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RESEARCH ARTICLE

THE AVAILABILITY OF THINKING SKILLS IN MATHEMATICS BOOKS DEVELOPED IN LIGHT OF NUMERACY IN THE REPUBLIC OF YEMEN

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Abstract

The study aimed to identify the availability of thinking skills in mathematics books developed in light of numeracy in the Republic of Yemen. The study sample consisted of mathematics books for the three grades of basic education, and exercise books. The researcher identified fourteen thinking skills as a tool for analysis, then the researcher analyzed the content of the six books to reveal the skills included in them, and calculated their frequencies and percentages. The results showed that the representation skill in the first grade and the problem solving skill in the second and third grades obtained the highest frequency. The representation skill in the second and third grades, and the arrangement skill in the second grade obtained reasonable percentages, while the rest of the skill percentages were weak. The results also showed that the books included (13) skills that were repeated (658), (455) and (626) times for the three grades, respectively. The representation and problem solving skills came in percentages of (30.53%) and (16.16%), while the rest of the skills were repeated in percentages ranging between (10.52-1.03)%, which are weak percentages. All books for the three grades were devoid of the questioning skill.

Keywords: Thinking skills, Mathematics, Numeracy.

Introduction:

The role of the textbook in the learning and teaching processes within the school is evident. It determines the information, concepts, facts, skills, attitudes, and values that the student will study. It is the primary means by which the curriculum is translated into tangible reality. It has a significant and clear impact on the teacher's performance in the classroom and with their students. It also influences the student's self-learning. It also occupies a prominent position in the overall educational process, as it is a key factor that makes students more prepared for learning (Al-Sadiq, 2001, 192).

In order for the textbook to fulfill its functions and maintain its position within the system of educational elements, it must be an effective educational tool. This is achieved by paying attention to the selection of its content, activities, and experiences, and by improving its quality by updating its material, presentation method, language style, and teaching aids (Ibn Salamah and Al-Harthi, 2005, 25).

Textbooks in the Arab world focus on abstract facts, which do not allow students the opportunity to participate. Following 2011, the Ministry of Education in the Republic of Yemen adopted a qualitative approach to education, recognizing that it provides the solution to both quantitative and qualitative problems. In this context, it was decided to focus on the curricula of the early grades as the foundation for subsequent grades, particularly in the areas of literacy and numeracy, as they constitute tools for learning and thinking in

general, as well as attitudes toward education and school, and also the cumulative nature of their subjects, both in terms of content and method (Ministry of Education, 2016, 3).

Therefore, the Ministry of Education in the Republic of Yemen, in cooperation with the German organization (giz), developed mathematics textbooks for the first three grades based on numeracy. This experience is considered pioneering in the Arab world.

Numeracy is a new approach to teaching mathematics, linking the concepts of the subject to the child's life and making optimal use of mathematics to solve problems faced by the child in their daily lives.

The Australian Curriculum states that numeracy encompasses the knowledge, skills, attitudes, and behaviors that students need to use mathematics in a wide range of situations. It involves students' awareness and understanding of the role of mathematics in the world and their ability to use mathematical knowledge and skills purposefully.

Numerous studies have been conducted in developed countries in the field of educational development on numeracy. These studies have concluded that a numeracy approach helps students develop their life skills and sharpen their thinking skills.

Teaching thinking skills and teaching for thinking enhances the excitement and attraction of classroom experiences and makes students' roles positive and effective, which in turn impacts their achievement and exam success. Ultimately, all of this benefits the teacher, the school, and society (Jarwan, 2011, 12).

Educators and educational institutions have worked to classify thinking skills to facilitate their study, monitoring, and development. One such institution is the American Association for Curriculum and Instruction, which classified thinking skills into eight main skills, each of which has sub-skills. Marzano (2004) classified thinking skills into twenty-one skills in eight categories.

The researcher classified thinking skills into fourteen skills: observation, questioning, comparison, classification, ordering, representation, identifying elements and components, identifying relationships and connections, prediction, completing details, creativity, identifying errors, critical thinking, and problem-solving. These skills are considered among the most important basic thinking skills that should be developed in children in the early stages of education.

Mathematics, as a subject, is rich in problematic situations that students can be directed to in order to find multiple, diverse, and novel solutions for each situation (Al-Mufti, 1995, 208).

The current study distinguishes itself from previous studies by examining mathematics textbooks developed in light of numeracy for the first three grades of basic education in Yemen, which are still in the field of experimentation.

The above highlights the importance of evaluating textbooks, including mathematics textbooks, using various evaluation methods. Perhaps the most important of these methods is content analysis, to identify the most important objectives of their composition, which is the necessity of including various thinking skills. Hence, the problem of this study arises, which aims to identify the extent of thinking skills in mathematics textbooks developed in light of numeracy for the first three grades of basic education in the Republic of Yemen.

Study Problem:

Educational field indicators and the results of Arab countries participating in some TIMSS (Trends in International Mathematics and Science Studies) sessions indicate that fourth-grade students suffer from a general weakness in mathematical and scientific abilities. This is evident in their averages—the highest average was 452—which did not reach the international level in any of the participating countries, as in the TIMSS 2015 study. Yemen, on the other hand, achieved an average of (278), (224), and (248) in the years 2003, 2007, and 2011, respectively. Thus, Yemen ranks last on the list of participating countries in the TIMSS 2015 study.

