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## Analysis of the Content of the Mathematics Textbook for the Eighth Grade in the State of Kuwait According to NCTM Standards

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### **Abstract**

*The research aims to analyze the content of the eighth-grade textbook in the State of Kuwait in light of the standards of the National Council of Teachers of Mathematics (NCTM). The researchers used the descriptive analytical method, and the research sample consisted of a mathematics textbook for the eighth grade in the State of Kuwait. The researchers used a prepared content analysis tool based on the National Council of Teachers of Mathematics (NCTM) standards for process standards, "Standards for Connecting, Representing, and Mathematical Communication." The validity and reliability of the analysis tool was confirmed. The research concluded that eighth-grade mathematics textbooks included the standards of the National Council of Teachers of Mathematics (NCTM) in varying proportions. Among the most important recommendations is conducting more research and studies on mathematics curricula, especially in the field of mathematical communication, and the need for mathematics textbook authors to be informed of the standards issued by the National Council of Teachers of Mathematics (NCTM).) in planning and developing mathematics curricula and the extent to which books take into account these standards due to their importance, and reconsidering the weaknesses in eighth-grade mathematics books and enhancing the strength point.*

**Keywords:** Content Analysis, Mathematics Textbook, NCTM Standards

### **Introduction**

The process of content analysis is a diagnostic process that aims to identify the strengths and weaknesses of the school curriculum, in order to keep pace with scientific and technical development, make the curriculum more effective in achieving goals, and enable alumni to possess competence, high capabilities, and higher thinking skills to be used in solving problems (Lavi, Tal, & Dori, 2021). Here the need arises to develop curricula so that their contents reflect the spirit of the times and are able to provide the learner with broad and diverse scientific horizons that help enrich his information and various mental skills, train him to think soundly, and deal with the encountered problems in daily life (Zighan & El-Qasem, 2021). The 2000 NCTM document also calls for a general foundation in mathematics that all students learn, while recognizing that there is variation among them, as they display different talents and abilities, and their achievements, interests, and needs in mathematics are distinct (Senk & Thompson, 2020). However, all students

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should be able to receive educational programs in Mathematics at a high level (Mulenga & Marbán, 2020). This research aims to investigate the degree of availability of mathematical connection, representation, and communication standards in the mathematics textbook for the eighth grade in the State of Kuwait, in order to develop them and identify the strengths and weaknesses. Sufficient analytical studies have not been conducted on them, so the researchers endeavor to conduct this study. The importance of this research is represented in several aspects, the most important of which is providing the curriculum developers with what should be done in order to develop the curriculum, revealing the strengths and shortcomings through the use of content analysis for the purposes of evaluating the curriculum, enriching the curriculum or the content of the book in a way that makes it more effective in achieving the objectives through the results reached by analysis, helping teachers to reorganize educational materials and providing them with what should be done in order to implement the curriculum at the planning level, choose methods, improve performance, build achievement tests, and choose appropriate teaching methods. Developing the content of the mathematics book based on its analysis helps identify the strengths and weaknesses of the book, as well as assisting officials in the ministry in the process of analysis, evaluation and development of the curricula. It works to meet the needs of researchers, science students, and those interested in mathematics curricula in light of NCTM standards, and responds to international recommendations and modern global trends that call for continuous evaluation and analysis of curricula, with the aim of improving and developing them.

The researchers are trying to answer the following question (to what extent are operations standards available in the mathematics textbook for the eighth grade in the State of Kuwait). Three questions branch out from this question:

- The first question: What is the degree of availability of the mathematical connection standard in the mathematics textbook for the eighth grade in the State of Kuwait?
- The second question: What is the degree of availability of the mathematical representation standard in the mathematics textbook for the eighth grade in the State of Kuwait?
- Question Three: What is the degree of availability of the mathematical communication standard in the mathematics textbook for the eighth grade in the State of Kuwait?

## **Research Terminology**

**Content Analysis:** A purposeful educational process that provides a quantitative, objective, and methodological description of the content of an eighth-grade mathematics textbook in light of the operational standards of the National Council of Teachers of Mathematics.

