Research Article

Systems thinking skills included in the mathematics textbook for the third intermediate grade

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Abstract:

The aim of the current research is to find out the extent to which systems thinking skills are included in the mathematics textbook scheduled for the third intermediate grade for the academic year (2020-2021) by answering the main research question: What are the systems thinking skills included in the mathematics textbook for middle third grade? The analytical descriptive approach was used, and to achieve the goal of the research, a list of the main systemic thinking skills and sub-skills was prepared, and after analyzing the content of the mathematics textbook, the reliability of the analysis was verified through the analysis over time and through others, and it obtained a reliability rate of 98% using the Holsti equation. The researchers found that all systems thinking skills were included, but in varying proportions. The percentage of systemic relations perception skill (25%), systems analysis skill (40%), systems installation skill (17%), systems evaluation skill (18%), and in light of the results of the analysis, several recommendations and suggestions were reached.

Keywords: systemic thinking, systemic thinking skills, textbook, content analysis.

1. Introduction:

Mathematics is one of the most important subjects that contribute to the development of thinking skills of students in their various stages of study, especially as it contains complex problems that challenge their mental abilities, which requires conducting higher thinking processes. Mathematics is an abstract science concerned with thinking and its various forms, so it is necessary to include thinking processes and skills within the textbooks and curricula, and the need to consider it as a starting point for programs and curricula that seek to develop thinking.

1.1. Research problem

The nature of mathematics is characterized by being a cumulative science as it includes an interconnected and ordered series of knowledge that consists of parts where students must be familiar with the parts that precede each part in this knowledge chain (Badawi, 2018: 64). To enable students to retain an enormous amount of information and develop their sound ideas, including the skill of (classification - detail - gathering information - understanding relationships - memorizing and remembering ... etc). (Nazal, 2018: 25), and through the researcher's experience in the field of teaching and her review of mathematics books for the past few years, she noticed that the authors and developers of the curriculum are proceeding according to the inclusion of thinking skills in them by placing life issues and challenging questions in the content of the courses, which It motivates students to self-learn and acquire information through the process of thinking to solve it, so I felt the need for learners to possess performance skills in order to be able to be able to think systemically, and according to the researcher's knowledge that the content of mathematics books was not analyzed according to these skills previously, and because of the importance of mathematics books in the educational process in All school levels, especially the middle school, especially the third intermediate grade, the researcher sensed the need to shed light on the systemic thinking skills included in the content of the mathematics textbook scheduled for the third intermediate grade.

The research problem was identified by answering the following main question:

What are the percentages of the systematic thinking skills included in the content of the mathematics textbook for the third intermediate grade?

1.2. Research importance:

The importance of this research can be summarized in two aspects, one is theoretical and the other is practical:
Theoretical importance:
1. The current research is in line with the recent trends of the educational system to develop the systemic thinking skills of high school students.
2. It shows the importance of the textbook, as it clarifies the educational goals that educational institutions seek to achieve and provides students with basic knowledge of educational materials according to the grade for which it is set.
3. This research provides information to teachers about the systemic thinking skills available in the content of the mathematics book for the third intermediate grade, which they may use as a guide in planning, teaching and evaluation processes.
Applied importance:
1- This research is the first of its kind in Iraq (according to the researcher's knowledge and knowledge), which examines the systems thinking skills included in the mathematics content of the third intermediate grade.
2- The research provides us with a theoretical background according to the constructivist theory in mathematics, which researchers in other disciplines can benefit from.
3- This research can provide an incentive for designers of mathematics curricula to present the content of the book in a systematic manner, in which the skills of systemic thinking are highlighted.

