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Analyzing the content of the mathematics textbook of the fifth grade preparatory according to the depth of knowledge levels

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Abstract:

The aim of the current research is to identify the degree of availability of levels of depth of knowledge in the mathematics book for the fifth grade of the scientific and applied branch, the research sample consisted of the mathematics book of the tenth edition of the year 2019 of the fifth grade of the scientific branch of the application. To achieve the goal of the research, the two researchers prepared a list of levels of depth of mathematical knowledge. The recall, the level of concepts and skills, the level of strategic thinking and the level of extended thinking, the book was analyzed according to the aforementioned levels, using the analytical descriptive method and the stability of the analysis was confirmed by analyzing over time and individuals and the proportion of stability was 75% that was obtained by applying the Holste equation The results of the analysis of the book, as I have said: the percentage of availability of the level of recall reached (36.65%), the percentage of availability of the level of concepts and skills reached (31.78%), the percentage of availability of the level of strategic thinking reached (20.88%), the percentage of availability of the level of extended thinking reached (6710%).

Key words: content analysis, 5th grade mathematics textbook, levels of depth of knowledge

The general framework of the search

1. THE RESEARCH PROBLEM

In recent years, the mathematics curriculum has witnessed wide and important changes to keep pace with the spirit of the times because of its prominent role in learning curricula, and at the present time, educators, researchers and those interested in mathematics curricula have led to reconsidering the choice of educational material and at all school levels in terms of the quality and quantity of mathematics covered by the mathematics curriculum. In the different academic stages, the National Council of Teacher Mathematic of America confirmed

There is a remarkable development in mathematics curricula in its various fields to face various modern and technological challenges, building new topics according to scientific, modern and technological concepts that lead to developing content that is considered one of the major development duties of the curriculum. Mathematics curricula are a means to prepare the individual to face his environment, solve its various problems and contribute to its development. This is in addition to preparing it to face many global, regional and local challenges (Raphael and Youssef, 2001: 49), and there are many scientific conferences held that emphasized the need to pay attention to curricula, including: The International Scientific Conference entitled Curriculum Development in Light of the Philosophy of Modern Education sponsored by the Araqah Foundation for Culture and Development Which was held at the College of Education - University of Maysan, which was organized by the General Directorate of Al-Qadisiyah Education in cooperation with the University of Al-Qadisiyah in May 2019 AD, the results of some studies indicated the need to pay attention to the depth of knowledge in the treatment of knowledge in order to link the new knowledge acquired by the student with his previous knowledge to make learning meaningful and lead The student will acquire the ability to analyze, evaluate, distinguish, compare and subtract Questions, understanding ideas, interpreting information in depth and more objectively, and applying mathematical knowledge in new, unusual or traditional situations to solve problems and make decisions, including the study of (Hassan, 2018), (Shaheen, 2019), (Abdel Malak, 2020), (Abdul Rahim, 2020) which called for employing the depth of knowledge in various pedagogical aspects for educational applications, and through the remarkable development of mathematics curricula, where the transition from a content-based evaluation culture to the evaluation of standards and after reviewing the mathematics curricula in the preparatory stage revealed that there is no study to analyze the mathematics book for the class The scientific fifth according to the levels of depth of knowledge in mathematics books in Iraq to the best of the researchers' knowledge. Therefore, this research came to stand on the nature of the depth of knowledge and the extent of its availability in the book scheduled for the fifth grade blind and applied branch, and therefore the research problem can be identified in the answer to the following question:

What is the extent of availability of levels of depth of knowledge in the mathematics textbook for the fifth grade?

2- The importance of research: We can determine the importance of research as follows: -

1. Paying attention to improving and developing mathematics books during the selection and organization of displaying mathematics content

2. Attention to developing the depth of knowledge through creativity and generating new ideas to enable students to achieve the skills of the twenty-first century

3. Attention to levels of depth of knowledge being one of the most prominent modern trends in the field of mathematics education and learning

4. The importance of the preparatory stage, which represents the last stage of school life.

5. It may open the way for researchers to analyze the content of mathematics books according to levels of depth of knowledge

6. Directing teachers to the levels of depth of knowledge and the possibility of employing it by the teacher and its importance in the textbook and in the educational process.

