of the brain among students of the Department of Mathematics in the College of Education and Basic Education		female students		.the required level
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Research Methodology

The researchers used the descriptive analytical method (content analysis):

The descriptive-analytical approach means a method of scientific research that falls under the descriptive research method, and its purpose is to know the characteristics of the communication material or textbooks, and to describe these characteristics as a quantitative description expressed in quantitative symbols, in addition to the results obtained by other methods that are indicators that determine the direction of development Required (Al-Hashimi, 2011: 175).

The analytical descriptive approach was used in this research to analyze the content of the mathematics book for the scientific fourth grade for the academic year (2020-2021 AD) approved by the Iraqi Ministry of Education, Accredited by the Iraqi Ministry of Education, to know the effective mathematical operations for both sides of the brain.

Research community:

The research community consists of:

Mathematics book for the scientific fourth grade approved in Iraq for the academic year (2020-2021).

Table (3) shows the textbook community

Book name	Class	edition	Number of chapters	Year of publication	Number of book pages
Mathematics	scientific fourth grade	12	7 chapters	2019 AD	156 pages

Research sample:

The research sample consisted of the mathematics book for the scientific fourth class scheduled for the academic year (2020-2021) as a sample for its research, after excluding the introduction of the book and the interface at the beginning of each chapter and the index in the analyzed book. shown in the following table (4)

Table (4) The scientific material that was analyzed and its percentages

the classroom	Chapter topic	number of pages	percentage
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the first	Mathematical logic	16	11%
The second	Equations and Inequalities	18	12%
the third	foundations and roots	17	12%
the fourth	Trigonometry	30	21%
Fifth	vector	19	13%
sixth	coordinate geometry	25	17%
seventh	Statistics	20	14%
		the total	100%

Research Tools:

It is a method that is used to collect data to solve the research problem, answer its questions and verify its hypotheses (Al-Duwaidi, 305: 2002), and for the purpose of collecting data for the research, the researchers prepared a tool with active mathematical operations in the brain to analyze the book on it, and the following is a detailed presentation of how to make These tools ready to measure research variables:

Analysis tool:

1. Examining a group of literature, research and scientific journals that dealt with the active mathematical operations of the brain.
2. Prepare a list of the active mathematical operations in the brain and their sub-indicators in their final form, table (1)

Validity of the Research tool (analysis):

In order to verify the validity of the tool, the researcher relied on the apparent validity by presenting a list of the active mathematical operations and the indicators indicating them to a group of arbitrators in the curricula and methods of teaching mathematics to verify the reliability and clarity of the formulation of these operations and indicators, and the representation of indicators for the operations that specify them and the modification of what is necessary in light of them.

Stability Analysis:

Therefore, the researchers used two types of stability:

1. **Stability through time:** The researcher re-analyzed the content of the mathematics book for fourth-grade students after thirty days of the first analysis process, using the Holstey equation to calculate the reliability coefficient and found it equal to (92%).

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Stability through another analyst: The two researchers hired an external analyst (teacher) who is specialized and experienced in the analysis process, after they trained him to use the list of indicators to calculate the stability between the researcher's analysis himself and the teacher's analysis, as the teacher analyzed the mathematics book for the scientific fourth class and the stability was calculated for the two analyzes By Holste's equation, it was found that the stability coefficient between the researcher and the teacher is (90%), and this percentage is considered high for the stability coefficient, as indicated by the educational literature, which reassures the researchers of the stability of the analysis process.

Presentation and interpretation of the results of the content analysis:

In order to achieve the goal of the research, which states (identifying the active mathematical operations on each side of the right and left brain and both sides available in the mathematics book for the fourth scientific grade), the content of the book was analyzed based on the list of active mathematical operations prepared by the researcher, and the results were as shown in the table 5):

Table (5)

Frequencies and percentages of the active mathematical operations in the brain included in the content of the mathematics book for the scientific fourth grade

