RES MILITARIS
REVUE EUROPEENNE D ETUDES EUROPEAN JOURNAL OF MILITARY STUDIES
Social Science Journal

Depth of knowledge among primary school students

By

Azhar Alwan Kashash
College of Education / Ibn Rushd - University of Baghdad/Iraq
Email: atlsomar83@gmail.com

Nour Alwan Karim
College of Education / Ibn Rushd - University of Baghdad/Iraq

Abstract

The aim of the current research is to reveal the depth of knowledge of the primary school students, as the research community was identified with the sixth grade students of the primary stage from the first, second and third directorates of Rusafa Education, where the number of the sample was (250) students. The descriptive approach was used, where the researcher built a special test of cognitive depth for sixth grade students, consisting of (20) questions, of whom (16) objective questions and (3) articles to know their depth of knowledge. The psychometric properties of them, as the reliability coefficient of the cognitive depth test was (0.86) The results resulted in the following: Sixth grade students in the research sample possessed the cognitive depth.

Keywords: cognitive depth, mathematics, sixth grade students.

Research problem

The cognitive depth in mathematics for the primary stage is a modern variable and one of the requirements of the twenty-first century for students who deal with knowledge deeply. Al-Saadi study (2021) confirmed the existence of a clear weakness in the dimensions of deep learning among primary school students in general, and the study attributed this weakness For several reasons, the most important of which are teachers' weak interest in modern technologies in education and their use of traditional methods, lack of interest in how students process knowledge and organize it within their knowledge structures, and not encourage them to ask questions that focus on scientific explanations of what they see, or urge them to generate new scientific ideas. (Al-Saadi, 2021: 32)

Thus, the problem of the current research is illustrated by a question
What is the cognitive depth of primary school students?
research importance

Mathematics is considered one of the most important basic infrastructure that helped man to develop and progress in many fields. Accordingly, mathematics was called (the mother of worldly sciences). Computer and medical sciences, and this science has great merit in the fields of statistics, physics, biology, means of transportation, astronomy, means of communication, environment, and many other fields that are completely related to this science. (Muhammad: 2015: 98) Mathematics is one of the basic science subjects in the primary stage, as the curriculum of the subjects in the primary stage aims to provide students with mathematical concepts and skills, which help them in studying other subjects, continuing higher education or following scientific and technological developments, increasing their ability to express their ideas accurately and clearly, and reaching Objective conclusions, logical thinking and the development of positive attitudes such as order, accuracy and objectivity. (Ahmed, 2010: 108-101) With the cognitive development witnessed by the contemporary

world, it has become necessary to pay attention to the depth of mathematical knowledge and to stay away from superficiality. Through deep knowledge, the student develops an understanding and meaning of what he learns, and is able to ask questions and analyze what is happening in a correct understanding. , discovers relationships and patterns, and becomes more capable of solving problems. 409 2008:, Benet & (Benet) Recently, many researchers have drawn great interest in developing the levels of depth of knowledge, and the importance of developing the levels of depth of knowledge is that it encourages the student to inquire about things why and not only inquire about how, and also stimulates him to reach the maximum levels understanding, and gaining him a broad vision of linking ideas together, enabling him to link new concepts and skills to everyday life situations and experiences, as well as levels of depth of knowledge that raise the student's internal motivation to learn, and stimulate his tendency to study beyond the requirements of the subject only (al feel, 2018 (Muhammad, 2019) identifies the importance of the levels of depth of knowledge in mathematics in that they: - enable the student to reach high levels of understanding, which develops positive attitudes towards mathematics, and helps the student to link his previous knowledge and experiences with new relevant knowledge and experiences. Mathematics applications outside school, help to develop inferential thinking skills, logical and reflective thinking, and develop the student's ability to predict and make decisions, and also help the student to integrate and focus more in an environment learning . (Mohammed, 2019: 28)

The importance of the current research is highlighted in:

1. Increasing teachers' awareness of the importance of developing and evaluating deep levels of knowledge in mathematics.
2. Develop educational practices and activities that stimulate students' desire to learn mathematics.
3. Helping students in developing the levels of depth of mathematical knowledge.
4. Helping students to improve their desire to learn mathematics.