7. This research is unique in analyzing the applied scientific mathematics book for the fifth grade according to the levels of depth of knowledge in Iraq according to the researchers' knowledge.

3- Research objective: The current research aims to:

1- Analysis of the mathematics book for the fifth grade according to the levels of depth of knowledge

4- Research Limits: The current search is determined by:

1- Levels of depth of knowledge, which are four levels (the level of recall and reproduction, the level of application of concepts and skills, the level of strategic thinking and the level of extended thinking)

2- The content of the mathematics book scheduled for the fifth science class of the scientific branch (from the first chapter to the ninth chapter) the tenth edition of 2019, in Iraq.

5- Define search terms

1- Content analysis defined by (Muhammad, Abd al-Azim, 2012: 21) as: “a scientific tool, and a methodical method used in analyzing the apparent content or the explicit content of a material in an objective and structured manner with the aim of reaching honest and consistent inferences, extrapolations and insights” (Muhammad, Abd The Great, 2012: 21).

2- The mathematics textbook for the fifth scientific grade as: the scientific subject prescribed for the fifth scientific and applied curriculum of the mathematics curriculum and all the lesson objectives, examples and all educational activities such as exercises, exercises and life issues approved by the Ministry of Education / General Directorate of Curricula and approved for the academic year (2019 -2020).

3- The levels of depth of knowledge defined by (Al-Feel, 2019) as: “It is a logical and precise organization of the knowledge and skills that the student should be able to in any field of study according to the degree of its depth and strength in four levels, beginning with the lowest depth and strength, which is the level of memory, then the level of application, then strategic and finally Extended thinking is the deeper and more powerful level '(Al-Feel, 2019: 240-239).

The theoretical side and previous studies

1- Content analysis: Content analysis is a method that gives the researcher freedom in dealing with texts in order to subject them to the evaluation, counting and classification process, which enables the researcher to qualitative analysis. Analysis represents a method of scientific research aimed at objective, structured and quantitative description of the apparent content that explores the strengths and weaknesses of the textbook as well as Educational materials without relying on self-impression, for the purpose of revision and modification to provide assistance to authors with numbers of new textbooks. (Taaima, 2004)

2- The textbook: The textbook is a reflection and translation of the main part of the curriculum contents and it is considered one of the most important tools and inputs of the educational systems. The textbook is more important in influencing what is learned in the school (Khatatiyyah, 2018: 2), and (Yaish, 2007) believes that the textbook is a translation that represents the curriculum and the practical side, as it reflects a picture of all its goals, content, methods of activities, and evaluation methods that represent the most important tool for basic communication. Which express the messages of the curriculum, the most important reference for the teacher and the student together, and a necessary pillar for society and its development (Yaish, 2007: 2)

3- Textbook content analysis: Textbook content analysis is represented by a set of procedures and technical methods joined to interpret and classify the content of the course material, including drawings, written texts and pictures, in addition to the ideas contained in the book. Content analysis skills are characterized by two characteristics: Focus on analyzing texts and topics and their interconnectedness together. Without touching on the hidden intentions of the author and using the scientific approach and the structured method in the analysis. (Al-Zwaini and others, 2013: 106).