1.3. Research aims:

1- Analyzing the content of the mathematics book for the third intermediate grade according to the list of systemic thinking skills prepared by the researcher.
2- Knowing the ratios of systemic thinking skills in the content of the mathematics book for the third intermediate grade
search limits:

1.4. Limits of research:

Limit the current research to the following:
1- Systems thinking skills, which include four main skills: (understanding systemic relations, analyzing systems, installing systems, evaluating systems), and twelve sub-skills.
2- The mathematics book in its two parts (first and second) for the third intermediate grade / second edition / for the year 2019, in Iraq

1.5. Search terms:

1.5.1. Systemic Thinking:

(Battista, 1998) defined it as: "The student's ability to form mental structures in a way that moves him from thinking specifically to comprehensive thought, which makes him look at many of the elements he was dealing with as divergent topics, which he sees as common in many aspects, that is, he looks at things from a structural or an evolving perspective "(Al-Saeed and Al-Nimr, 2006: 120)

1.5.2. Systematic Thinking Skills:

The researcher defined it procedurally as: “These are the skills of systemic thinking, represented by (the skill of understanding systemic relations, the skill of analyzing systems, the skill of installing systems, the skill of evaluating systems).

1.5.3. Textbook:

Define it (Al-Zuhairi, 2015): as "an integrative system that deals with the content component of the curriculum and is represented by several elements (objectives, content, activities and evaluation) and aims to help the teacher and the learner in a class and in a subject to achieve the desired goals as defined by the curriculum." (Al-Zuhairi, 2015: 175)

1.5.4. Content analysis:

(Al-Zwaini, 2013) defined it as: "A set of artistic methods and procedures designed to interpret and classify the study material, including written texts, drawings, pictures, and ideas contained in the book." (Al-Zwaini et al., 2013: 106)

The researcher defines the process of analyzing the content of the curriculum:

It is an analysis of the mathematics book scheduled for third-grade intermediate students for the year 2020-2021, in an organized scientific manner for the purpose of knowledge of systems thinking skills (the skill of understanding systemic relations, the skill of analyzing systems, the skill of installing systems, and the skill of evaluating the systems) included in it.

2. Theoretical background

2.1. Thinking:

2.1.1. Concept of thinking:

Human is distinguished from other creatures in the physical world (physical and material) by thinking, in general, thinking is a process that takes place inside a person through two main components (the mind) and the moral (the soul). It requires multiple mental skills such as interpretation, analysis, synthesis and evaluation. (Al-Ashqar, 2011: 5)

Thinking is a series of mental activities that are not seen by the mind, which is found when it is received by one or more of the five senses in search of meaning in a situation or experience. (Al-Afoon and Muntaha, 20:2012) Thinking is an essential factor in the life of the individual, as it helps in the direction and progress of life, and with it he can control his affairs and manage them for his benefit, and thinking is indispensable in the processes of acquiring knowledge and solving problems. (Razuki and Muhammad, 2019: 12)

(Mayer, 1992) mentions that the concept of thinking includes four main ideas are ((mental activity- directed behavior-Analytical activity- Process)

As shown in Figure (1):