This unacceptable performance of Yemeni students by international standards was sufficient evidence of the lack of even the minimum quality standards for education in Yemen. This is likely an expected result of the preoccupation of Yemeni educational policy over the past five decades with quantitative indicators such as increased enrollment and gender equity. However, this quantitative focus has failed to achieve the goal of universal education. Enrollment remains below 85%, dropout rates remain high, and completion rates are abnormally low. Consequently, in 2011, a qualitative approach to education was adopted, sensing that it would provide the solution to both quantitative and qualitative problems. Within this framework, it was decided to focus on the curricula of the early grades as the foundation for subsequent grades, particularly in the areas of literacy and numeracy, which constitute tools for learning and thinking in general, as well as attitudes toward education and school, as well as the cumulative nature of their subjects, content, and method. The drive to develop numeracy and mathematics curricula is no longer a choice, but rather a duty dictated by contemporary developments in the teaching and learning of the subject, as well as by addressing the problem of the declining quality and quantity of Yemeni education. (Ministry of Education, 2016, 3).

In line with the educational development plans implemented by the Ministry of Education in Yemen, which aim to develop mathematics textbooks and develop students' thinking skills, the Ministry has developed numeracy and mathematics curricula for the first three grades of basic education, which are currently in a pilot phase.

Given the aforementioned considerations, this study investigates the availability of thinking skills in mathematics textbooks developed in light of numeracy for the first three grades of basic education. The researcher also noted that the intellectual and age levels of students are appropriate for the teaching of these skills, as they are mental skills that require cognitive and linguistic foundations to master.

Accordingly, the study attempts to answer the following questions:

1. To what extent are thinking skills available in the mathematics textbook developed in light of numeracy for the first grade of primary school?
2. To what extent are thinking skills available in the mathematics textbook developed in light of numeracy for the second grade of primary school?
3. To what extent are thinking skills available in the mathematics textbook developed in light of numeracy for the third grade of primary school?
4. To what extent are thinking skills available in the mathematics textbooks developed in light of numeracy for the first, second, and third grades of primary education?

Significance of the Study:

The importance of the study lies in the following:

1. Providing a clear vision for officials and those responsible for curricula and textbooks in the Ministry of Education in the Republic of Yemen regarding the reality of mathematics textbooks developed in light of the numeracy approach for the first, second, and third grades, in terms of demonstrating the extent to which they incorporate thinking skills.
2. Discovering the extent of compatibility between theory and practice regarding thinking skills for curriculum developers, by analyzing the mathematics textbooks developed in light of the numeracy approach for the first, second, and third grades.
3. Assisting educational supervisors in guiding the performance of mathematics teachers to activate their teaching of the thinking skills included in the mathematics textbooks developed in light of the numeracy approach for the first, second, and third grades.

4. Providing some suggestions for conducting further research in the field of developing students' thinking skills.

Objectives of the Study:

The current study aims to achieve the following objectives:

1. To determine the extent to which thinking skills are present in the mathematics textbook developed in light of the numeracy approach for the first grade.
2. To determine the extent to which thinking skills are present in the mathematics textbook developed in light of the numeracy approach for the second grade.
3. To determine the extent of the availability of thinking skills in the mathematics textbook developed in light of the numeracy approach for the third grade of primary school.

Study Limitations:

The current study is limited to the following limitations:

- The mathematics textbooks developed in light of the numeracy approach for the first, second, and third grades of primary school (student's book + workbook).
- The results are limited to the analysis tool used by the researcher for the purposes of this study that contain Fourteen thinking skills in children: observation, questioning, comparison, classification, ordering, representation, identifying elements and components, identifying relationships and connections, prediction, completing details, creativity, identifying errors, critical thinking, and problem solving.

Study Terminology:

Thinking Skills: The researcher defines thinking skills as a set of skills necessary for any logical thinking process. They include basic, fundamental skills that students in grades one through three of primary education can perform, and they represent a stepping stone to more complex and creative skills. These skills include fourteen skills: observation, questioning, comparison, classification, ordering, representation, identifying elements and components, identifying relationships and connections, prediction, completing details, creativity, identifying errors, critical thinking, and problem solving.

Numeracy: The researcher defines mathematics as the knowledge, skills, behaviors, and actions that students in the first three grades of basic education need to use mathematics in a wide range of situations.

Content Analysis: The researcher defines content analysis as revealing the inclusion of fourteen thinking skills.

Mathematics textbooks for the first, second, and third grades of basic education: These are the books developed by the Ministry of Education and distributed to a sample of public schools for pilot testing in the 2024/2025 academic year. These textbooks include the student's textbook and workbook for each of the first three grades of basic education.

Theoretical Literature

Characteristics of Thinking in Children

Those who study the level of mental development of young children may be confused about the distinctive features of the child's mental world, viewing it as fragmented pieces or disjointed fragments. In reality, the child's mental world has its own unique organization and systems that are distinct from those of adults. Adults

are no strangers to this world, as they often revert to the child's own patterns of thought, which can be characterized by the following distinguishing characteristics:

- Apparent causality: The child assumes a causal relationship between things that occur together. The child may be frightened and hide behind his blanket; he comes to believe that the blanket has protected him from harm, so as soon as the child feels frightened again, he runs and hides behind the blanket.
- Animism: This is a tendency based on the belief that inanimate objects are alive. This is because the child patterns the physical world around him within the framework of his experience. When he feels pain, heat, and cold, he assumes that stones and trees also feel pain and feel heat and cold.
- Purpose: Young children believe that everything in the world was created by humans for them, and we must understand the child's eternal question "why" within this framework. Therefore, we must provide appropriate answers to the child's questions so that they understand and remain on the side of truth. (Abu Jado, 2004, p. 24).

Thinking Skills:

Ryan defines thinking skills as "the set of mental processes that take place within a student's mind, with the aim of linking facts, concepts, information, principles, and related data, and employing them to solve problems they face or to answer questions and inquiries arising from the elements of the environment in which they live" (Ryan, 2010, 29).