**Mathematics Book:** It is the mathematics book for the eighth grade of middle school, part one, in Kuwait, fifth edition.

**NCTM Standard:** It is the highest level of performance that a person can reach, or aspire to reach, and in light of it, the various levels of performance are evaluated. The operational definition of it in this study is a set of statements used to evaluate the teaching of mathematics, agreed upon by experts and specialists in the field of mathematics education who are members of NCTM.

**The National Council of Teachers of Mathematics (NCTM):** It is an international body founded in America. It spearheads research on issues of learning and teaching mathematics at all educational levels, and issues specialized technical and professional recommendations and instructions, through regional and national conferences.

**Theoretical Framework:** Mathematics curricula in most countries of the world have enjoyed a large share of development and modernization, in line with the developments and changes that have occurred in all fields that the world has witnessed in recent years, as mathematics has invaded other branches of science. However, when referring to previous studies on the subject of school mathematics standards and their availability in books, as well as analyzing and evaluating mathematics curricula, we find that they revealed a gap between the content of actual mathematics school books and what the standards call for. It emphasizes reducing this gap by making a radical change to these books in accordance with these standards. In addition, many of them recommend conducting more studies and research on the content of mathematics books and analyzing them in light of international standards. Therefore, discovering the suitability or inadequacy of the mathematics curriculum is a process that involves complexity, because it ultimately requires making critical educational decisions given the importance of teaching curricula, especially mathematics curricula, in developing many skills and abilities among students. Therefore, educational decisions in adopting or not adopting curricula must be based on a set of data available from scientific studies in this field, and from here comes the importance of the current study in that it will work to provide a set of quantitative and qualitative information about the extent to which the mathematics textbook for the eighth grade contains the linking standards, mathematical representation and communication stemming from the standards of the American National Council of Teachers of Mathematics (NCTM), which were issued in 2000. The standards document (2000) (NCTM) included ten standards for grades from kindergarten to the twelfth grade. These standards are divided according to (NCTM, 2000, p. 29) into two groups:

**First: Content Standards:** It classifies what students should learn. These standards include number and operations standards, algebra, identifying patterns, relationships and conjunctions, geometry, measurement, data analysis and probability.

- Number and Operations: This standard describes a deep understanding of numbers, the ability to deal with number, operations and calculations, in addition to understanding number systems and their structure.
- Algebra: This standard focuses on discovering relationships between algebraic and mathematical expressions and functions. The algebra standard emphasizes the relationships between quantities, including coupling, methods of representing mathematical relationships, and analysis of change. Associative relationships can be expressed using symbols, which allows complex ideas to be expressed tightly and change to be analyzed effectively.
- Geometry: The geometry standard indicates the need to master geometric thinking, analyze the properties and qualities of two- and three-dimensional geometric shapes, and develop mathematical arguments about geometric relationships and logical thinking skills. Geometry is the main subject in mathematics related to describing the environment, understanding it, identifying locations and describing spatial relationships using coordinate geometry and other representation systems, and developing logical thinking and reasoning skills peak in working with proofs in the secondary grades, and play an important role in mathematical modeling and problem solving.
- Measurement: Measurement is assigning a numerical value to a property of a solid or shape. Measurement at higher levels includes assigning a numerical value to a property of a situation, that is, it is an association from the property to a set of numbers. The study of measurement is important in the mathematics curriculum at various levels, due to its practical benefit and its prevalence in various aspects of life. It helps to understand the

properties of measurable objects, as well as to understand measurement units, systems, and processes. It also provides an opportunity to teach and apply number operations, geometric ideas, statistical concepts, and conjunctions. It highlights the strong connection between mathematics and other fields.

- **Data Analysis and Probabilities:** Students need to identify, apply and use basic concepts in probability and choose and use appropriate statistical methods to analyze data, which are essential skills. In order for students to understand the basics of statistical ideas, they must work with data directly.