5- Depth of Knowledge: The depth of knowledge was developed by Norman Lott Webb in 2002, a senior research scientist at the Wisconsin Center for Educational Research at the University of Wisconsin-Madison in America, who directs curriculum evaluation and professional development projects (webb, 1997: 5), The emergence of the depth of knowledge is a contemporary trend for curriculum building and development, and we mean by depth knowledge all the foundations of knowledge from concepts, definitions, facts and generalizations, and the emergence of this trend represents a reaction to some of the cognitive content problems that the curricula suffered from, such as the surface knowledge evident in textbooks, which is considered a source of knowledge (Al-Ghamdi) Norman Webb, 2019: 11), believes that depth of knowledge is an educational process that requires teachers to explain the depth at which learning takes place, and teachers must reflect the level of this depth and define the purpose of their teaching to students and then evaluate students on the information that must be preserved for lifelong learning (elephant , 20019,238), and represents the depth of knowledge of the criterion and the question itself. The depth of knowledge is not concerned with the action, but rather on the context in which the action is used and on the mental processes that are practiced, that is, it is concerned with what The following is the act of metacognition processes and the cognitive depth is not related to the difficulty. It requires looking at the level of knowledge and not the student's work in order to

determine the level (Al-Fayez, 2014: 9). The depth of knowledge can vary in a number of dimensions, including the level of complexity. The knowledge of the information that students should expect to know, the extent to which they are able to transfer this knowledge to different contexts, the extent to which they must be able to form generalizations, the amount of previous knowledge they must possess in order to understand ideas, and the depth of knowledge is related to the depth of knowledge that is required Predicting or evaluating the number of concepts and ideas correlations that the student needs in order to produce a response and the level of thinking (Hiebert, 1992: 67), and both (Hess, 2013) and (Webb, 2002) agreed to divide the levels of depth of knowledge into four levels, and as explained by Naumann Web as follows: -

The first level: Recall And Reproduction: This level includes the basic tasks that require students to remember or reproduce knowledge and skills. This level usually involves students dealing with facts and different characteristics of objects and objects. It involves the use of simple procedures and formulas. Among the questions of this level, the student who answers an element either knows the answer or not; That is, the answer does not need to be "calculate" or "solve" (8-9 Wyse & Viger, 2011 :)

Level Two: Basic Application of Skills / Concepts

This level requires students to be able to highlight differences or compare people, places, events and concepts, and reformulate information from one form to another. It also requires classifying or sorting things into meaningful categories, describing or explaining issues, problems, and patterns, and clarifying the relationships between cause and effect, importance and effect. This goes beyond the first level by requiring students to go beyond simply summoning information to describing or explaining it and answering questions such as "how" or "why". The elements in the curricula that fall into this category include working with or applying skills and concepts, as well as tasks related to the field of study in laboratory settings. This level includes work in light of a set of principles and protocols and with a set of categories (Hess and others, 2009: 3).

 The third level: Strategic Thinking: This level is called Short-Term Strategic Thinking. It requires students to be able to use short-term higher-order thinking processes such as analysis and evaluation in order to solve problems in the real world with anticipation and prediction of results that Reasoning and logic are the main hallmarks of tasks that fall into this particular category. The tasks require students to coordinate knowledge and skills from multiple fields to carry out the required processes and arrive at solutions within a project-based framework (11 Mississippi State University, 2009 :)

 The fourth level: Extended Thinking: This level is called Strategic Extended Thinking. This level requires students to use higher-order thinking processes such as installation, reflection, evaluation and modification of plans over time, and students participate in conducting investigations to solve problems from the world. Reality with unpredictable results (Wyse & Viger, 2011: 10)

6- The importance of depth of knowledge: which is represented in both of the following: -

1- The suitability of all academic subjects due to the multiple levels of depth of knowledge and the diversity of goals for each level.

2- It is in line with the different ages of the students as a result of its inclusion of all kinds of knowledge

3- It was distinguished by comprehensiveness and knowledge when categorizing the various knowledge goals

4- Includes various simple and compound actual capabilities.

7- The role of depth of knowledge in curriculum building and development

1- I helped to use the basic functions of science, interpretation, expectation and control.

2- I participated in using the method of deduction and extrapolation and worked to develop it

3- I worked on organizing information into new patterns

4- Helps build the knowledge structure (Al-Sumairi, 2004: 98)

2. RESEARCH AND ITS PROCEDURES

1- Research Methodology: The researchers used the descriptive and analytical method in this research and used the content analysis method.

