

The extent of inclusion of mathematical thinking skills in the textbook of the preparatory section in Algeria

Received date:27/12/2024 Accepted date:15/10/2025 Published date:28/10/2025

Oumhani Fares ¹

¹ University of Khemis Miliana , Algeria, Email: O.fares@univ-dbkm.dz

Abstract:

The study aimed to identify the extent to which mathematical thinking skills, in their three forms (logical, inferential, and deductive thinking), are incorporated into the preparatory grade textbook (pre-formal education) prescribed by the Ministry of National Education in Algeria. To achieve this, the researcher employed the descriptive-analytical method (using content analysis) by constructing a checklist to analyze the content of the mathematics textbook for the preparatory grade. The study's findings revealed that the inclusion of mathematical thinking skills in their three forms at this level is moderate, with variation among the three types.

Keywords: Inclusion; Thinking; Mathematical Thinking; Textbook; Preparatory Grade.

Corresponding Author: Oumhani Fares, Email: o.fares@univ-dbkm.dz

1. INTRODUCTION

Mathematics is considered one of the most essential subjects taught across all levels of education (Accompanying Document, 2006). It is the science that focuses on the study of numbers, patterns, relationships, and logical structures, making it a cornerstone for various sciences and practical applications (Al-Aboudi, 2000). The significance of mathematics lies in its ability to enhance logical and inferential thinking among students, fostering their capacity to analyze problems and derive solutions in a systematic and scientific manner.

Mathematical thinking, with its three core components—logical, inferential, and deductive thinking—serves as the foundation for developing cognitive abilities and strengthening students' intellectual competence. Logical thinking helps organize ideas and analyze problems systematically, while inferential thinking enables deriving solutions through relationships and available information. Deductive thinking, on the other hand, facilitates the construction of new knowledge based on established rules and general principles. These three skills are not merely tools for solving mathematical problems but are life skills that enhance the ability to make informed decisions and interpret various phenomena.

Integrating mathematical thinking into textbooks at early educational levels contributes to building a solid foundation for students' intellectual abilities from a young age. Such curricula help develop analytical and critical thinking skills in an engaging and simplified manner (Al-Azab, 2018). They also stimulate children's curiosity and enhance their problem-solving abilities, enabling them to face challenges with greater creativity and organization.

Focusing on incorporating mathematical thinking into educational curricula from early stages is not only an investment in improving

academic performance and cognitive development, as noted by Khirfan (2022), but it is also a necessary step to prepare a generation with flexible intellectual skills capable of adapting to the demands of the modern era.

Given the increasing attention to reviewing mathematics curricula and textbooks in general, and their contents in particular, there arises a need to evaluate the content. This evaluation represents the first step toward amending and improving the content to achieve the desired goals and objectives for all inputs and outputs of the educational process for this subject. The Accompanying Document for this stage emphasizes the importance of meeting students' needs by engaging with daily life, enhancing their ability to solve real-world problems, and fostering their capacity for reasoning and applying mathematical knowledge across various scientific fields.

In light of the above, this research paper aims to examine the extent to which mathematical thinking skills—logical, inferential, and deductive—are incorporated into the preparatory grade mathematics textbook (pre-formal education) prescribed by the Algerian Ministry of National Education.

2. Background and Significance of the Study

2.1 Significance of the Study

Through this study, the researcher aims to achieve the following objectives:

- Identify the mathematical thinking indicators embedded in the content of the mathematics textbook designed for the preparatory grade.
- Draw the attention of curriculum planners and developers to the need for evaluating textbooks at this educational level.
- Align with international recommendations and modern global



trends, which emphasize the continuous evaluation and analysis of curricula and textbooks to improve and develop them.

- Meet the needs of researchers, scholars, and those interested in the field of mathematics curricula, as well as authors of textbooks and supplementary educational materials aimed at preparatory grades, preschools, and kindergartens that offer this type of mathematical activity.

2.2 Scope of the Study

The study is limited to analyzing the content of the mathematics textbook designed for the preparatory grade in Algeria, which has been officially implemented since 2008. The focus is on examining the extent to which the textbook incorporates mathematical thinking in its three forms (logical, inferential, and deductive thinking). The analysis is based on the 2008/2009 edition of the textbook, as used during the 2023/2024 academic year.