**Second: Operations standards: process standards:** These standards include problem solving, logical thinking and proof, mathematical representation, communication, and relationships.

- **Problem Solving:** Problem solving means engaging in a task in which the solution method is not identified in advance. Students build on their knowledge, and through this process they will develop an understanding of mathematics. Solving the problem is not only the objective of understanding mathematics, but it is a main means of achieving it. By learning to problem solve in mathematics, students acquire ways of thinking, habits of perseverance, curiosity, and self-confidence that will serve them well.
- **Logical Thinking and Proof:** Students learn methods of logical thinking and proof, constructing mathematical guesses and testing them, realizing the importance of thinking and proof as a basis in mathematics, using logical probability methods to confront many mathematical problems and issues, and developing and evaluating mathematical arguments and proof.
- **Representation:** The standards-based curriculum is expected to help the student carry out mathematical modeling operations, master the skills of reproducing learned solutions and measuring them in situations similar to the situations during which the learning occurred, apply and translate mathematical representations to solve problems, and use representations to model and interpret natural, social, and mathematical phenomena, which leads to helping the student to organize his mathematical ideas more effectively.
- **Communication:** Communication is an essential part of mathematics and mathematical education. It is a way to exchange ideas, organize and enhance students' mathematical thinking and clarify understanding. Through communication, ideas become a subject for contemplation, discussion and modification and help to communicate students' mathematical ideas to others in a coherent and clear way. The communication process also helps in giving meaning and permanence to ideas. Because mathematics is transmitted through symbols, we typically do not view oral and written communication about mathematical ideas as an important part of mathematics education. Students do not necessarily talk about mathematics naturally, so it is necessary for teachers to help them learn how to do it. As students advance through the grades, the mathematics they express becomes more complex and abstract as students' repertoire of tools and methods of communication becomes in addition to their mathematical thinking that supports their communication. more complicated.
- **Connections and Relations:** This standard works on identifying the relationships and links between mathematical ideas and their uses, understanding how these ideas are related to each other and how they are built to become an integrated subject, linking the relationships in them in a logical way, focusing on the sequence of ideas, and learning about mathematics and its uses in practical contexts.

Accordingly, this study adopts in its procedures the operations standard “Standards for Mathematics Connection, Representation, and Communication” in light of the standards of the National Council of Teachers of Mathematics (NCTM), and to determine the extent to which these standards are available in the content of the mathematics book for the eighth grade.

## **Previous Studies**

Study by Al-Zuhairi et al. (2022): The study aimed to analyze the content of mathematics textbooks for the ninth grade in Jordan in light of the standards of the National Council of Teachers of Mathematics (NCTM) by investigating the degree of availability of standards for connection, representation, and mathematical communication. For the purposes of the study, the researchers developed the study tool, which is a mathematics book content analysis list, based on the process standards issued by the National Council of Teachers of Mathematics (NCTM, 2000). The validity of the tool’s content and the stability of the analysis tool were confirmed. The results of the study showed that the connectivity standard was available to a moderate degree and was ranked first, while the mathematical connection standard was available to a weak degree and ranked second. The degree of availability of the mathematical representation criterion was weak and ranked third.

The study also concluded with a number of recommendations, the most important of which are: the need for specialists and those responsible for curriculum development to be informed of international standards for mathematics curricula, such as: NCTM standards, and to reconsider the weaknesses in school mathematics curricula.

Study by Al-Zuhairi and Sari (2020): The study aimed to analyze the content of middle school mathematics books in Iraq in light of the standards of the National Council of Teachers of Mathematics (NCTM), by indicating the degree of availability of mathematical linking, representation, and communication standards in mathematics books for the first and third grades of the Intermediate Stage. For the purposes of the study, the researchers developed the study tool, which is a mathematics textbook content analysis list, based on the process standards issued by the National Council of Teachers of Mathematics (NCTM, 2000). The validity of the tool content and the stability of the analysis tool were confirmed. The results of the study related to analyzing the content of the mathematics book for the first intermediate grade showed that the mathematical connection criterion ranked first with a score of (medium). The mathematical communication criterion also came second with a (low) degree, while the mathematical representation criterion came third with a (low) degree. The results related to the content analysis of the mathematics book for the third intermediate grade also revealed that the mathematical communication standard came in first place with a (medium) degree, as did the linking criterion. The athlete came second, with a (low) degree, while the sports representation criterion came third, with a (low) degree.