If we view learning as a result of thinking, it is crucial to provide children with the opportunity and support to explore their thoughts and ideas during the learning experience. This enables them to understand their own thinking process, achieve comprehensive and healthy growth, and equip them with the tools necessary to face challenges in their daily lives and in the future. Developing children's thinking skills is essential to enhancing their overall development. Here are some effective ways to foster the development of thinking skills in children:

- Encourage children to ask questions and explore their curiosity; this in turn helps develop critical and exploratory thinking skills.
- Providing games that stimulate creative and logical thinking, which contribute to the development of children's mental skills. - Encouraging children to read, which enhances linguistic and representational thinking. It is preferable to provide a variety of books appropriate to the child's age level.
- Stimulate their artistic imagination through arts such as drawing, painting, and sculpture, which help develop creative and representative thinking skills.
- Enhance the scientific experience by providing opportunities for simple scientific experiments, which enhances scientific and exploratory thinking.
- Develop problem-solving skills by providing small problems to solve, which contributes to the development of logical and deductive thinking skills.
- Promote critical thinking by asking questions about ideas and concepts.
- Conduct conversations that stimulate children to think deeply and enhance their linguistic and analytical abilities.
- Develop their social thinking skills by encouraging interaction with others, which contributes to the development of social thinking and cooperation skills. Motivate them to think outside the box and develop innovation skills through creative activities. (Bayer, 2003, 23).

Classification of Thinking Skills:

The American Association for Curriculum and Instruction has classified thinking skills into:

1. Focusing Skills: - Defining problems or clarifying the circumstances of a problem -Setting goals and determining directions and objectives.
2. Information Gathering Skills: - Observation: Obtaining information through one or more of the senses. - Questioning: Searching for new information by formulating and raising questions.
3. Memory Skills: -Encoding: - Encoding and storing information in long-term memory. - Recall: Retrieving information from long-term memory.
4. Information Organization Skills :- Comparison: Noticing similarities and differences between two or more things. -Classification: Placing things into groups based on shared characteristics.-Ordering: Placing things or items into a system or context according to a specific criterion.
5. Analysis Skills: - Defining terms and components: Distinguishing between things and knowing their characteristics and parts.-Defining relationships and patterns and understanding the ways in which components are linked.
6. Productive/Generative Skills: - Inference: Thinking beyond the available information by filling in gaps. - Predicting expected outcomes.- Elaboration: Developing the main ideas and information given, enriching them with important details and additions that may lead to new outcomes.- Representation: Adding new meaning to information by changing its form (representing it with symbols, charts, or graphs).
7. Integration Skills: - Summarizing: Shortening a topic and stripping it of non-main ideas in an effective and practical manner. -Reconstructing: Modifying existing cognitive structures to incorporate new information.
8. Evaluation Skills: - Setting Criteria: Establishing standards for making judgments and decisions.- Proving: Providing evidence for the validity or accuracy of claims.-Identifying Errors: Detecting fallacies or weaknesses in logical reasoning and information related to a situation or topic, and distinguishing between opinions and facts.

Marzano and his colleagues identified twenty-one thinking skills, divided into eight categories, as follows: Focusing, Information gathering, Memory, Organization, Analysis, Generating, Integrating, Construction and synthesis (Marzano, 2004)

Numeracy and Mathematics:

Dave (2020, 4) defines numeracy as the knowledge, skills, behaviors, and aptitudes students need to use mathematics in a wide range of situations.

Alberta Education defines numeracy as the ability, confidence, and willingness to handle quantitative and spatial information to make informed decisions in all aspects of daily life.

Quantitative information refers to information that can be measured and expressed as a quantity. This includes: having a sense of magnitude, using numbers in real-life situations, estimating amounts, interpreting statistical information, recognizing patterns, and determining probability.

Spatial information refers to the physical location of objects or people, or the relationships between objects or people. This includes: understanding shape and space; measuring time, weight, length, or quantities; determining location and direction; interpreting and creating maps and diagrams; and visualizing shapes from different perspectives. The Australian Curriculum also states that numeracy encompasses the knowledge, skills, attitudes, and behaviors students need to use mathematics in a wide range of situations. It involves students' awareness and understanding of the role of mathematics in the world and their ability to use mathematical knowledge and skills meaningfully. The Australian Parenting also notes that numeracy is the

ability to see and use mathematical concepts in all areas of life. Numeracy skills include understanding numbers, counting, solving numerical problems, measuring, estimating, sorting, observing patterns, adding and subtracting numbers, etc.

Children and adults need numeracy and math skills to do everyday things such as:

- Solving problems (e.g., How long will it take to walk to school)?
- Understanding information (e.g., How many wins does my team need to reach the top of the competition(?
- Understanding patterns (e.g., What is the next house number on this street(?
- Making choices (e.g., Which bike is the best value?) Your child's daily experiences are full of learning opportunities that lay the foundations for numeracy.

Children begin learning numeracy skills from birth, and parents play an important role, especially at home. The Australian Parenting offers several tips for parents to introduce math through play and everyday activities by encouraging their child to:

- Compare and order objects of different sizes (large, small, and medium(
- Group objects together and talk about "same" and "different"
- Use words to describe where objects are (above, below, and next to).
- Help set the table with the appropriate number of plates, forks, spoons, and cups
- Observe and create patterns using everyday items, such as shells, leaves, or beads.

When you talk to your child about math concepts in your daily activities, it helps your child understand how and why math is useful. For example, this happens when you refer to: big and small (size), high and low (height), long and short (length), heavy and light (weight), fast and slow (speed), near and far (distance), first, second, and last (order).

Young children need lots of practice and hands-on play with everyday objects to develop numeracy and math skills like matching, sorting, comparing, and ordering.

Children love hearing their parents' voices and enjoy stories and songs that involve repetition, rhyme, and numbers. Here are some things you can do with your child to build numeracy skills:

- Read stories that involve numbers, for example, "Goldilocks and the Three Bears".
- Play counting, sorting, and matching games.
- Sing number songs and rhymes.
- Change your voice tone to describe concepts. For example, use a deep, high voice to describe something large, or a soft, squeaky voice to describe something small.