2- The research community and its sample

a. Research Community: It is the mathematics textbook for the fifth grade of applied science and decided by the Iraqi Ministry of Education, and the following table (3) explains that: -

Table (3) shows the research population

The number of pages	The number of parts	**year**	Edition	Mathematics book	**s**
258	nine	**2019**	the second	Fifth grade applied science	**1**

B. Research sample: The research sample was represented in the mathematics book for the fifth grade of applied science, and the sample was subjected to analysis of (228) pages, which represents (88.3) of the total content of the book after excluding indexes and chapters' interfaces, and Table (4) illustrates this: -

Table (4) Description of the research sample

ratio	The	Chapter title	the

	numb er of pages		classroom
%5.7	**13**	Logarithms	the first
%7.89	**18**	Sequences	The second
%6.14	**14**	Conic sections	the third
%15.35	**35**	Circular Functions	the fourth
%7.89	**18**	Purpose and continuity	Fifth
%16.66	**38**	Derivatives	sixth
%10.96	**25**	Aerospace engineering	Seventh
%10.96	**25**	The principle of counting, exchange and combinations	eighth
%18.42	**42**	Matrices	The ninth
%100	**228**	**Total**	

3- Research Tool: A tool for content analysis was prepared, where the researchers followed the following steps to prepare a tool for content analysis as follows: -

a. Determining the analysis tool: After reviewing the educational literature and previous studies for content analysis, the researchers relied on the classification (Webb, 1997,2002), (Al-Fayez, 2017) and (Abdul Malak, 2020) to determine the levels of depth of knowledge, and Table (5) clarifies this:

Table (5) List of levels of depth of knowledge

Levels of depth of knowledge	Levels
Remembering and reproducing	the first
Apply concepts and skills	The second

Strategic thinking	the third
Extended thinking	the fourth

B. Validation of the analysis tool: The two researchers presented the tool in a preliminary way to a number of experts and referees with experience and competence in the field of methods of teaching mathematics and content analysis.

C. The final list of content analysis: the validity of the tool was verified, and then the content analysis tool was finalized.

4- Analyzing the content of the mathematics book for the fifth grade of science:

A- The objective of the analysis: To identify the availability of levels of depth of mathematical knowledge in the mathematics textbook for the fifth grade of applied science.

B- The analysis sample: represents the mathematics book with its nine chapters, as well as all the examples and exercises included in each of the nine chapters of the book.

C- The unit of analysis: The unit of idea was relied on because it is the most useful unit in analyzing the mathematics book for the fifth grade of applied science, and it used repetition as a unit of counting.

D- Categories of Analysis: Depth levels of mathematical knowledge (remembering and reproduction, application of concepts and skills, strategic thinking, extended thinking) were used as categories for analysis.

C- Analysis process steps: The content analysis process included the steps as follows: _

Analytical careful reading of the mathematics book - extracting what it contains from the content of the analysis list -

Explicitly adopting the example and the exercise as a unit of analysis - after classifying the frequency, it will be converted into percentages.

5- Validity of the analysis: To ensure the validity of the analysis, the two researchers took a sample of the analysis sample, which is the second chapter (sequences) of the mathematics textbook for the fifth grade of applied science. 80%, thus achieving the validity of the analysis.