Karazon’s study (2019): The study aimed to determine the availability of content standards set by the National Council of Teachers of Mathematics (NCTM) in the content of Palestinian mathematics textbooks for the third, fourth, and fifth grades. The researcher used the descriptive analytical approach in the study. The researcher prepared a list of content standards (numbers, operations, algebra, geometry, measurement, data, and probability) after translating them. The researcher used a content analysis card based on content standards to analyze Palestinian mathematics books for basic grades (3-5), implemented in 2018/2019, with six

books, two parts for each book. The results of the study showed that the content of Palestinian mathematics books for grades 3-5 conforms to the standards set by NCTM to varying degrees, ranging from weak to average for most of them. In light of these results, the study recommended the need to enrich new editions of basic Palestinian mathematics books.(5-3)

Study by Askoul, Abu Odeh, and Ahmed (2019) : Askoul's study aimed to analyze the content of the Palestinian mathematics textbook for the ninth grade in light of the (NCTM) standards. The researchers used the descriptive analytical method, and the study sample consisted of the content of the mathematics textbook for the ninth grade, which was implemented in 206/2017 in Palestine as two books. The researchers used a content analysis tool that was prepared based on the standards of the National Council of Teachers of Mathematics (NCTM) .The study concluded that the mathematics textbook for the ninth grade for the year 2017/2018 included the National Council of Teachers of Mathematics (NCTM) standards for content in varying proportions. One of the most important recommendations of the study is the need for curriculum specialists to be informed of international standards for curriculum development, such as: NCTM standards, and to reconsider areas of weakness in Math books for ninth grade and enhancing strengths.

Al-Asi's study (2018): The study aimed to determine the extent to which mathematics textbooks developed for the third and fourth grades in Palestine include the standards of the National Council of Teachers of Mathematics (NCTM, 2000). The researcher used the descriptive analytical method. The study sample consisted of the content of the mathematics books developed for the third and fourth grades that were implemented in the year 2017/2018 in Palestine, with four books. The researcher used the content analysis tool that was prepared based on the standards of the National Council of Teachers of Mathematics (NCTM) in its two branches, content standards and process standards. The study concluded that the mathematics books developed for the third and fourth grades for the year 2017-2018 included the standards of the National Council of Teachers of Mathematics (NCTM) in its two branches in varying proportions.

Study by Al-Tamimi (2017): The study aimed to analyze the content of the mathematics textbook for the third intermediate grade in the Kingdom of Saudi Arabia in light of the standards of the National Council of Teachers of Mathematics (NCTM, 2000). The study population and sample were from the mathematics textbook for the third intermediate grade. To answer the study questions, the researcher developed a tool consisting of two models: the first for process standards and the second for content standards. The results of the analysis study showed that the book included standards (mathematical problem solving, mathematical thinking, mathematical representation, and mathematical communication) with a high degree of consistency .The mathematical coherence criterion was moderately consistent. The results of the study also showed that the standards (number and operations, algebra, geometry, measurement, data analysis and probability) were highly consistent. The researcher recommended the need to keep pace with developments and pay attention to international standards and apply them to achieve quality in the educational process.

Study by Asqoul, Abu Odeh, and Ahmed (2019): The study aimed to analyze the content of Palestinian mathematics textbooks for the ninth grade in light of the NCTM standards. The researchers used the descriptive analytical method, and the study sample consisted of the content of mathematics textbooks for the ninth grade, which were applied in the 2016-2017 academic year in Palestine in two books. The researchers used a content analysis tool that was prepared based on the National Council of Teachers of Mathematics (NCTM) standards for

content standards. The study concluded that mathematics books for the ninth grade for the academic year 2017-2018 included the National Council for Teachers of Mathematics (NCTM) standards for content in varying proportions.