The aim of the research

to identify the level of cognitive depth among primary school students in the schools of Baghdad Governorate / Al-Rusafa.

search limits

1. ***Human Boundaries: Sixth*** grade students.
2. ***Spatial Boundaries*****:** Schools of the General Directorates of Education in Baghdad Governorate / Al-Rusafa
3. ***Time limits: the*** academic year (2021-2022).

Define terms

First: the depth of knowledge: defined by

Webb (2007) that: "An educational process requires teachers to explain the depth in which learning takes place, and teachers must reflect this depth and specify the purpose of their teaching to students, and base them on the information that must be retained for lifelong learning." (45 web, 2007:)

Holmes (2011) as: a critical examination of new ideas and facts and placing them in the cognitive structure and making multiple links between them, and the student searches for meaning in them, and focuses on the basic arguments, proofs, and concepts required to solve a problem." (Holmes, 2011: 29)

Al feel (2018) as: "a tight logical organization of the knowledge and skills that students

must be able to master in any field of study according to the degree of its depth and strength in four levels, starting with the lowest in depth and strength, which is the level of remembering, then the level of application, then strategic thinking, and finally extended thinking, which is the most profound level. (Al feel, 2018:79)

Procedural definition: It is the organization of mental processes used in processing the knowledge and skills included in the study materials, which include four levels: remembering and reproduction, application of concepts and skills, strategic thinking, and then extended thinking.

Theoretical framework: Depth of knowledge

The emergence of depth of knowledge

In light of the development that the educational curricula have witnessed and the criticisms found by Bloom's hexagram division, Norman Webb (1997, Webb) revised Bloom's hexagonal model by designing a knowledge model called Depth of Knowledge. This model helps to develop educational curricula. From content-based assessment to criteria-based assessment, meaning that this model relies on the assumption that all elements of knowledge can be categorized into a set of tasks that reflect a different level of awareness and expectation needed to complete the task. This model includes all forms of procedural, declarative and applied knowledge. (Salam, 2019:6)

The importance of cognitive depth is due to the achievement of meaningful learning and linking new knowledge with previous knowledge within a conceptual framework of knowledge existing in the learner's cognitive structure, which leads to the production of interconnected ideas and also the ability to compare, distinguish and understand contradictory ideas, and that the individual who is characterized by depth of knowledge has the ability On the analysis and evaluation of new scientific knowledge and linking it to his knowledge in building knowledge and placing it in a conceptual framework, and this matter leads to a deep understanding and also to the preservation of scientific concepts and the development of the ability to solve problems and also the interpretation of scientific phenomena in depth, discrimination, comparison, asking questions and applying scientific knowledge in New unfamiliar contexts (Ibrahim, 103: 2017) Webb developed the cognitive depth theory by representing the cognitive component in four levels, where each level deals with a type of thinking processes that organize each level, taking into account the difficulty of the task presented. And not the degree of similarity in the performance of the task, which requires a higher level of cognitive depth and greater understanding and treatment by the learners, and Hess (2009, 2009) sees that Cognitive depth ("It is a critical examination of new ideas and facts and placing them in the cognitive structure and making multiple links between them and in which students reveal meaning and focuses on the basic arguments, proofs and concepts required to solve a problem"). (Shaheen, 2020: 422) We can conclude that cognitive depth is a measure of the cognitive aspect and thinking, and the most important thing that distinguishes it from Bloom's model and classification is that it balances standards and evaluation, and that Bloom's classification depends on the use of verbs, while the depth of knowledge depends on the context used in the act. People familiar with Bloom's taxonomy focus on similarities with levels of cognitive depth, but there are important differences between them. Bloom's taxonomy focuses on the verbs you use, for example (mention, explain, analyze), while Webb's levels of cognitive depth depend on the context of the question. For example, note the following examples where the same verb is used, but they represent increasing levels of complexity in cognitive processes, such as:

1. Describe the properties of an ionic bond.

2. Describe the differences between an ionic bond and a covalent bond
3. Describe, a diagram that allows an individual to compare the similarities and differences in chemical bonds.
4. The action is the same, but the gradation of tasks requires deeper and more complex thinking.