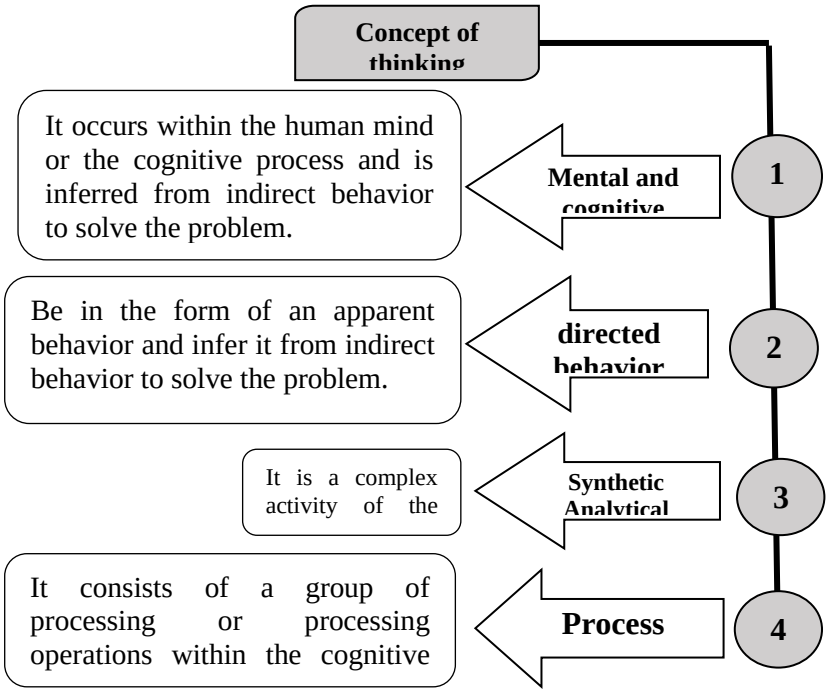


Figure (1) the concept of thinking (Hamid and Muhammad, 2019:51)

2.1.2. Types of thinking:
Each of (Obaid and Afanah, 2003) classified thinking into six types, as shown in Figure (2):

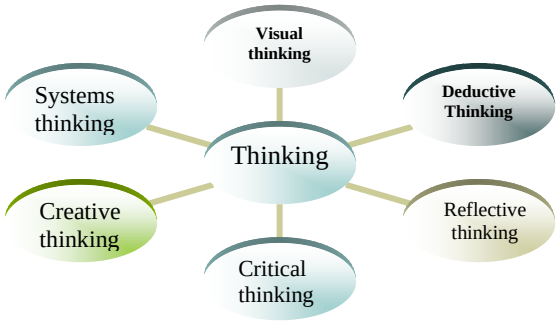


Figure (2) Types of thinking (Obaid and Afanah, 2003:39)

2.1.3. Thinking Skills:
Thinking skills are among the mental processes that are intentionally practiced to process information and data in order to achieve educational goals, starting with remembering information, describing things, taking notes, leading to predicting things, classifying things, evaluating evidence, solving problems, and finally conclusions. (Saada, 2003: 45)

2.2. systemic thinking

2.2.1. Systems thinking (concept and importance):
Systems thinking is one of the types of thinking that focuses on complex scientific contents through integrated systems in which all relationships between concepts and topics are clear, so that the learner is able to perceive the contents of the presented systems in their holistic form. and interact dynamically. (Obaid and Afanah, 2003: 63)

Systemic thinking is an open thinking that stems from a comprehensive awareness and awareness of the dimensions of the problem to which the individual is exposed. It starts from a holistic perspective and from the relationship of the whole to the part and the relationship of the parts to each other and the relationship of each of them to the overall position. (Al-Saeed and Al-Nimr, 2006: 120)

Systemic thinking is simple thinking to obtain a comprehensive understanding and understanding of complex situations and problems, as it is based on analyzing them and searching for similarities between them, and then finding the necessary information to reach a solution to these problems.

Thus, it includes two types of thinking, which are analytical and synthetic simultaneously, as shown in Figure (3):

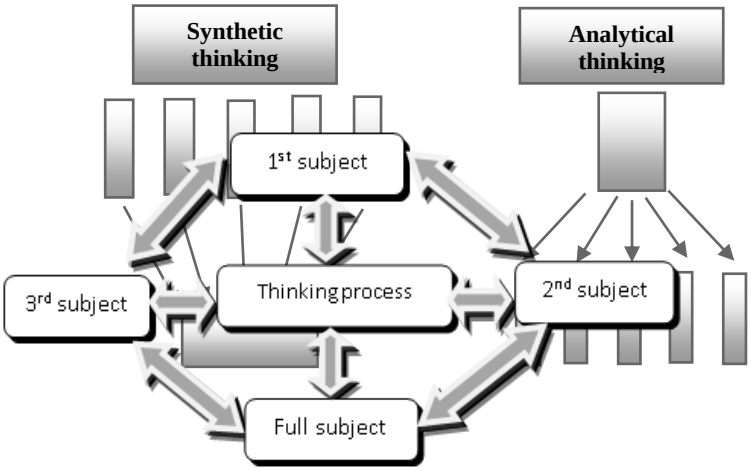


Figure (3) types of thinking (Al-Kubaisi, 2010: 61)