Study by Abdul Amir and Wadhaal (2018): The study aimed to identify mathematical coherence in the mathematics textbook for the third intermediate grade in Iraq. The researchers followed the descriptive analytical approach and prepared a questionnaire that represents the criteria for mathematical connection for the purposes of this study. The researchers also used statistical tools such as (Cronbach's alpha, weighted mean, and percentile weight). The researchers concluded that the percentage of mathematical coherence in the third-grade intermediate textbook reached 48%. The researchers presented a number of recommendations and proposals, the most important of which is: training those responsible for writing mathematics books to analyze the content of textbooks according to mathematical correlation standards.

Looking at previous studies, we note that the studies that investigated the degree of adoption of the standards of the American National Council of Teachers of Mathematics have concluded that the representation of mathematics textbooks was uneven and unbalanced. All previous studies and research recommended the importance of continuing to analyze and develop mathematics curricula for all educational levels. What distinguishes the current study is that it is an analytical study based on the analysis of the mathematics book for the eighth grade and the availability of the mathematical connection, representation, and communication standards for the standards of the National Council of Teachers of Mathematics, where the analysis was combined between the mathematical connection, representation, and communication standards for the operations standards issued by the National Council of Teachers of Mathematics (NCTM). The researchers benefited from these studies by learning about the method and procedures, building the analysis tool, discussing the results, and enriching his current study with one or more of its aspects by being informed of them.

## Method and Procedures

**Research Methodology:** In this research, the researchers used the descriptive analytical approach, following the content analysis method, where the content of the eighth grade mathematics book was analyzed in light of the NCTM standards to determine the extent to which these books are compatible with the standards of connection, representation, and mathematical communication of the standards of the National Council of Teachers of Mathematics (NCTM).

**Research Sample:** The study sample represented the topics included in the mathematics textbook curriculum for the eighth grade of middle school applied in the 2021/2022 academic year.

**Table 1:** The Relative Weight of the Topics Included in the Mathematics Textbook Curriculum.

Unit	Address	Number of Pages	Relative Weight of the Unit
First unit	Sets	22	% 12.7
Second Unit	Relative Numbers	40	%23
Third Unit	Ratio and Proportion	23	%13.4
Fourth Unit	Congruence and Similarity Triangles	49	%28.3
Fifth Unit	Relationship and Mapping	21	%12
Sixth Unit	Statistics Science	18	%10.4

## Research Tool

To achieve the research objectives, the researchers used the descriptive analytical approach, following the content analysis method that was prepared in light of the standards of the National Council of Teachers of Mathematics (NCTM).

**Analysis Process Controls:** The researchers identified a number of controls that govern the analysis process, which are:

- The analysis process included all topics in the content of the book and specified in the six units of the book for the eighth intermediate grade in the Kuwaiti curriculum, fifth edition, implemented in 2021/2022.
- The analysis process does not include the teacher's guide or any activity book accompanying the book, and the analysis process does not include the cover, index, and introduction of the book.

**Unit of Analysis:** The researchers adopted the paragraph as a unit of content analysis due to its suitability to the subject of the study. The researchers defined the paragraph as:

- Each question or exercise is a paragraph.
- Every theory, theorem, or Lemma is a paragraph.
- Every example, activity or exercise is a paragraph.
- Every statement that falls between two subtitles is a paragraph.

**Validity of the Study Tool :** The researchers presented the research tool to a group of specialists in mathematics curricula and teaching methods to express their opinion on the soundness of the wording of the statements, their belonging to the research topic, their suitability to the categories of analysis, the conformity of the tool used to the purpose of the analysis, its validity, the suitability of the paragraphs to the research objectives, and the belonging of the sub-appearance to the main criterion, as no deletion or adding any paragraph because the standards contained in the tool are a translation of the original standards in the (NCTM) document, and the arbitrators merely reformulated some of the sub-aspects mentioned in the study tool.