Parents can also talk about:

- Daily activities, for example, "Let's put half the birdseed here and half the other way" or "Let's find matching socks".
- The environment, for example, "Look at the little bird over there" or "That's a tall tree".
- Food, for example, "Let's eat two bananas" or "How many cups do we need"?
- Time, for example, "7 p.m., bedtime".
- Shapes and patterns, for example, "Let's find all the triangles".

Parents and teachers play a crucial role in developing a child's numeracy skills. They can help children see the importance of numeracy in their daily lives and provide them with opportunities to practice their numeracy skills. For example, parents can engage their children in activities that require numeracy skills, such as cooking, shopping, or planning a trip. They can also encourage their children to play games that involve numeracy skills.

The Five Stages of Learning Numeracy:

Numeracy, the ability to understand and work with numbers, plays a vital role in our cognitive development. Here, we review the five stages of learning numeracy:

1. The Emergent Stage: At this stage, children begin to recognize numbers and basic mathematical concepts. They understand the relationship between numbers and quantities and begin to develop a sense of number. For example, they may begin to understand that the number "3" represents three apples or three toys.
2. The Cognitive Stage: In the cognitive stage, children begin to understand numbers and the relationships between them. They begin to understand the concept of counting and begin to recognize patterns. This stage is crucial for developing a strong foundation in numeracy. For example, they may realize that adding another block to a set of two blocks creates three blocks.
3. The Figurative Stage: At this stage, children begin to understand numbers in a more abstract way. They begin to use numbers to represent quantities and begin to perform basic operations such as addition and subtraction. For example, they may understand that if they have three sweets and their friend gives them two more, they now have five sweets.
4. Stage Counting: While stage counting, children begin to develop more advanced numeracy skills. They begin to understand the concept of "counting," which involves starting with a number other than one and counting from there.
5. Easy Stage: The final stage is where children become comfortable with numbers. They develop a deep understanding of arithmetic and its associated concepts. At this stage, children are able to perform complex calculations and solve problems with ease.

In addition to these stages, it is important to note that learning Numeracy is not a linear process. Children may move back and forth between stages as they engage with new concepts and challenges. Furthermore, children may be at different stages in different aspects of arithmetic. For example, a child may be in the figurative stage when it comes to understanding quantities but still in the perceptual stage when it comes to understanding spatial relationships.

Moreover, the learning process is influenced by a variety of factors, including the child's cognitive development, the teaching methods used, and the child's exposure to numbers in his daily life. (guruathome)

The Yemeni Vision for Developing Numeracy and Mathematics Curricula in Basic Education:

The Yemeni Team for Developing Mathematics Curricula (Ministry of Education, 2016, pp. 3-4) defined numeracy as a methodology for developing numerical sense and the ability to effectively use mathematics for understanding, interpretation, thinking, communication, and practical application in the primary grades, in preparation for future mathematics studies.

From an operational perspective, the definition can be read as follows: The subject is mathematics, the conventional subject in our schools. What's different here is that the subject isn't just for reading, understanding, and thinking, as we've come to expect; it's for effective use. Use propels the subject toward the practical life of the child and student. When this use is effective, it inevitably leads to better understanding, comprehension, and awareness of the subject, serving the individual in their academic and professional lives

by solving problems and meeting learning needs. This is the new vision for numeracy and its relationship to mathematics.

In this context, the school should be a model for life and the future, not a place isolated from them. Given the limited resources of Yemeni schools in general, this vision poses a challenge. This challenge can be met with one or more of the following approaches, depending on the capabilities of each school:

- Computer simulations of life and the future.
- Activating school activity groups and drawing on learners' experiences.
- Incorporating lessons into visits to life's outlets in the community surrounding the school.
- Utilizing smart technology (phones, tablets, computers.(

To achieve this, the design, structure, and implementation of the curriculum must take these approaches into account, including the following:

- The conceptual structure of the educational content topics. Topics cannot be presented without a conceptual structure that connects them to each other and gives them meaning.
- Conceptual structure serves to present topics in tangible, dynamic activities, particularly in the early grades. Here, the educational content acquires a meaningful interpretation for the learner and is connected to their perception and thinking. Concrete images and abstract concepts work in an integrated and interconnected manner, which requires intuitive thinking in initial images. Gradually, the learner's thinking skills develop, leading to abstract mathematical thinking.

In light of this, the individual initially becomes a mathematician (a master of the basics of mathematics and a practitioner of what he or she has learned) in all areas of life, understanding data, interpreting situations, thinking about solutions, anticipating outcomes, and making decisions. This occurs in every situation they encounter, interacting and communicating with all the people, material, and intangible elements in the situation. Ultimately, the individual becomes a mathematician: a realistic thinker and a future modeler.

Adopting a computational approach to mathematics as a foundation requires sufficient time to focus on the practical and performance aspects until each concept is fully grasped.

Teacher training and preparation are required to implement these approaches effectively and professionally.

The student must be active, central to the educational process, and a builder of knowledge.

The family bears its responsibility in partnering with the school to raise the educational levels of its children.

To achieve the aforementioned concept of numeracy, the Yemeni team prepared a set of documents, including:

A. Mathematics Curriculum for Grades 1-12. This can be developed in two phases: the first for Grades 1-9 and the second for Grades 10-12. The curriculum includes the following: a range and sequence matrix (content), learning standards, and their indicators.

B. A guide for writing the student's book and teacher's guide.

C. The student's book, consisting of two sections (a content book and an activity book), was analyzed by the researcher to determine the extent to which they contain thinking skills.

D. A teacher's guide.

E. Supporting materials: These include training kits for supervisors and teachers, a family and school administration guide, a teaching strategies guide, and a reference book for primary school teachers.

Evaluation Guide: For student and teacher performance, and for the national assessment of students.