3. Terminology of the Study:

3.1 Mathematical Thinking:

Mathematical thinking is a mental activity specific to the field of mathematics, carried out through a set of skills. Al-Shamrani (2018) described it as a cognitive process or mental activity dedicated to mathematics. Mathematical thinking is characterized by several aspects, including induction and generalization, deduction, symbolic representation, conjecturing, modeling, logical reasoning, and mathematical proof (Al-Absi, 2009).

Operationally, in this study, mathematical thinking is defined through the various activities and indicators present in the preparatory grade mathematics textbook, which fall under one of the following categories: logical thinking, inferential thinking, or deductive thinking.

3.2 Mathematics Textbook

The official textbook designed and approved by the Algerian Ministry of National Education for teaching mathematics to preparatory grade students.

3.3 Preparatory Grade

The preparatory grade is a level of early childhood education that accommodates a maximum of 25 children, aged between 5 and 6 years. At this stage, children follow a specific curriculum designed to prepare them for the first cycle of formal education (primary school). Education at this level is conducted in institutions affiliated with the Ministry of National Education and is supervised by qualified teachers specialized in this stage. (Ministry of National Education, 2008)

4. Background and Significance of the Study

To achieve the objectives of the current study and to answer its research questions, the researcher developed a content analysis tool for the mathematics textbook intended for the preparatory stage in order to assess the extent to which it includes the three types of mathematical thinking: logical thinking, inferential thinking, and deductive reasoning. The researcher constructed this tool by following the steps outlined below.

4.1. Development of a Criteria List

The list of criteria for the three types of mathematical thinking was developed through reviewing and researching the relevant literature in this field from the following sources:

- Educational studies, research, and pedagogical literature related to the topic. Consequently, the preliminary list was formed for the mathematics subject within three dimensions of mathematical thinking. These dimensions included indicators to assess their



presence across 48 pages of activities from the mathematics textbook at this level (Appendix 1).

- The analysis included evaluation questions found at the end of each lesson, chapter, or unit.
- The analysis also included the diagrams, figures, and activities present in the content.
- Any sub-items derived from a question, exercise, or main activity (e.g., A, B, C, etc.) were considered repetitions.
- This list was presented to several university researchers in the field of educational sciences to provide their opinions and feedback on the indicators listed, as well as to a group of specialists in mathematics, curricula, and teaching methods. The researcher made the necessary modifications based on their suggestions.

4.2.Procedures for Analysis:

The analysis of the mathematics textbook for the preparatory educational level was carried out based on the prepared analysis tool as follows:

- Obtaining the most recent edition of the mathematics textbook prescribed for preparatory students for the academic year 2023-2024.
- Carefully reading the mathematics textbook (the study sample) for each unit, thoroughly examining all the chapters, topics, questions, diagrams, images, and activities included, while excluding the introduction and the table of contents, in order to identify whether or not it contains various aspects of mathematical thinking, which in this study are confined to three aspects: logic, reasoning, and deduction.
- Marking (/) in the appropriate place on the form: if the criterion is included, a (/) is placed in the "Included" column; if the criterion is not included, a (/) is placed in the "Not Included" column.

- Analyzing the results by calculating the frequency of occurrences of the included criteria, the frequency of non-occurrences, and the corresponding percentage.

5. Presentation of Results

After analyzing the content of the mathematics book intended for preparatory education (for children aged 5-6 years), using the tool developed to achieve this purpose, the results are presented in the table below as follows:

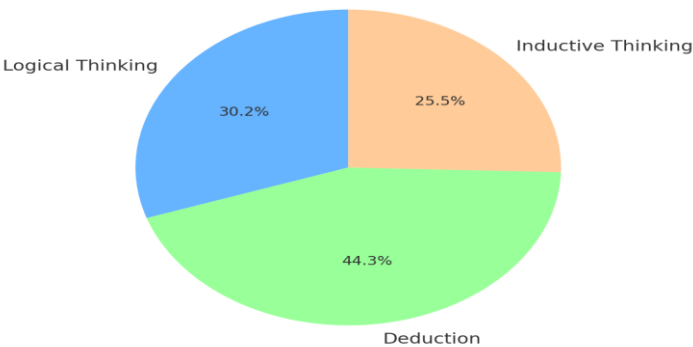
Table 1. Inclusion of Mathematical Thinking and Its Three Aspects: Logic, Inference, and Deduction