**Analysis Card Stability:** In order to stabilize the tool, the Holsti equation was used, which is considered a simple method to evaluate agreement between analysts using the method of stability of analysis across people:

$$(1) \quad \frac{2M}{N_1+N_2} \text{ C.R} =$$

Where: **R.C:** means stability coefficient.

**M:** The number of cases in which the researcher agrees with the second analyst who analyzed the same agreed upon units.

**N1:** The number of iterations matched with the other researcher from the analysis.

**N2:** The number of iterations of an analysis that was disagreed with the other analyst.

Two researchers conducted a content analysis of the mathematics book for the eighth intermediate grade separately and independently. The researchers applied the Holsti equation between the two analyzes to calculate the reliability coefficient of the analysis.



Therefore, the results reached by the analysts were collected and calculated using the Holsti equation. It was found that the reliability coefficient of the analysis for the eighth grade book reached 95%, which is a high and reassuring value for research purposes. Thus, the tool became final.

**Research Implementation Procedures:** Study procedures were carried out as follows:

**First:** A theoretical study of the standards of the National Council of Teachers of Mathematics (NCTM) and identification of previous studies and research related to the current field of research.

**Second:** The scientific part in which the following methodological procedures were followed:

1. Developing a mathematics book analysis tool according to the standards of the American National Council of Teachers of Mathematics.
2. Carrying out procedures to ensure the validity of the tool and the stability of the analysis.
3. Carrying out the analysis process, the following procedures were followed:
  - Identifying the analysis sample, which is the first chapter of the mathematics textbook for the eighth intermediate grade taught in schools in the State of Kuwait in the academic year 2021/2022.
  - Identifying the categories of analysis that included the standards for mathematical connection, representation, and communication issued by the American National Council of Teachers of Mathematics.
  - Choosing the paragraph as the unit of analysis in the case of explanation and activities. The issue, question, example, data, and geometric shapes were also tackled by describing each of them as a paragraph.
  - Conducting the analysis process, by monitoring the pages allocated to the analysis process, dividing each page into a group of paragraphs, each of which includes one idea, identifying from the elements of the analysis the ideas that include an element, and calculating their frequencies and percentages in relation to the total frequencies of the elements of the standard.

**Third:** Put a sign (/) in the appropriate place according to the availability of the standard in the paragraph, and then collect the repetitions mentioned in all paragraphs of the book and for each of the standards.

**Fourth:** Transcribing the frequencies into tables prepared for this purpose, and four divisions were given in which (frequency, percentage, level, and rank) appear.

**Fifth:** Calculating the percentage of achieving the sub-criteria and the main criterion of the book that it achieves. If the percentage is equal to (0), then the grade is nil, and if the percentage is between (33%-1) then the grade is weak, and if the percentage is between (66-34%) then the grade is average, but if the percentage is (100-67%), the score is high.

**Sixth:** Monitoring the results and processing them statistically.

**Seventh:** Presenting the results of the study, discussing and interpreting them, and giving recommendations in light of the results.

## **Presentation and Discussion of Results**

Presenting the results related to the first question, which stipulates the availability of standards (NCTM) for mathematical connection operations in the mathematics textbook for the eighth

grade in the State of Kuwait. The percentages and frequencies were extracted, as in Tables (3, 4). The sub-criteria were arranged according to the percentage of occurrence of each of them, and the percentages were calculated from the total number of frequencies of the criterion.

**Results Related to the First Question:** To answer the first question, which states: What is the availability of NCTM standards for mathematical connection operations in the mathematics textbook for the eighth grade in the State of Kuwait.

The content of the book was analyzed in light of the mathematical connection standard included in the school mathematics standards of the National Council of Teachers of Mathematics. Frequencies, percentages, and the degree of availability of sub-standards for the mathematical connection standard were calculated as shown in Table (2).

**Table 2:** Frequencies, Percentages, and Degree of Availability of Sub-Criteria for the Mathematical Connectivity Criterion.