	Active math operations in the brain	Math book by seasons							frequencies	Process Percent ages
		S1	S2	S3	S4	S5	S6	S7		
left side	Math reading	63	28	46	55	73	38	32	335	21%
	Math writing	37	7	13	15	39	15	5	131	8%
	Labels	14	14	53	26	33	20	25	185	12%
	mathematical calculations	4	14	30	37	55	14	10	164	10%
	Analysis	9	5	11	3	15	11	5	59	4%
	Logic	29	0	0	0	0	4	0	33	2%
	Classification and ranking	0	0	1	0	0	0	0	1	0%
	sequence	0	0	0	0	0	0	0	0	0%
	Calendar	0	7	0	0	0	0	0	7	0%
	Mathematical	59	38	42	48	69	38	32	326	21%

	thinking									
	perceive the parts	0	0	0	0	0	0	0	0	0%
right side	creativity	0	0	0	0	0	0	0	0	0%
	Perception of images and colors	0	0	0	0	0	0	0	0	0%
	intuition	0	0	0	0	0	0	0	0	0%
	imagination	0	0	0	0	0	0	0	0	0%
	Comprehension	0	0	0	0	0	0	0	0	0%
	Understand abstract patterns	0	0	0	0	0	0	0	0	0%
	constructivism	3	3	7	8	0	6	6	33	2%
	Perceive spatial relationships using pictures	0	0	0	0	0	0	0	0	0%
	Realizing it all together	0	0	0	0	0	0	0	0	0%
	Exploring nonverbal reasoning	0	0	0	0	0	0	0	0	0%
Both sides	Integration of both sides	32	30	73	36	39	71	29	310	20%
	total summation	250	146	276	228	323	217	144	1584	100%

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It is clear from the above table that the number of frequency obtained by the researchers from the book is (1584), distributed among (21) major operations of the active mathematical operations on both sides of the brain and both sides together. And it turned out that the operations of the left side got the highest percentage of Frequencies as the process of (mathematical reading) got the highest number of frequencies and it was (335) with a percentage of (21%). This is followed by the process of (mathematical thinking), at a rate of (326) frequencies and at a percentage of (21%), then the process of (labels) at a rate of (185) frequencies at a rate of (12%), and then (arithmetic operations) at a rate of (164) frequencies at a rate of (10) %, Then the process of (mathematical writing) at (131) frequency at (8%), then the (analysis) process at (59) frequency at (4%), and then the (logic) process at (33) frequency at (2%), While the operations (classifying and arranging, sequencing, and realizing the parts) got the least number of frequency of (0) and therefore the rate was (0%).

As for the operations of the right side, it is clear from Table (14) that the total number of frequency is (33), which is the number of frequency of the constructive process, i.e. at a rate of (33) frequency and a percentage of (2%), as for the other operations on the right side (creativity, perception of images and colors, Intuition, imagination, comprehension, perceiving abstract patterns, perceiving spatial relationships using images, perceiving all together, exploring non-verbal inference) the frequency in it were (0) and also their percentage (0%), as for the operations of the two sides together (integration of the two sides) the number of Frequency (310) with a percentage of (20%).

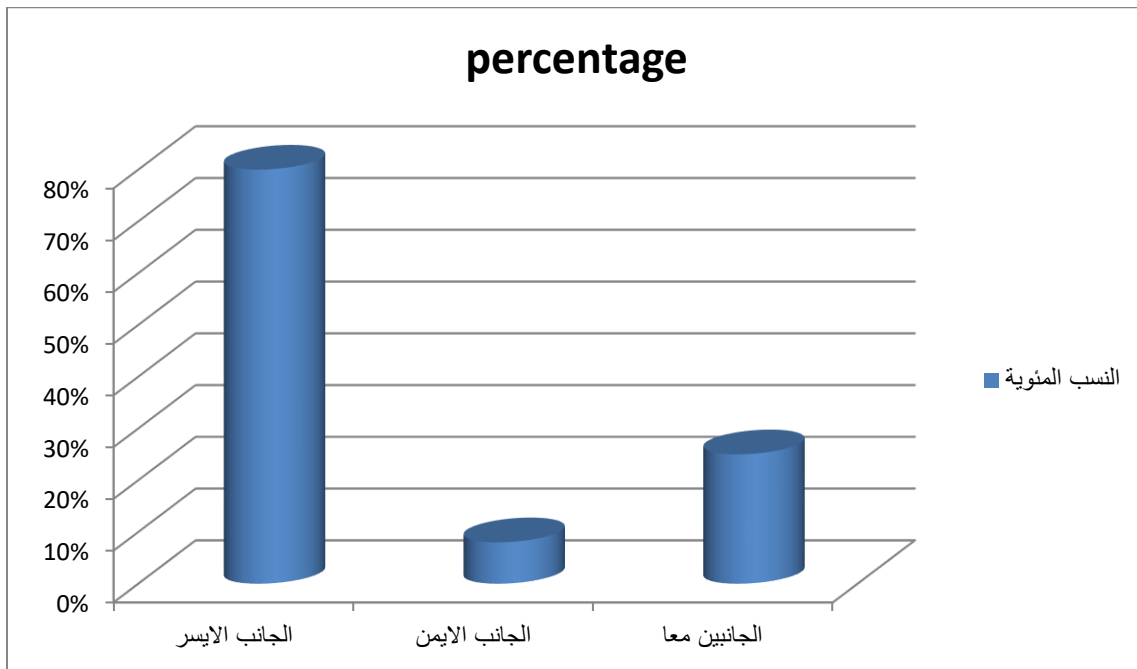


Figure (4)