2.2.2. The difference between systems thinking and linear thinking:

Obaid and Afanah (2003) pointed to the difference between systems thinking and linear thinking by explaining them to them, as linear thinking can be illustrated through successive systems in one direction (horizontal or vertical), with an awareness of the relationships associated with it, as shown in Figure (4):

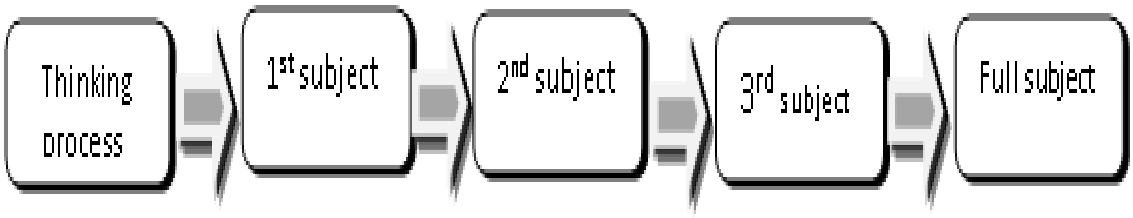


Figure (4) linear thinking

As for systems thinking, it can be illustrated through systems that consist of concepts and elements between them, including horizontal and vertical relationships that work together as a total structure. as shown in Figure (5):

Figure (5) Systems Thinking (Al-Nimr, 2021:55)

2.2.3. Systems thinking and mathematics:

Mathematics has become as close to what can be described as an integrated educational system in itself, meaning that mathematics is a science of systems formation whose concepts are linked by network relationships, and the content of mathematics includes many systems that highlight their systemic nature, such as:

1- Numbers groups system
2- The system of special cases of parallelograms
3- System of conical sections
4- System of basic relationships for trigonometric functions (Al-Kubaisi, 2010: 46)

Systemic thinking is used in reading large numbers, in performing arithmetic, algebraic and analytical operations, in engineering operations, and in proofs of mathematical problems and theories in general, away from unproductive stereotypes and linearities. From the foregoing, it can be said that mathematics, by its nature, is a science of systems formation, and its concepts are linked to each other in an integrated system, making it a fertile field for the development of systemic thinking skills. (Hassan, 2013:33-34)

Mathematics consists of a group of mathematical systems, and its applications are found in various aspects of human life. (Al-Tamimi, 2016: 16)

2.2.4. Systemic Thinking Objectives:

1- Develop the learner's ability to link concepts as an integrated system.
2- Increasing the learner's motivation.
3- Developing the learner's ability to express with shapes.
4- Develop the learner's creative thinking skills.
5- Emphasis on the systemic linkage of knowledge branches in all fields.
6- Activating the role of the teacher as a mentor and guide, and the role of the learner as the focus of the educational process. (Al-Nimr, 2021: 61)

2.3. Systematic Thinking Skills:

There are several classifications of systems thinking skills since its inception, and they are:

2.3.1. Richmond Classification (1993) of Systematic Thinking Skills:

Richmond (1993) pointed out to seven skills of systems thinking that work together simultaneously and are highly related to the (SD) Systemic dynamic model, namely:

1. Dynamic Thinking
2. Closed-loop thinking
3. Generic Thinking
4. Structural Thinking
5. Operational Thinking
6. Continuum Thinking
7. Scientific Thinking. (Richmond, 1993: 122-131)

2.3.2. Classification of Al-Saeed and Al-Nimr (2006) of Systematic Thinking Skills:

Al-Saeed and Al-Nimr (2006) categorized the systemic thinking skills into four basic skills, and each skill has three sub-skills, i.e. (12) sub-skills as follows:

1. The skill of perceiving systemic relationships, including:

A. Understand the relationships between parts of a subsystem.
B. Understand the relationships between one system and another.
C. Understanding the relationships between the whole and the parts.