Factor	Aspect	Indicator	Frequen cy	Percent age
Mathe matical Thinki ng	Logical Thinking	- Matches objects (numbers, shapes, etc.) - Similarity: Identifies similarities and differences between two existing things -Completes a logical sequential cognitive process (drawing, counting, sequences, etc.) -Classification: Classifies objects such as shapes, numbers, etc.	24	30.37%
	Inference	-Uses logical induction for a process -Sequences operations in a structured manner -Uses previous results as premises for subsequent operations -Uses the problem-solving method (presentation, deduction, application, and review)	35	44.30%



Deduction	- Reaches a conclusion based on existing premises		
n	- Solves the problem without going through the steps	20	25.31%
	- Relies on mathematical intuition derived from the context of the activity		
	- Focuses on generalizing knowledge and its fundamental principles		

Fig.1. The figure represents the distribution of the three mathematical thinking skills in the preparatory section textbook.



By analyzing the previous results, we notice a relative balance in the distribution of sports activities at this level to train students in mathematical thinking, with a focus on logical thinking and reasoning, as the percentage for the first reached 30.37%, while the percentage of deductive thinking reached 25.5%, while the percentage of inferential thinking reached 44.3%, which is much

higher compared to the other two aspects, but they remain average and insufficient levels and need significant reinforcement. In addition, the analysis of the textbook content reveals the repetition of types of activities in the same pattern with each new lesson, which reduces the diversity of the textbook, and lacks the creation of attractive activities that stimulate students' attention and thinking, which are necessary at this developmental stage. Expanding their cognitive abilities in different forms of mathematical thinking would positively affect their academic performance, not only in mathematics, but in all subjects. This approach would also improve students' attitudes towards learning mathematics, a subject in which academic performance is generally low in all Arab countries due to poor results at all educational levels. This is what several studies have indicated, including Jihan (2021) and Al-Shahri (2024). Based on these results, this study presents the following recommendations:

6. Recommendations

-Involving Curriculum Developers:It is essential to inform mathematics curriculum developers about the importance of incorporating mathematical thinking into the design, development, and evaluation of curricula.

-Focusing on Mathematical Thinking Development:Greater attention must be given to fostering mathematical thinking rather than merely teaching mathematical rules and basic computational methods. This is particularly critical for children aged 5–6 years, to train their minds in this type of thinking and encourage them to approach mathematics learning without hesitation or fear.

-Explicit Integration of Mathematical Thinking:The inclusion of various aspects of mathematical thinking, either as a standalone unit or explicitly embedded within curricula, should be prioritized. These should be implemented in engaging, active, and applied ways to promote creativity and overall cognitive development.



-Teacher Training Programs:The integration of mathematical thinking skills into teacher preparation courses, as well as training and professional development programs, is crucial. This ensures that teachers can develop their teaching skills and later transfer these skills to their learners.

-Conducting Similar Studies:Future research should replicate studies similar to this one across other educational levels and stages.

-Curriculum Analysis and Enrichment:Research should focus on analyzing mathematics curricula and enhancing them with strategies designed to develop mathematical thinking, tailored for all educational levels and stages.

7. Bibliography List :

1. Al-Absi, H. M. (2009). **Games and Thinking in Mathematics** (1st ed.). Dar Al-Maseera for Publishing and Distribution, Amman, Jordan.
2. Al-Aboudi, F. (2000). **Mathematics: The Queen of Sciences**. Okaz Newspaper, Issue 2156.
3. Ministry of National Education of Algeria. (2006). **Accompanying Document for the Curriculum of Fifth Grade**.
4. Ministry of National Education of Algeria. (2008). **My First Learnings – Scientific Activities Notebook for Preparatory Education** (1st ed.). National Printing Office for School Publications, Algeria.
5. Al-Shehri, A. A. M. (2024). The inclusion of higher-order thinking skills in the first-grade mathematics textbook in Saudi



- Arabia. **Journal of Curricula and Teaching Methods**, 3(7), 76–90. <https://doi.org/10.26389/AJSRP.S050524>
6. Al-Ahmad, J. A. H. (2021). The extent to which fifth-grade mathematics textbooks in Jordan include critical thinking skills. **Al-Athar Journal for Psychological and Educational Studies**, 2(4), 31–51.
 7. Al-Azab, Z. (2018). Teaching mathematics and developing students' thinking skills. **The International Journal of Research in Educational Sciences (Estonia)**, 1(1), 161–223.
 8. Al-Khrafan, S. A. (2022). The degree of inclusion of mathematical thinking skills in the 2021 developed eighth-grade mathematics textbook in Jordan. **Unpublished Master's Thesis**, Al al-Bayt University, Jordan.