(Al-Awfi, 2020)

Norman Webb (1997 Webb's model of cognitive depth)

Webb has developed the theory of cognitive depth by representing the cognitive component in four levels, where each level deals with a type of thinking processes that organize each level, taking into account the difficulty of the task presented and not the degree of similarity in the performance of the task where the higher level of knowledge is required. Cognitive depth Greater understanding and cognitive processing by learners The Depth of Knowledge (1997, Webb) model presents the cognitive expectations required by curricular activities, assessment tasks, and standards. An acceptable response, where each group of tasks reflects a different level of cognitive expectations or depth of knowledge required to complete the task. Strategic (short term thinking), extended thinking (i.e., extended thinking) (Webb, 2009: 5).

Levels of cognitive depth as defined by Webb (1997,): (Webb

The first level: Recall and retrieval: The first level requires retrieval and recall of information, such as defining a term, a fact, a simple scientific procedure, or performing a process. This level requires students to show a response, use a known formula, follow a specific procedure, or perform a series of steps that are analyzed. clearly. (2005: 1, Hess)

The second level: the application of concepts and skills: This level includes the involvement of some mental processes in processing information that goes beyond the usual and known response, as this level requires students to make some decisions about how to deal with the problem or activity. And making observations, displaying and comparing that data (12: 2007, Webb)

The third level: Strategic thinking: We mean by strategic thinking, it is the cognitive process that enables the learner to access previous information, explore and synthesize information and correct wrong information, as well as ask clarifying questions that are related to the topic. Strategic thinking also includes the ability to synthesize information to generate new knowledge and ideas that are more Effective and more efficient, how to convert these ideas into a product, and how to take advantage of the available conceptual tools. (Al-Feel, 2016: 63)

Level 4: Extended Thinking (Broad): At this level, the assigned methodological elements require extensive use of higher-order thinking processes such as reasoning and synthesis, adjusting plans over time and evaluation, where students are involved in conducting investigations to solve real-world problems with unexpected results, as well as the ability of the student to deal with the problem in different circumstances and from different mental perspectives. (Webb, 2009:13)

Principles for using and measuring levels of depth of knowledge:

When using Norman Webb's four levels of depth knowledge, the following principles must be considered:

1. The teacher must determine the deeper level of the question in the event that the question reflects more than one level of knowledge.
2. The teacher at each level must determine the level of performance acceptable to the students.
3. The teacher should classify the type of thinking required to complete the task.
4. The teacher must determine the level of cognitive depth based on the cognitive demands mentioned in the course objectives.
5. When completing a certain task, the teacher must describe the type of thinking required.
6. Before determining the level of knowledge depth required and stipulated in the objectives, the level of complexity of the task and the students' prior knowledge is taken into consideration.(2017:100), Thomas)

Previous studies

Study (Al feel , 2018): It aimed to identify the effect of a proposed program to employ the scenario-based learning model in teaching in developing levels of depth of knowledge, the effect of the proposed program in reducing mental wandering, and finally revealing the degree of continuity of the impact of the proposed program to employ the scenario-based learning model In developing the levels of depth of knowledge among students of the Faculty of Specific Education, Alexandria University. The study used the experimental method, and the research sample was random, consisting of (90) students from the fourth year students, with (46) male and female students as an experimental group, and (44) male and female students as a control group. The researcher used the depth of knowledge test, the mind wandering questionnaire, and the proposed program for employing the scenario-based learning model in teaching, all of which were prepared by the researcher. The researcher used a one-way analysis of variance to extract the results that revealed a statistically significant effect of the proposed program to employ the scenario-based learning model (SBL) in teaching in developing levels of depth of knowledge and reducing mental wandering among students of the Faculty of Specific Education, Alexandria University. (Al feel,2018:67)

Study (malak, 2020) The aim of the research is to know the effect of using the realistic mathematics strategy to develop the levels of depth of mathematical knowledge and improve the desire to learn mathematics among middle school students in the city of Kharga in the New Valley. The study used the experimental method as a method for its study. The research sample consisted of 76 male and female students who were divided into two groups: one of them was experimental and studied according to the realistic mathematics strategy, and the other was a control one who studied the same unit in the usual way. The test of levels of depth of mathematical knowledge was built, and the scale of desire to learn mathematics was used. The t-test for two independent samples (t-test), arithmetic mean, standard deviation. The results of the research found a statistically significant difference at the level (0.01) between the mean scores of the experimental group students and the scores of the control group students in the post application to test the levels of mathematical knowledge depth in favor of the group. Experimental. (Malak, 2020: 15)

Research Methodology and Procedures

First: Research Methodology: The researcher adopted the descriptive research method to achieve the research objective.