2. System analysis skill, including:
A. Derivation of sub-systems from the main system.
B. Draw conclusions from the system.
C. Finding the wrong parts of the system.
3. The skill of installing systems, including:
A. Building a system of several concepts.
B. Derive generalizations from the system.
C. Write a report on the system.
4. The skill of evaluating systems, including:
A- Judging the validity of the relationships between the parts of the system.
B- System development.
C - the overall vision of a situation through the system. (Al-Saeed and Al-Nimr, 2006: 125)

2.3.3. Alfeel Classification (2011) of Systematic Thinking Skills:
As for (Alfeel, 2011), it classified the skills of systemic thinking into:
1. The skill of identifying the system.
2. The skill of realizing the relationships between the components of the system.
3. The skill of analyzing the elements of the system into its components.
4- The skill of building and restructuring the system. (Alfeel, 2011: 35)
The researcher will adopt the classification of Al-Saeed and Al-Nimr (2006) in her field of research because she considers it appropriate as a tool for analyzing the content of the mathematics book, and will clarify the main skills as follows:
1- The skill of perceiving systemic relationships: It is represented in realizing the relationships within a single topic, idea, or single paragraph. (Al-Zuhairi, 2017: 469)
An example in which the skill of realizing systemic relationships becomes clear: Simplify the following numerical sentence: $(\sqrt{5}-\sqrt{2})(\sqrt{5}+\sqrt{2})$
2- The skill of systems analysis: This skill is represented in dividing and analyzing the elements of the system into its smaller and constituent components and understanding the function of each of these elements within the framework of the sub-system and within the framework of the overall system. (Alfeel, 2011: 35)
An example in which the skill of systems analysis becomes clear: Factor an algebraic expression into its simplest form: $\mathbf{x^3-27}$
3- The skill of installing systems: It is represented in assembling the parts of the content or the main topic in one system. (Al-Kubaisi, 2010: 60), the skill of composition is a reverse process of the skill of analysis, the skill of analysis represents the fragmentation of the material into its elements, while the skill of composition represents the assembly of elements in an integrated whole.
(Faraj Allah, 2019: 43)
An example in which the skill of constructing systems becomes clear: Write a complex inequality showing the extent of the length of the third side of the triangle**: 3 cm, 5 cm, x cm**
4- The skill of evaluating systems: it requires the learner to judge the value of things or events he may have previously learned. (Faraj Allah, 2019: 44)
An example in which the skill of evaluating systems becomes clear: Does the given set represent a solution to the equation or not?

$$5x^2= 4, \{\frac{4}{\sqrt{5}}, -\frac{4}{\sqrt{5}}\}$$

2.4.The textbook

It represents the means of communication between the teacher and the curriculum and between the student and the curriculum. It is not only a tool and a means of learning, but a transmitter of culture and a tool of communication for generations. It also helps to create a good teacher and a student who wants to learn. (Mahmoud, 2013: 29)

The textbook occupies a very important position in education in the Arab countries, as it is concerned with writing, directing and distributing it to students, so that some of these countries have established specialized devices to print and distribute it according to advanced foundations. (Al-Zuhairi, 2015: 177)

2.4.1. Analyzing the content of the textbook:

The content is one of the most important components of the textbook, and it organizes a set of knowledge and skills according to a specific style that helps in achieving the planned goals. Content analysis also helps categorize or classify the elements of the textbook to facilitate the implementation of the plan, and to reveal weaknesses and strengths in the textbook. (Al-Zuwaini, 2013: 107)

2.4.2. Content analysis steps:

A- Determining the sample: It is an important step for the content analysis. In selecting it, consideration is given to the representation of each of the sample groups in proportion to their presence in the community.

b- Defining the categories of analysis: they mean the main elements that make up the content and for which the content is analyzed, and they differ from one material to another.

C- Determining quantification methods: It includes multiple methods such as repetition or measuring space and time.