Description of the Student Book:

The Student Book consists of two sections: a content book and an activity book. A brief description of each is provided below.

A. Mathematics Book for the First Grade: The content book contains (29) lessons on (114) pages. All of its lessons are designed according to two stages: I learn and I practice. The activity book contains a number of activities for the content book lessons and is (173) pages long.

B. Mathematics Book for the Second Grade: The content book contains (39) lessons on (136) pages. All of its lessons are designed according to five stages: I remember, I learn, I practice, I think, and I do activities. The activity book contains a number of activities for the content book lessons and is (73) pages long.

C. Mathematics book for the third grade: The content book contained (43) lessons in (195) pages and all its lessons were designed according to five stages: introduction, I learn, I practice, I solve a problem, and activity. As for the activities book, it contained a number of activities for the lessons in the content book and the number of its pages was (79) pages.

Previous Studies:

1. **Study (Ni nyoman Rediani, 2024, Indonesia)** aimed to assess the literacy and numeracy skills of third-grade students in primary schools. This study was descriptive and quantitative in nature, and included a sample of (32) subjects. Data collection methods included interviews, observations, and tests. The research results indicated that students' literacy and numeracy skills fall into the low category. The study identified, among the six components of literacy and numeracy measured, the indicator that required the most attention was the use of measurement tools such as length, time, area, and others.

2. **A study (Wilibaldus, 2024, Indonesia)** aimed to determine the impact on students' numeracy skills after using inquiry-based student worksheets (SW) and a learning model in fifth grade. A quasi-experimental design was used, and data was collected through numeracy tests conducted before and after the implementation of the SW program. The results revealed a significant improvement in students' numeracy skills, with the average numeracy score increasing from 60% before the implementation of SW to 80% after its implementation. Additionally, numeracy test scores increased from 42% on the initial AKM Numeracy test to 50% on the final test.

3. **A study (Shallinie and Richar, 2023, Philippines)** aimed to determine the significant relationship between arithmetic skills and students' mathematics performance. The study sample consisted of (251) first-grade students at Ibunan Elementary School in Cagayan de Oro City. The primary research instrument used in this study was the ASER TOOL (Annual Education Status Report) to determine students' mathematics skills. Statistical treatments such as frequency, percentage, mean, standard deviation, and t-test were used to determine the significant difference between students' mathematics skills and mathematical performance. The results showed that students' mathematics skills were at an advanced level. Students' mathematics performance was excellent. There are statistically significant differences between students' mathematics skills and mathematics performance.

4. **A study (Hamza and Al-Suwaih, 2018, Jordan)** aimed to identify the effect of a program based on sensory activities on developing some mathematical thinking skills among kindergarten children in Oman. The study sample consisted of (60) boys and girls, distributed equally into two experimental groups. The study tools were: a list of some mathematical thinking skills, a sensory activities program, and a test of some mathematical thinking skills. The results of the study showed that there were statistically significant differences between the average scores of the children of the two groups in some mathematical thinking skills: modeling, guessing, deduction, and induction in favor of the experimental

group. While there were no statistically significant differences attributed to the gender variable in modeling, guessing, and induction, and there was a difference in the induction skill in favor of females.

Study Methodology:

This study uses a descriptive approach by following content analysis.

Population and Sample:

The study population consists of mathematics textbooks developed in light of numeracy. These textbooks were developed by the Ministry of Education and were downloaded to a sample of public schools for pilot use during the 2024/2025 academic year. These textbooks include the student's book and the workbook for each of the first three grades of basic education. The study sample consisted of these textbooks, which included all the lessons from the prescribed units.

Study Tool:

The researcher developed a preliminary analysis form and presented it to a committee of arbitrators and curriculum experts from the Ministry of Education and a number of specialists in the Curriculum and Instruction Department at the University of Aden. A number of mathematics teachers were also consulted for their comments and suggestions, which were taken into consideration.

In light of the above, thinking skills were classified into fourteen skills, as follows: observation, questioning, comparison, classification, ordering, representation, identifying elements and components, identifying relationships and connections, prediction, completing details, creativity, identifying errors, critical thinking, and problem solving. The current study used this classification to analyze the content of mathematics textbooks as a study tool, with the aim of fulfilling the elements of analysis and calculating the frequencies of thinking skills.

Analysis Procedures:

The analysis of thinking skills was carried out according to the following steps:

1. Reading all the content of mathematics textbooks developed in light of numeracy for the first, second, and third grades of basic education in Yemen (the student's book and the workbook), then identifying the phrases that include the fourteen thinking skills.
2. Calculating the total frequencies for each of the fourteen thinking skills, and preparing special tables to interpret the results.
3. Extracting the percentage for each of the fourteen thinking skills.

Validity And Reliability of The Analysis:

The fourteen thinking skills were presented to a group of arbitrators who are specialists in the field of curricula to learn their opinions about them, and then the necessary modifications were made in light of their suggestions. To ensure the reliability of the analysis, the researcher conducted the analysis process twice, separated by a month. Table (1) shows the results of the analysis:

Table (1): Analysis of mathematics books for the first three grades of basic education in terms of thinking skills

M	Thinking Skill	Researcher Analysis		Points of Agreement	Points of Difference
		First	Second		
1	Observation	113	119	104	15
2	Questioning	0	0	0	0
3	Comparison	119	120	117	3

	Classification	48	49	44	5
5	Ordering	183	190	183	9
6	Representation	585	564	531	54
7	Identifying elements and components	171	181	148	33
8	Identifying relationships and connections	119	122	102	20
9	Prediction	85	80	74	11
10	Completing details	28	27	27	1
11	Creativity	91	80	76	15
12	Identifying errors	18	18	18	1
13	Critical thinking	40	44	34	10
14	Problem solving	316	306	281	35
The Total		**1916**	**1900**	**1739**	**212**

The researcher used Cooper's equation referred to in (Ta'ima, 2008, 178) to calculate the percentage of agreement between the analysis process that the researcher conducted twice, which is:

$$\text{Agreement rate} = \frac{\text{Number of times of agreement}}{\text{times of agreement+ times of disagreement}} \times 100$$

The researcher found that the agreement rate was 89.13%, indicating that the analysis process was highly reliable.