A graph representing the percentages of the active mathematical operations in the brain contained in the content of the mathematics book for the scientific fourth class

Conclusions:

In light of the results reached by the researcher, the following can be concluded:

1. The results of the book analysis showed the authors focus on the left side operations and neglect the right side.
2. Although the content is focused on the left side, it was not at the required level.
3. Weakness of the scientific material in the scientific fourth grade book, and this weakness appeared when analyzing
4. When selecting and organizing the content, there was no consideration of global educational trends related to brain research.

Recommendations:

In light of the results reached by the researcher, the research recommends the following:

1. Directing the attention of the employees of the General Directorate of Curricula to the necessity of following the modern global educational trends.
2. Emphasis on book-writing committees to include active mathematical operations of the brain in the content of mathematics books.
3. It is very important to carry out the development of scientific content in accordance with new research and studies to keep pace with modernity in the world.

Suggestions:

To complement the current research, the researcher suggests:

1. Conducting more studies related to the active mathematical operations of the brain in the different school stages (primary, intermediate, preparatory).
2. Conducting a study on the active mathematical operations in the brain, according to the gender variable, to compare the results.

References

1. Badawi Ramadan Massad (2019): Strategies in Teaching and Assessing Mathematics Learning, 2nd Edition, Dar Al-Fikr for Publishing and Distribution, Amman.
2. Khawaldeh, Muhammad Mahmoud (2011): Foundations of Building Educational Curricula and Designing an Educational Book, 3rd Edition, Dar Al Masirah for Publishing and Distribution, Amman.

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3. Dumas, Mustafa (2011): Modern Strategies in Teaching Science, 1st Edition, Dar Ghaida Publishing and Distribution, Amman.
4. Al-Duwaidi, Rajaa Waheed (2002): Scientific Research, Its Theoretical Basics and Its Scientific Practice, 1st Edition, Scientific Press, Dar Al-Fikr, Damascus.
5. Razuqi, Raad Mahdi and others, (2013): Methods of Teaching Science, 2nd Edition, House of Books and Documents, Baghdad
6. Al-Saadi, Ammar Tohme (2017): The Mathematical Structure and its Relationship to Active Mathematical Operations on Both Sides of the Brain for Students of the Mathematics Department in the Faculties of Education and Basic Education, Journal of Educational and Psychological Research, Issue (52).
7. Saeed, Suad Jabr, (2008a): Educational Psychology, 1st Edition, Modern Book World, Irbid.
8. Al-Sulaiti, Firas, (2008): Learning based on the brain, 1st Edition, The Modern World of Books, Irbid.
9. Obeidat, Thouqan and Sahlia Abu Al-Sameed, (2007): Teaching Strategies in the Twenty-first Century, Teacher and Educational Supervisor's Guide, 1st Edition, Dar Al-Fikr, Amman.
10. Al-Ghouti, Atef Abdulaziz (2007): Active Mathematical Operations on Both Sides of the Brain for the Ninth Grade Students in Gaza, an unpublished master's thesis, presented to the Department of Curricula and Teaching Methods, Faculty of Education, Islamic University, Gaza, Palestine.
11. Faraj Allah, Abdul Karim Musa (2011): Evaluation of the mathematics textbook for the twelfth grade of the humanities from the point of view of teachers in the light of quality standards, Journal of Islamic Sciences.
12. Mahmoud, Mervat (2015): Mathematics Education Development Resources, 1st Edition, Debono Center for Teaching Thinking, Amman.
13. Al-Mashhadani, Abbas Naji (2011): Educational Methods and Models, 1st Edition, Dar Al-Yazuri for Publishing and Distribution, Amman.
14. Al Hashemi, Abdul Rahman, Mohsen Ali Attia (2011): Analysis of the content of the school curricula, 1st Edition, Dar Safaa for Publishing and Distribution, Amman.
15. Al Hashemi, Abdul Rahman and Mohsen Ali Attia, (2009): Analysis of the content of the Arabic language curricula - an applied theoretical vision, Dar Al Safa, Amman.