Second: the research community and its sample: The research community was determined by the sixth grade students of the primary stage for the academic year (21-2022) in the education of Rusafa first, second and third in the province of Baghdad, and table (1)

illustrates this.

Table (1): *Research communit*

Total	Female	Male	Directorate	T
1418	1166	252	Rusafa first	1
1709	1271	438	Rusafa second	2
1368	857	511	Rusafa third	3
4495	3294	1201	the total	4

Third: The basic research sample

The basic research sample amounted to (250) male and female students who were chosen by the stratified random method, according to what is approximately proportional to their number in the research community and according to the type, and the table (2) illustrates this.

Table (2): the research sample of sixth graders in the province of Baghdad, Al-Rusafa Education Directorates

Total	Females	Males	**Directorate**	T
79	65	14	Rusafa first	1
95	71	24	Rusafa second	2
76	48	28	Rusafa third	3
250	184	66	Total	4

Fourth: Research Tool

Knowledge Depth Test: Since the current study requires preparing a test to measure the cognitive depth of primary school students, and due to the lack of a ready-made test suitable for the current research, the researcher prepared a test based on the academic content of the specified sixth grade mathematics book, characterized by honesty, stability and objectivity. In its construction phase, this test went through the following steps:

Levels of the test

The researcher has adopted three levels of cognitive depth, which are:

- ❖ Level of recall/recall.
- ❖ Level of application of concepts and skills.
- ❖ Strategic thinking.

The researcher has adopted the definition of (Al feel 2018): as he defined the cognitive depth as a logical and tight organization of the knowledge and skills that students must be able to achieve in any field of study according to the degree of its depth and strength in four levels, starting with the lowest depth and strength, which is the level of remembering / recall, then the level of The application of concepts and skills, then strategic thinking, and finally extended thinking, which is the most profound level. The researcher prepared a test consisting of (3) levels, because the fourth level (extended thinking) requires a long time and projects and long-term tasks and is often used in experimental research.

Determining the type of test items

The researcher counted the test items for the subjects of the mathematics book for the sixth grade of primary school, of two types:

A- Objective tests***: to*** measure the first and second levels (level of recall/recall, level of application of concepts and skills)

B - Mathematical problems: to measure the third level of strategic thinking.

C- Preparing the test map: for that, the researcher prepared a test map for the topics studied by the sixth grade students in the first semester, which included the three levels to measure the depth of knowledge.) explains it.

Table (3): *The test map of the levels of cognitive depth for the topics of the mathematics book*

Total %100	strategic thinking %.1	Apply concepts and skills 20%	levels of cognitive depth remembering/recalling 30%	Relative importance for the seasons	N.O of pages	Chapter
5	1	2	2	%23	13	the first
4	1	1	2	%19	11	Second
3	1	1	1	%16	9	Third
5	1	2	2	%23	13	the fourth
4	1	1	2	%19	11	Fifth
21	5	7	9	%100	57	the total

Drafting of test items

The researcher prepared a test to measure cognitive depth, consisting of (21) items distributed over the three levels of cognitive depth:

- 9 items, type of multiple choice with two alternatives.
- ***Level of application of concepts and skills:*** 7 paragraphs, type of multiple choice with two alternatives.
- ***Strategic thinking:*** 5 paragraphs to solve mathematical problems.

Test validity

A- Apparent honesty: This type of honesty was verified by presenting the test items to a group of arbitrators and specialists in teaching methods, measurement and evaluation to determine the validity of the test items and the extent to which the levels of depth of knowledge were achieved. The test consisted of (21) items.

Content validity: The researcher verified this validity by building a test map.

Test correction instructions: the researcher assigned one point for the correct answer and zero for the wrong answer or left out for the objective paragraphs (multiple choice), as for the paragraphs of solving mathematical problems, the marks for correction were graded (3 2 1 0), and on this basis the degree was The highest score for the test is (31) and the lowest score is (zero).

The exploratory sample: To verify the clarity and validity of the test paragraphs, and the time taken to answer it, the researcher applied the test to a survey sample from the same research community in Yarmouk Primary School, which consisted of (50) female students. The average response time for the test items was (45) minutes.