6- The stability of the analysis: The two researchers calculated the consistency of the content analysis for this research by agreeing with other experienced analysts to analyze the content of a sample of the mathematics book according to the principles, instructions and method agreed upon with the analysts, and then calculate the stability by using the Holste equation, and obtain a coefficient Stability through the Holste equation (0.83) and this is a high degree, which indicates the stability of the tool. As for the second method, it is the stability of the analysis over time, represented by re-analysis after a period of time, where the researchers,

after a period of three weeks, re-analysis after the first analysis and to know the coefficient Consistency for analysts by using the Holste equation to calculate the number of times of agreement for the analysts

sort	**ratio**	**Repeat chapter**	**Mathematics book chapters**									**Levels of depth of knowledge**	**s**
			F9	**F8**	**F7**	**F6**	**F5**	**F4**	**F3**	**F2**	F1		
the first	the first	the first	the first	the first	the first	the first	the first	the first	the first	the first	**9**	Remembering and reproducing	**1**
The second	The second	The second	The second	The second	The second	The second	The second	The second	The second	The second	**1**	Apply concepts and skills	**2**
the third	the third	the third	the third	the third	the third	the third	the third	the third	the third	the third	**4**	Strategic thinking	**3**
the fourth	the fourth	the fourth	the fourth	the fourth	the fourth	the fourth	the fourth	the fourth	the fourth	the fourth	**4**	Extended thinking	**4**
99.98%		**431**											**Total**

Through the results shown in Table (6), it is clear that the level of remembering and reproduction came in a percentage (36.65%) and by (158) repetitions and in the first order, and the researchers attribute the reason to the mathematics book that includes topics that include identifying a fact, a property, or a law, as well as applying A simple algorithm and a specific or routine procedure and solving a problem in one step, so that this level focused on

the lower levels of thinking represented by remembering and understanding, and this result agreed with the results of both studies (Al-Obaidan and Al-Zaabi, 2014), (Al-Qahtani, 2012), (Al-Fayez, 2016) and the level of application Concepts and skills came in a percentage (31.78%) and by (137) repetitions in the second order. The researchers attribute the reason to the fact that the mathematics book includes topics that include solving routine problems that require multiple steps or applying multiple concepts as well as organizing and displaying data in tables and graphs so that this level focused On the lower levels of thinking represented by understanding and application, so that this level focused on the lower levels of thinking, remembering and understanding, so that this level focused on the lower levels of thinking, remembering and understanding. This result agreed with the results of both studies (A By Obaidan and Al-Zaabi, 2014), (Al-Qahtani, 2012), (Al-Shara, 2013) and the level of strategic thinking came with a percentage (20.88%) and by (90) iterations and in the third order. The researchers attribute the reason to the fact that the mathematics book includes topics that include solving complex non-routine problems. A solution and explanation of the system of equations for a specific problem, so that this level focused on the higher levels of thinking represented by analysis and evaluation. This result agreed with the results of both studies (Al-Obaidan and Al-Zaabi, 2014), (Al-Qahtani, 2012), (Al-Fayez, 2017), (Walkup, 2009). The level of extended thinking came with a percentage (10.67%) and at a rate of (90) iterations and in the fourth order. The researcher attributes the reason to the mathematics book that includes topics that include linking mathematical concepts with real-world applications in new situations, so that this level focused on higher levels of thinking represented by creativity.

3. CONCLUSIONS

1- The mathematics book for the fifth grade of applied science includes all levels of depth of knowledge in varying degrees.

2- The mathematics textbook for the fifth grade of applied science focused on the integration of mathematical concepts and mathematical skills.

3- The mathematics book for the fifth grade included the applied science on the lower stages of thinking as well as the higher stages of thinking

4. RECOMMENDATIONS

1- Urging mathematics teachers to pay attention to levels of depth of knowledge, considering it to provide a road map for appointing teachers to guide students to more levels of depth of knowledge.

2- Emphasis on holding seminars and conferences and organizing courses for specialized supervisors and educational cadres and introducing them to the importance of levels of depth of knowledge in the textbook.

3- Work on the necessity of having levels of depth of knowledge within all school curricula for the different stages

5. PROPOSALS

1- Conducting studies similar to the current research at different stages of study and for other subjects.

2- Conducting experimental studies to find out the extent to which students possess levels of depth of knowledge.

3- Analyzing mathematics books for different school stages according to levels of depth of knowledge

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