Sub-Criterion	Repetition	Percentage%	Degree of Availability	Rank
Relationships and connections between mathematical ideas and their use	909	57.79	middle	1
Connecting mathematical ideas and building them on each other to become a logically integrated subject	481	30.58	weak	2
Apply mathematics in contexts outside mathematics	183	11.63	weak	3
The sum of the occurrences of the total mathematical linkage criterion	1573			

It is noted from Table (2) that this book includes all aspects of the sub-criteria of the mathematical connection standard in varying proportions, and that the first sub-criteria (relations and connections between mathematical ideas and their use) received the highest frequency (909) of repetitions, with a percentage of (57.79%), with a moderate degree of availability, and came in first place. As for the second criterion (the connection between mathematical ideas and their construction on each other to become a logically integrated subject.) It received a total of (481) repetitions, a percentage of (30.58%), and a weak degree of availability, with a rank of second. As for the third sub-criterion of the linking criterion (applying mathematics in contexts outside the scope of mathematics), it received the lowest frequency (183), with a percentage of (11.63%), and a weak degree of availability, ranked third.

The total frequencies and percentages of the manifestations belonging to the sub-criteria of the mathematical linkage criterion were calculated, as shown in Table (3):

**Table 3:** Results of the Content Analysis of the Mathematics Textbook for the Eighth Intermediate Grade according to the Mathematical Connection Criterion.

Sub-Criteria of the Math Connectivity Standard	Repetition	The Ratio	Rank
Relationships and Connections between Mathematical Ideas and their Use			
1 .The textbook links two or more mathematical concepts	130	8.26	6
2 . The textbook links two or more mathematical generalizations	222	14.11	3
3. The textbook links relationships or ideas in one mathematical topic	127	8.07	7

Sub-Criteria of the Math Connectivity Standard	Repetition	The Ratio	Rank
4. The textbook links conceptual knowledge with procedural knowledge	247	15.70	1
5. The textbook presents the same concept in various ways (models, langConnecting mathematical ideas and building them on each other to become a logically integrated subject, symbols).	183	11.63	4
Connecting Mathematical Ideas and connecting them on each other as a Logically Integrated Subject			
6. The textbook links the new concept to previously learned concepts in the same subject	125	7.95	8
7. The textbook links different mathematical topics (algebra, geometry, statistics)	133	8.45	5
8. The textbook uses previous experiences to solve the mathematical problem	223	14.17	2
Apply Mathematics in Contexts outside Mathematics			
9. The textbook links the mathematical topic with technology	35	2.22	11
10. The textbook provides opportunities to apply mathematics in other sciences (science, commerce, economics)	56	3.56	10
11. The textbook links mathematics topics to applications in the student's scientific life	92	5.85	9

It is noted from Table (3) that the aspects belonging to the sub-criteria of the mathematical linking criterion indicated in different percentages, as the third aspect (the book links conceptual knowledge with procedural knowledge) with a rate of (15.7%), while the aspect (the book links the mathematical topic with technology) with the least frequency. (9) of repetitions and the lowest percentage. (%5.85)

*Results Related to the Second Question:* To answer the second question, which states: What is the availability of NCTM standards for mathematical representation operations in the mathematics textbook for the eighth grade in the State of Kuwait. The content of the book was analyzed in light of the mathematical representation standard included in the school mathematics standards of the National Council of Teachers of Mathematics. Frequencies, percentages, and the degree of availability of sub-standards for the mathematical representation standard were calculated as shown in Table (4):

**Table 4:** Frequencies, Percentages, and Degree of Availability of Sub-Criteria for the Mathematical Representation Criterion.