D- The unit of analysis: the smallest part of the content to be analyzed, and the word is one of the easiest units of analysis. While the idea is one of the most widely used units of analysis in content analysis.

E- Measure the stability of the analysis:

It is done in two ways:

The first method: Knowing the degree of agreement between two or more researchers, meaning that they would obtain the same results if they applied the same test.

The second method: consistency over time, meaning that the analyst or group of analysts obtain the same results if they are analyzed according to one classification for the same content at separate intervals.

As for stability, it means the degree of agreement of the content elements, and it represents the stability coefficient of the analysis, and its value is limited between zero and the correct one.

F- Ensuring the validity of the analysis: it includes the ability of the analysis to provide the information contained in the paragraphs of the book's analysis (Bahri, 2012:200-202)

3.Previous studies:

There are several studies that dealt with systemic thinking skills, including:

3.1. The study (Al-Maliki, 2006): This study was conducted in Saudi Arabia / Umm Al-Qura University, and it aimed to determine the systemic thinking skills necessary for sixth-grade students in the subject of reading and to identify the extent to which reading book exercises take into account the skills of systemic thinking.

3.2. The study (Farawneh, 2017): This study was conducted in Palestine / the Ministry of Education and Higher Education, and it aimed to enrich the content of the technology course for the twelfth grade in the light of systems thinking skills.

4.Research Methodology and Procedures

4.1. Research Methodology

The researcher followed the descriptive-analytical approach as it fits the objectives she has set for her research

4.2. The research community and its sample

The (community and sample) for research is represented in the content of the mathematics book in its parts (first and second) which is scheduled for third intermediate grade students by the Iraqi Ministry of Education for the academic year (2020-2021 AD), the second edition of the year 2019.

4.3. Tool of the search:

The tool means the means by which we obtain information and knowledge that is objective, accurate, and free from bias. These methods include: observation, questionnaire, interview, test, standards, analysis, monitoring lists and evaluation. (Atwan and Youssef, 2018: 99)

One of the requirements of the current research is to prepare an analysis tool represented by a list of systemic thinking skills, in order to use it in analyzing the part (first and second) of the content of the mathematics book for the third intermediate grade, and this was done by following the following:

1- Reviewing the educational literature and previous studies that dealt with the skills of systemic thinking.

2- Determining a list of the systemic thinking skills and their components after taking into consideration the content of the mathematics textbook for the third intermediate grade students. The classification of the researchers (Al-Saeed and Al-Nimr, 2006) for the skills of systemic thinking was adopted in determining this list. The list consisted of four main skills and twelve skills. subfolders as shown in Table (1):

Table (1)

skills of systemic thinking.

No.	Main Skill	Components	
1.	**Realizing the mathematical relationships**	1.	Realizing the mathematical relationships between a major mathematical system and its sub-components.
		2.	Realizing the mathematical relationships between the sub-systems within a major mathematical system.
		3.	Realizing the mathematical relationships that link two different mathematical systems.
2.	**Systems Analysis**	1.	Derivation of a sub-system from a main mathematical system.
		2.	Derivation of mathematical generalizations by analyzing a main mathematical system into its sub-parts.
		3.	Deriving appropriate conclusions and solutions in a mathematical system by analyzing it into its sub-parts.
3.	**Systems Installation**	1.	Assembling several mathematical concepts to build a specific mathematical system.
		2.	Write a report on a specific mathematical system.
4.	**Systems Evaluation**	1.	Judging the validity of the mathematical relationships that link the parts of a specific mathematical system.
		2.	Developing a mathematical system by making modifications to one or more parts of it.
		3.	Issuing a judgment on a mathematical system by presenting a comprehensive vision or conception of its parts.

		4.	Discovering mathematical errors in the parts of a mathematical system by realizing the mathematical relationships that link them.