Study Procedures:

The researcher carried out the following procedures to achieve the study objective: Reviewing the educational literature to determine the study tool for thinking skills to include fourteen skills, prevalent in mathematics books developed in light of arithmetic for the first, second and third grades of basic education in Yemen, then presenting them to a group of arbitrators in the field of curricula, to express their opinion, and modify them in light of their opinions and suggestions, then emptying the fourteen thinking skills into special tables after calculating their frequencies and percentages, then discussing and interpreting the results and presenting recommendations.

Statistical Methods:

The researcher used descriptive statistics to calculate the total frequencies, percentages, ranks, and order of the fourteen thinking skills, and to find the percentages. He also used the Cooper equation.

Study Results and Discussion:

Results Related to The First Question:

This question states: To what extent are thinking skills available in the mathematics book developed in light of numeracy for the first primary grade? To answer this question, the researcher calculated the total frequency of thinking skills, their percentage, and the skill rank, as shown in Table (2).

Table (2): Calculating the sum of repetitions of thinking skills in the mathematics book for the first grade

M	Thinking Skill	Frequency			Percentage	Skill Rank
		Student's Book	Workbook	Total		
1	Observation	23	11	34	5.17	5
2	Questioning	0	0	0	0	10
3	Comparison	34	24	58	8.82	4
	Classification	10	19	29	4.41	7
5	Ordering	35	43	78	11.8	2

6	Representation	136	143	279	42.4	1
7	Identifying elements and components	42	27	69	10.49	3
8	Identifying relationships and connections	28	5	33	5.03	6
9	Prediction	2	1	3	0.48	9
10	Completing details	0	12	12	1.82	8
11	Creativity	2	27	29	4.41	7
12	Identifying errors	0	0	0	0	10
13	Critical thinking	0	0	0	0	10
14	Problem solving	2	32	34	5.17	5
The Total		**314**	**344**	**658**	**100%**	

It is noted from Table (2) the distribution of thinking skills included in the mathematics book developed in light of numeracy for the first basic grade, the repetitions of each of them, their percentage, and their ranks. The student book and the exercise book included (11) skills, and these skills were repeated (658) times. These skills were varied, but this variety was uneven in terms of focusing on some skills to a very large extent.

To discuss the repetitions that each skill obtained, the researcher deemed that the highest repetition, which was for the representation skill, which reached (279) repetitions, is the upper limit and its percentage is (42.4)% of the total thinking skills included in the book. This skill occupies the highest rank relative to other skills. Accordingly, the skill whose repetitions are less than (139) repetitions is considered by the researcher to be skills that must be focused on. The remaining skills were repeated at percentages between (0.45-11.8)%, which are weak percentages. The researcher attributes this to the fact that the authors focused on representational skills due to their importance at this stage of a child's life, who learns through tangible objects and objects. They also wanted to connect mathematics to the child's life with its various forms and different representations. However, this led to a weakness in the evocation of the remaining skills in the book, as the book is still in its experimental stages. The researcher also notes that the mathematics book, in both its parts - the student's book and the workbook - lacks the skills of questioning, error identification, and critical thinking. The researcher attributes this to the fact that the authors did not pay attention to these skills, believing that these skills are better developed in subjects other than mathematics, such as language.

Results Related to The Second Question:

This question states: To what extent are thinking skills available in the mathematics book developed in light of the numeracy approach for the second primary grade? To answer this question, the researcher calculated the total frequency of thinking skills, their percentage, and the skill rank, as shown in Table (3).

Table (3): Calculating the total repetitions of thinking skills in the second grade mathematics book

M	Thinking Skill	Frequency			Percentage	Skill Rank
		Student's Book	Workbook	Total		
1	Observation	24	6	30	6.59	7
2	Questioning	0	0	0	0	14
3	Comparison	16	17	33	7.26	6
	Classification	2	1	3	0.66	13
5	Ordering	38	25	63	13.8	3
6	Representation	36	35	71	15.6	2
7	Identifying elements and components	28	14	42	9.23	4
8	Identifying relationships and connections	18	10	28	6.15	8
9	Prediction	20	17	37	8.13	5
10	Completing details	2	2	4	0.88	12
11	Creativity	14	4	18	3.96	9

12	Identifying errors	6	4	10	2.2	11
13	Critical thinking	6	6	12	2.64	10
14	Problem solving	74	30	104	22.9	1
The Total		**284**	**171**	**455**	**100%**	

Table (3) shows the distribution of thinking skills included in the mathematics book developed in light of numeracy for the second grade of basic education, the repetitions of each, their percentage, and their ranks. The student's book and the exercise book included (13) skills, and these skills were repeated (455) times. These skills were varied, but this variety was uneven in terms of focusing on some skills to a very large extent. To discuss the repetitions that each skill received, the researcher deemed that the highest repetition was for the problem-solving skill, which reached (104) repetitions, which is the upper limit and its percentage is (22.9)% of the total thinking skills included in the mathematics book for the first grade of basic education. This skill occupies the highest rank relative to other skills, and accordingly, the researcher considers the skill that has fewer than (52) repetitions to be skills that must be focused on. The representation skill was repeated at a rate of (15.6)%, and the arrangement skill was repeated at a rate of (13.8), which are reasonable percentages. The remaining skills were repeated at rates between (9.23 - 0.66)%, which are weak rates. The researcher attributes this to the fact that the authors focused on the representation skill due to its importance at this stage of a child's life, who learns through tangible objects and objects, as well as to link mathematics to the child's life with its various forms and different representations. However, this led to a weakness in the evocation of the remaining skills in the book. Furthermore, the book is still in the experimental stage, and it has not been possible to analyze the book and care for it from all aspects. The researcher also notes the absence of the questioning skill in the mathematics book, in both its parts, the student's book and the workbook. The researcher attributes this to the fact that the authors did not pay attention to this skill, believing that it is better developed in non-mathematical subjects, such as language.