Sample of statistical analysis: The researcher applied the test to a sample of (100) students from the following schools: (Al-Sadiq Elementary, Miqdad Elementary, and Al Badia Elementary). The upper and lower levels (27%) for each group as the best proportion of the balance between two extreme groups of the total group to study the characteristics of the items statistically. Thus, the number of students in the upper group was (27), and the number of students in the lower group was (27). The following is an explanation of the statistical analysis

procedures for the test items:

A- Difficulty level of paragraphs

The difficulty level of the test items is determined by the objective items between (0.52-0.67), while the mathematical problems are (0.46-0.51), which is a good level.

B- Paragraph discrimination power: Determining the power of discernment of substantive paragraphs (0.44-0.70). As for sports matters. Its distinction is (0.60-0.72) which is a good level.

C- ***Effectiveness of the wrong alternatives:*** It is clear that the wrong alternatives to the items of the cognitive depth test have attracted more students of the lower group than the students of the upper group, so it was decided to keep all of them without deleting or modifying.

Depth of knowledge test

A- The stability of objective questions: In order to verify the reliability of the depth of knowledge test, the researcher used Keoder-Richardson's equation 20 for objective items (multiple choice 16 items) and the sample size was (50) male and female students, and after applying the mentioned equation, the reliability coefficient reached (0.88), and this It indicates that the stability coefficient of the test is good.

B - The stability of problem solving: In order to verify the stability of the depth of knowledge test (problems), the researcher used the Facronbach equation (5 paragraphs), and the sample size was (50) male and female students, and after applying the mentioned equation, the reliability coefficient reached (0.86), and this indicates that The stability coefficient of the test is very good.

Application of the tool: The depth of knowledge test was applied to the basic research sample who answered the test from 1/3/2022 to 1/4/2022 for a month.

Sixth: Statistical means: The researcher used the spss program to process the data and extract the results, as follows: the t-test for one sample. Chi-square Cronbach's alpha coefficient, the equation of difficulty, discrimination, and the effectiveness of false alternatives.

Presentation and Interpretation of Results: Recognizing the level of cognitive depth among primary school students in the schools of Baghdad Governorate / Al-Rusafa. The arithmetic mean of the research sample was extracted (21.9480) with a standard deviation of (5.36998). As for the hypothetical mean of the test, it was (15.5), and in order to know the significance of the difference between the two averages, a single-sample t-test was used, and the table (4) illustrates this.

Table (4): *The results of the one-sample T-test for the level of cognitive depth among primary school students in the schools of Baghdad Governorate / Al-Rusafa*

Indication Level (0,05)	Tabular t-value	Calculated T-value	hypothetical mean	Standard deviation	SMA	Sample
Significant	1.96	13.739	15.5	5.36998	21.9480	250

It is clear from Table (4) that the calculated t-value of (13.739) is greater than the tabular t-

value of (1.96) at the level of significance (0.05) and the degree of freedom (249), which means that the members of the research sample, elementary school students, have a depth of knowledge in a statistically significant manner. The result of the current research revealed that the sample members have a cognitive depth. It was found that his primary school students whose teachers have technical competencies have the ability to visualize cognitive accuracy by dividing and categorizing the various thinking processes necessary to solve the problem correctly, and by dividing and distinguishing between the level of depth Knowledge is required for each question, and teachers are shown to further determine the pupil's understanding. By revealing the depth of knowledge, the evaluation element becomes apparent by linking the actual question stem and its answer, the length of the questions, and other existing components of the same element, such as solving mathematical problems in several steps, as (Norman Webb) indicated that the student transfers the depth of knowledge in focus to the cognitive aspects that he must Practice it to navigate through questions and address the question appropriately Depth of knowledge is important for teachers and evaluators to consider fully understanding pupils' expectations in their answers to questions. Deep knowledge that requires complex thinking processes. Students answering the questions of depth of knowledge makes them move through each question from beginning to end and take the test. Of course, some questions take longer, other questions are shorter to answer, and each question is not equal. Depth of knowledge helps visualize cognitive accuracy by properly dividing and categorizing the different thought processes needed to solve a problem. And by dividing and distinguishing levels of thought required For each question, teachers can further define the student's understanding to identify deficiencies or wrong areas and to identify misconceptions and points where students need more help thinking about a problem.