4.3.1 Validity of the analysis tool:

Honesty is an important condition and must be met in the data collection tool, and the tool's validity means the tool's ability to measure what it was actually prepared to measure (Abbas and others, 2014 :262). Mathematics and its teaching methods, and in the light of their opinions and observations, a final list of skills was reached, where the percentage of agreement between them reached more than 85%, and this percentage is very good and evidence of the suitability of the analysis tool to the goal that was set to achieve it.

4.4. Analytical procedures:

A- Determining the objective of the analysis: to identify the percentages of including systemic thinking skills in the content of the mathematics book for the third intermediate grade.

B - Determining the analysis sample: It was determined by (parts one and two) for the content of the mathematics book for the third intermediate grade, which is scheduled for government day schools for the academic year (2020-2021 AD).

C- Determining the unit of analysis: The researcher chose the implicit and explicit idea as a basic unit for content analysis on the grounds that it represents what the content may contain of components of sub-skills of the main systemic thinking skills.

D- Determining the enumeration unit: The researcher used the repetitions as a unit to enumerate the skills.

E- Preparing the analysis card: The analysis card was prepared to monitor the results of the analysis, which included a list of systemic thinking skills prepared in advance by the researcher, the unit of analysis, the page, the frequency and proportions.

f- Steps of the analysis process:

- Read the content of the mathematics textbook for the third intermediate grade students, as it is the subject of the analysis process.
- Starting the analysis process to determine the extent to which the book's content includes the skills of systems thinking (awareness of system relationships, analysis of systems, installation of systems, evaluation of systems), which are included in the list of analysis as an appendix.
- Unpacking the results of the analysis, classifying them and converting them into repetitions, and then into percentages that can be explained or commented on statistically.

4.4.1. Validity of the analysis: The researcher presented a model for her analysis, which is the first chapter of the first part of the mathematics book for the third intermediate grade, to a group of arbitrators and specialists in mathematics and its teaching methods. It was clear from the results of the questionnaire that the arbitrators agreed on them after the formulation of some of the sub-indicators included in the main skills was modified. In order for the analysis tool to fulfill the condition of validity.

4.4.2. Stability of the analysis: This was done in two ways as follows:

Stability through time: the researcher re-analyzed the content of the mathematics textbook for third-grade intermediate students after thirty days had passed a table on the first analysis. This indicates the stability of the analysis over time, and reassures the researcher to use the content analysis tool, as the references confirm that the acceptable percentage of agreement is (70%) and above.

Stability through others: the researcher calculated the stability coefficient between the researcher's analysis over time and the analysis of another teacher after she trained him to use the list of components, as the teacher analyzed the content of the mathematics book for the third intermediate grade, and the stability coefficient of the two analyzes was calculated using the Holsti equation, and it became clear that the coefficient of The calculated stability between the researcher and the teacher (98.0). This is a high percentage of the reliability coefficient as indicated in the educational literature, which enables the researcher to be assured of the stability of the analysis process.

4.5. Statistical means

The researcher used the following methods in dealing with her research statistics:

4.5.1. Frequencies and percentages

4.5.2. Holsti equation for calculating the stability of content analysis

$$CR=\frac{2M}{N_1+N_2}$$

CR: Stability coefficient

M: The number of categories with which the researcher agreed with himself or with the other analyst.

N1: The sum of the categories analyzed by the first researcher.

N2: The sum of the categories analyzed by the other.

N1 + N2: The sum of the categories analyzed by both researchers. (Al-Hashimi and Attia, 2014: 229)

5.Search results and their Discussion:

5.1. View the results

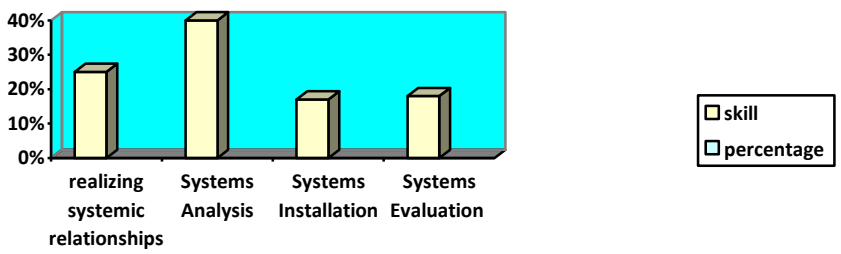
After completing the analysis of the content of the mathematics textbook for the third intermediate grade students in its parts (first and second), according to the systemic thinking skills, and after completing the analysis process, the frequencies and percentages of these skills were calculated, , as shown in table (2):