Results Related to The Third Question:

This question stated: To what extent are thinking skills available in the mathematics book developed in light of numeracy for the third basic grade? To answer this question, the researcher calculated the total frequency of thinking skills, their percentage, and the skill rank, as shown in Table (4).

Table (4): Calculating the total repetitions of thinking skills in the third grade mathematics book

M	Thinking Skill	Frequency			Percentage	Skill Rank
		Student's Book	Workbook	Total		
1	Observation	34	6	40	6.39	5
2	Questioning	0	0	0	0	14
3	Comparison	13	13	26	4.15	9
	Classification	8	4	12	1.92	11
5	Ordering	32	10	42	6.72	3
6	Representation	136	45	181	28.91	1
7	Identifying elements and components	28	9	37	5.91	6
8	Identifying relationships and connections	24	17	41	6.55	4
9	Prediction	23	11	34	5.43	7
10	Completing details	5	6	11	1.76	12
11	Creativity	21	8	29	4.63	8
12	Identifying errors	7	1	8	1.28	13
13	Critical thinking	18	4	22	3.51	10
14	Problem solving	97	46	143	22.84	2
The Total		**446**	**180**	**626**	**100 %**	

It is noted from Table (4) the distribution of thinking skills included in the mathematics book developed in light of numeracy for the third basic grade, and the repetitions of each, their percentage, and their ranks. The student's book and the exercise book included (13) skills, and these skills were repeated (446) times in the student's book and (180) times in the exercise book. These skills varied, but this variety was uneven in terms of the focus on some skills to a very large extent. To discuss the repetitions obtained by each skill, the researcher deemed that the highest repetition was for the representation skill, which reached (181) repetitions, which is the maximum and its percentage is (28.91)% of the total thinking skills included in the book. This skill occupies the highest rank relative to other skills. Accordingly, the researcher considers the skill with fewer than (90) repetitions to be skills that must be focused on. The problem-solving skill was repeated (143) times at a rate of (22.84)%, which is a reasonable rate. The remaining skills were repeated at rates ranging between (6.72 - 1.28), which are weak rates. The researcher attributes this to the fact that the authors focused on the representation skill due to its importance at this stage of a child's life, who learns through tangible objects and models, as well as to link mathematics to the child's life with its various forms and different representations. The focus was also on the problem-solving skill due to its importance at this age stage, as this helps students understand the solution. However, this led to a weakness in evoking the remaining skills in the book, and the book is still in the experimental stage, and it was not possible to analyze the book and care for it from all aspects. The researcher also notes that the mathematics book, in its two parts, the student's book and the workbook, is devoid of the questioning skill. The researcher attributes this to the fact that the authors did not pay attention to this skill, believing that it is better developed in subjects other than mathematics, such as language.

Results Related to The Fourth Question:

This question stated: To what extent are thinking skills available in mathematics textbooks developed in light of numeracy for the first, second, and third grades of basic education? To answer this question, the researcher calculated the total frequency of thinking skills, their percentage, and the skill rank, as shown in Table (5).

Table (5): Calculating the total frequency of thinking skills in mathematics textbooks for the three grades

M	Thinking Skill	Frequency in Class Books				Percentage	Skill Rank
		First	Second	Third	Total		
1	Observation	34	30	40	104	5.98	6
2	Questioning	0	0	0	0	0	14
3	Comparison	58	33	26	117	6.73	5
4	Classification	29	3	12	44	2.53	10
5	Ordering	78	63	42	183	10.52	3
6	Representation	279	71	181	531	30.53	1
7	Identifying elements and components	69	42	37	148	8.51	4
8	Identifying relationships and connections	33	28	41	102	5.87	7
9	Prediction	3	37	34	74	4.26	9
10	Completing details	12	4	11	27	1.56	12
11	Creativity	29	18	29	76	4.37	8
12	Identifying errors	0	10	8	18	1.03	13
13	Critical thinking	0	12	22	34	1.95	11
14	Problem solving	34	104	143	281	16.16	2
The Total		**446**	**180**	**626**	**1739**	**100 %**	

It is noted from Table No. (5) the distribution of thinking skills included in the mathematics books developed in light of numeracy for grades one to three of basic education, and the repetitions of each, their percentage, and their ranks. The student books and exercise books for the three grades included (13) skills, and these skills were repeated (1739) times, distributed as follows: (658) repetitions in the first grade, (455) repetitions in the second grade, and (626) in the third grade. These skills varied, but this variety was uneven in terms of focusing on some skills to a very large extent. It is also noted that the repetition of the skills was not gradual from the first to the third, neither ascending nor descending. To discuss the frequency of each skill, the researcher determined that the highest frequency was for the representation skill, which reached (531) repetitions, representing (30.53)% of the total thinking skills included in the textbooks for the three grades. This skill occupies the highest rank relative to other skills. Accordingly, the researcher considers skills with fewer than (265) repetitions to be skills that should be emphasized. The problem-solving skill was repeated (281) times, representing (16.16)%, which is a reasonable percentage. The remaining skills were repeated at percentages ranging from (10.52-1.03)%, which is a weak percentage.