Conclusions

Students have depth of knowledge, which is basically a form of students' perception and some of the principles that govern it. Because of its dynamic nature, information is processed on the basis of a number of information, while processing questions according to cognitive levels, not always completely based on sensory data or facts.

Recommendations

It is necessary to provide educational programs at the beginning of the school year to educate students about the importance of depth of knowledge and use it in their real life and benefit from it as experiences in their lives.

Suggestions

1- Detecting the cognitive depth of learners in other stages of study and other age groups.
2- Studying the depth of knowledge and its relationship to other variables such as creativity in solving problems.
3- Building a training program for university students in developing the depth of knowledge and its relationship to information processing.

Sources

1- Ibrahim, Asim Muhammad (2017). The effect of teaching science using digital learning units in developing the levels of depth of scientific knowledge and confidence in the ability to learn science among second-grade intermediate students, Educational Journal, Volume 32, Issue 125, Scientific Publication Council, Kuwait University.

2- Ahmed, Shukri Sayed (2010). Attitudes towards mathematics and its relationship to choosing the type of academic specialization and some other variables, research published in Risalat Al-Khaleej, No. 50.
3- Al-Saadi, Maryam Rahim Hashem (2012). The depth of mathematical knowledge and its relationship to information processing among primary school students, Master's thesis, Ibn Al-Haytham College, University of Baghdad, Iraq.
4- Salam, Bassem Sabri Muhammad (2019). The effect of experiential learning in geography on developing the depth of geographical knowledge and mental motivation among secondary school students, Journal of the College of Education, Volume 35, Number 5, Assiut University, Egypt.
5- Shaheen, Abdul Rahman bin Youssef (2020). The availability of levels of knowledge depth in biology textbooks for the secondary stage, Scientific Journal, Volume 26, Issue 1, Faculty of Education, Assiut University.
6- Al-Awfi, Majid bin Awad (2020). The effectiveness of a proposed unit in chemistry in the light of the Next Generation Science Standards (NGSS) on the depth of knowledge among first-year secondary students, Al-Fath Journal, Issue (83), Iraq.
7- The Elephant, Helmy Mohamed Helmy (2018). A proposed program to employ the scenario-based learning model (sbl) in teaching and its impact on developing levels of depth of knowledge and reducing mental wandering among students of the Faculty of Specific Education, University of Alexandria, Journal of the Faculty of Education, Menoufia University, Faculty of Education, Alexandria, Egypt, Issue 2, Volume 33.
8- The Elephant, Helmy Mohamed Helmy (2016). The effectiveness of a training program based on the cognitive apprenticeship model in improving strategic thinking skills and learning efficiency for high school female students, The Egyptian Journal of Psychological Studies, Volume 26, No. 91, The Egyptian Association for Psychological Studies, Egypt.
9- Mohamed, Mervat Mahmoud (2015). Mathematics Education Development Resources, Debono Center for Teaching Thinking, Amman.
10- Mohamed, Ehab El-Sayed Shehata (2019). A proposed unit in mathematics based on fuzzy logic to develop levels of depth of knowledge and decision-making skills among undergraduate students, Journal of Mathematics Education, Egyptian Society for Mathematics Education, No. 22, Volume 11.
11- The Angel, Maryam Musa, Matta Abd (2020). Using the realistic mathematics strategy to develop the levels of depth of mathematical knowledge and improve the desire to learn mathematics among middle school students, Fayoum University Journal of Educational and Psychological Sciences, College of Education, New Valley University, Egypt, No. 3, Volume 13.
12- Bennet, D, & Beenet, A (2008). the death of knowledge, surface, shallow or deep Journal of information and knowledge management systems:38(4), 405.
13- Holmes, S, R, (2011). teacher preparedness for teaching and assessing depth of knowledge Doctoral Disso station, university of Southern Mississippi, USA .
14- Thomas, J (2017). Noticing And Knowledge Exploring Theoretical Knowledge For Teaching ,The Mathematics Educator.
15- Webb, N, L (2007). Depth-of- knowledge levels for four content are as. Language Arts 2 28 (march).
16- Webb, Norma, (2009). Webb's Depth of Knowledge Guide. www.mpe.k12.ms.us.
17- Webb, Norman, L, (1981). Depth of Knowledge Levels For Four Content Areas, www.ossucurr.pbworks.coml.