Table (2)

Frequencies and percentages of the systematic thinking skills included in the content of the mathematics book for the third intermediate grade in its parts (first and second)

No.	Systematic Thinking Skills	Frequencies	Percentages	Skill Rank
1)	realizing systemic relationships	504	25 %	2
2)	Systems Analysis	789	40 %	1
3)	Systems Installation	324	17 %	4
4)	Systems Evaluation	345	18 %	3
Total		1962	100 %	-

Figure (6) shows the distribution of the systems thinking skills included in the content of the mathematics book for the third intermediate grade according to the mentioned results



5.2. Discussion of the results of the analysis:

Through the results shown in Table (2) and Figure (6) regarding the analysis of the content of the mathematics book for the third intermediate grade in its parts (first and second) for the skills of systemic thinking, the researcher extracted (1962) iterations distributed over (four) main skills, as the skill of systems analysis obtained the rank The first was by (789) iterations at a rate of (40%), followed by the skill of perception of systemic relations at the rate of (504) iterations at a rate of (25%), while the skill of evaluating the systems occurred at the rate of (345) iterations at a rate of (18%). As for the skill of installing systems, it came In 1st place by (324) recurrences, a rate of (17%). The researcher concluded from the previous results that the mathematics textbook for the third intermediate grade dealt with all systemic thinking skills, but in varying proportions, and according to the researcher's belief that the reason is due to the book's authors 'interest in the skill of system analysis because the mathematics book contains ideas or topics that form intertwined systems that complement each other. Some that need to simplify and explain their results, as well as the perception of systemic relations, that is, the perception of the relationships between the various topics of the book, which are presented in the form of main and subsystems, and the skill of installing systems, i.e. collecting ideas and concepts to form an idea or form a main topic, as for the skill of evaluating the systems, it cannot be dispensed with in the content Mathematics because it helps students discover and correct their mistakes and judge the validity of the relationships that connect parts of the same topic. The researcher believes that this result is expected in proportion to the mathematics book, and through the analysis it appears that there is a weakness in the skills in some chapters of the book, for example, the skill of installing systems in the first three chapters, and the skill of evaluating systems in the fourth, fifth and sixth chapters, through the above. Curricula that take into account the need to develop students' systemic thinking skills by including them in the content of mathematics textbooks.

5.3. Recommendations:

1- The necessity to include systems thinking skills in all mathematics school books and for all school levels, due to the importance of this type of thinking as a kind of higher levels of thinking.

2- The researcher recommends that those in charge of preparing school curricula in the Iraqi Ministry of Education should develop the content of mathematics books in a manner that takes into account the diversity when developing the subjects decided upon for students in a manner appropriate to include the skills of systemic thinking and present them clearly in the chapters of the book.

3- Organizing in-service training courses for mathematics teachers on employing systemic thinking skills in teaching mathematics in order to provide them to students.

4- Inclusion in the curricula of students of mathematics departments in the faculties of education with the skills of systemic thinking and training them on how to use it in teaching mathematics and developing it for their students in the future.

5- Benefiting from the list of main and systemic thinking sub skills prepared by the researcher in this research in developing school mathematics textbooks.

5.4. Suggestions:

To complement this research, the researcher suggests conducting the following studies:

1- Conducting a similar study for this research on other mathematics books for all academic levels.

2- Conducting a descriptive study to find out the extent to which middle school students possess systemic thinking skills.

3- Building a training program for mathematics teachers on teaching systems thinking using various strategies.

4- Conducting a sequential study to detect the growth of systemic thinking among middle school students.

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