With these figures in Table (5), we conclude that the committees specializing in curriculum development did not consider a relatively equal distribution of thinking skills, and that this noticeable disparity does not serve the educational process, which is student-centered, as the curriculum works to develop the individual's personality in all its mental, psychological, social, and religious aspects. Developing these skills in students has a significant impact on building a balanced personality. Students at this stage are in dire need of developing their thinking skills through training, teaching, and learning. This will enable them to participate in a democratic society. Teaching thinking skills is not an educational option; rather, it is an urgent educational necessity. Students have the right to learn how to think creatively and critically, as it is a positive activity that enhances individual value and self-confidence. Therefore, the curriculum has focused on one skill over others. In view of these skills, we find that acting has received a significant share of these skills. This demonstrates the utmost importance of acting, particularly in mathematics textbooks for grades one through three. Table (5) also shows that the skills of comparison, ordering, and identifying elements and components are ranked in descending order from grade one to three. The researcher attributes this to the fact that these skills are easy and needed by children at an early age, with interest in them gradually decreasing with age. It is also noted that the skills of critical thinking and problem solving came in ascending order from the first to the third grade. The researcher attributes this to the fact that these two skills are complex and multifaceted and require progressive training. As for the remaining skills, there was neither an ascending nor a descending state. The researcher attributes this to the fact that each of the three grades had its own team, which made each team focus on certain skills and neglect others. This is evident in the acting skill, as it was focused on greatly in the first grade (53)% of the total skill repetitions in the three grades. Then the percentage decreased to (13)% in the second grade, and the percentage rose in the third grade to (34)%. Likewise, the percentages of the classification skill were (66)%, (7)%, and (27)% of the total skill repetitions in the three grades, respectively. The researcher also noted the absence of the questioning skill in all books for the three grades.

Recommendations:

In light of the findings of the process of incorporating thinking skills into mathematics textbooks for the first three grades of basic education, the following recommendations can be made:

1. Curriculum developers should benefit from the analysis results by increasing the number of phrases that develop children's thinking skills and balancing these skills when reviewing pilot versions in the future.
2. Focus on questioning, error identification, critical thinking, and detail completion as thinking skills, as these represent a low percentage (less than 2%) of other skills.
3. Adopt the list of thinking skills derived from the current study when analyzing the content of other textbooks as criteria for analysis.

Suggestions:

The researcher proposes conducting the following research:

1. An experimental study examining the impact of teaching mathematics textbooks developed with arithmetic in mind on student achievement.
2. Another study examining the availability of creative and critical thinking skills in mathematics textbooks developed with arithmetic in mind in the Republic of Yemen.

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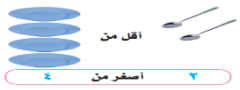
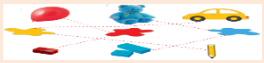
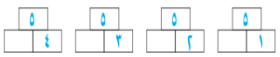
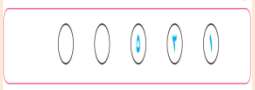
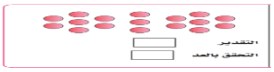
Appendix:

Content analysis tool in light of thinking skills

M	Thinking Skill	Operational Definition of Skill	Example	Suitable	unsuitable	Proposed amendment
1	Observation	A thinking process that involves observation, monitoring, and perception, usually coupled with a goal that requires focused attention and careful observation.				
2	Questioning	Formulating and raising questions to obtain new information				
3	Comparison	Identifying similarities and differences between given information or information being researched and investigated				
4	Classification	Grouping things according to common characteristics.				
5	Ordering	Putting things or items into a system or context according to a specific criterion				
6	Representation	Transforming and changing the form of information from its natural state when presented to the student into a set of images or symbols.				
7	Identifying elements and components	Knowing the parts that together make up a whole.				
8	Identifying relationships and connections	Knowing the internal relationships that determine patterns and relationship				
9	Prediction	Predicting or envisioning new events based on previous information				
10	Completing details	The student's ability to provide new additions to a particular idea, or a simple drawing or diagram of a topic the students are exposed to..				
11	Creativity	The student's ability to produce the largest possible number of diverse ideas in an original manner, i.e., one that is rarely repeated by peers.				
12	Identifying errors	Identifying errors and working to correct them or change one's thinking.				
13	Critical thinking	Understanding and evaluating viewpoints in order to make a decision, through careful examination of all evidence in an objective manner, to arrive at accurate and consistent conclusions.				
14	Problem solving	A new and unique question facing the student that requires an answer				

مقالة بحثية

مدى توافر مهارات التفكير في كتب الرياضيات المطورة في ضوء الحسابية في الجمهورية اليمنية

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المُلخّص

هدفت الدراسة إلى التعرف على مدى توافر مهارات التفكير في كتب الرياضيات المطورة في ضوء الحسابية في الجمهورية اليمنية. تكونت عينة الدراسة من كتب الرياضيات للصفوف الثلاثة من التعليم الأساسي، وكتب التدريبات، حدد الباحث أربعة عشرة مهارة من مهارات التفكير كأداة للتحليل، ثم قام الباحث بتحليل محتوى الكتب الستة للكشف عن تلك المهارات المتضمنة فيها، وحساب تكراراتها ونسبها المئوية. أظهرت النتائج أن مهارة التمثيل في الصف الأول ومهارة حل المسألة في الصفين الثاني والثالث حصلت على أعلى تكرار. كما حصلت مهارة التمثيل في الصفين الثاني والثالث، ومهارة الترتيب في الصف الثاني على نسب معقولة أما باقي نسب المهارات فكانت ضعيفة. كما أظهرت النتائج أن الكتب اشتملت على (13) مهارة تكررت (658) و(455) و(626) مرة للصفوف الثلاثة على التوالي، وجاءت مهارة التمثيل وحل المسألة بنسب (30.53%) و(16.16%)، أما باقي المهارات فقد تكررت بنسب تتراوح بين (1.03-10.52)% وهي نسب ضعيفة، كما خلت جميع الكتب للصفوف الثلاثة من مهارة التساؤل.

الكلمات المفتاحية: مهارات التفكير، الرياضيات، الحسابية.

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