Sub-Criterion	Repetition	Percentage %	Degree of Availability	Rank
Construct and use mathematical representations to organize, record, and communicate mathematical ideas	918	62.40	middle	1
Select, apply, and translate mathematical representations to solve problems	444	30.18	weak	2
Modeling and interpreting natural mathematical and social phenomena	109	7.41	weak	3
Total	1471			

It is noted from Table (4) that this book includes all aspects of the sub-standards of the mathematical representation standard in varying proportions, and that the first sub-standard

(constructing and using mathematical representation to organize, record and communicate mathematical ideas) received the highest frequency (918) of repetitions, with a percentage of (%62.4) and a moderate degree of availability, and ranked first. As for the second criterion (selecting, applying and translating mathematical representations to solve problems), received a total of (444) repetitions and a percentage of (30.18%), and a weak degree of availability, ranked second. As for the third sub-criterion of the linking criterion (modeling and interpreting natural mathematical and social phenomena), received the lowest frequency (109), with a percentage of (7.41%), and a weak degree of availability, ranked third.

The total frequencies and percentages of the manifestations belonging to the sub-criteria of the mathematical representation criterion were calculated, as shown in Table (5):

**Table 5:** Results of the Content Analysis of the Mathematics Textbook for the Eighth Intermediate Grade according to the Mathematical Representation Criterion.

Rank	The Ratio	Repetition	Sub-criteria of the Mathematical Representation Standard and their Manifestations
a. Construct and use mathematical representations to organize, record, and communicate mathematical ideas			
8	6.39	94	1. The Textbook presents a single mathematical concept in various representational ways
4	8.22	121	2. The Textbook provides pictorial presentations or illustrations that explain mathematical relationships
6	6.53	96	3. The Textbook provides activities that require the use of mathematical representations
9	6.05	89	4. The Textbook provides tangible, physical representations of the environment
11	5.51	81	5. The Textbook presents representations from the concrete to the abstract
10	5.57	82	6. The Textbook provides mathematical representations that make it easier for students to understand mathematical problems and ideas
1	24.13	355	7. Writers translate mathematical ideas into illustrations or graphical representations
B. Select, Apply, and Translate Mathematical Representations to Solve Problems			
5	6.59	97	8. The Textbook explains how to use mathematical representations
2	11.90	175	9. The Textbook uses mathematical representations to solve problems inside and outside mathematics
3	11.69	172	10. The Textbook presents the most appropriate and easiest representation of the idea among the various representations
C. Modeling and Interpreting Natural Mathematical and Social Phenomena			
12	0.95	14	11. The Textbook presents electronic technological representations for solving mathematical problems
7	6.46	95	12. The Textbook presents natural situations such as applied and social sciences; the solution of which requires a mathematical model

It is noted from Table (5) that the aspects belonging to the sub-criteria of the mathematical connection criterion came in different percentages, as the seventh aspect (the book translates mathematical ideas into illustrations or graphical representations) came with a percentage of (24.13%), when the aspect came (the book presents technological representations Electronic

mathematics problem solving) with the lowest frequency (14) of repetitions and the lowest percentage(0.95) .

**Results Related to the Third Question:** To answer the third question, which states: What is the availability of NCTM standards for mathematical communication operations in the mathematics textbook for the eighth grade in the State of Kuwait.

The content of the Textbook was analyzed in light of the mathematical communication standard included in the school mathematics standards of the National Council of Teachers of Mathematics. Frequencies, percentages, and the degree of availability of sub-standards for the mathematical communication standard were calculated as shown in Table.(6)

**Table 6:** Frequencies, percentages, and Degree of Availability of Sub-criteria for the Mathematics Communication Standard.

Sub-Criterion	Repetition	Percentage%	Degree of Availability	Rank
Organizing and promoting mathematical ideas	321	25.43	Weak	2
Communicating mathematical ideas in a coherent and explicit way	400	31.69	Weak	1
Analyze and evaluate other people's thinking and strategies	283	22.42	Weak	3
Using the language of mathematics to express mathematical ideas accurately and precisely	249	19.73	Weak	4
the total	1262			

It is noted from Table (6) that the aspects belonging to the sub-criteria of the mathematical connection criterion came in different percentages, as the seventh aspect (the book translates mathematical ideas into illustrations or graphical representations) came with a percentage of (24.13%), when the aspect came (the book presents technological representations Electronic solution for solving mathematical problems) with the lowest frequency (14) of repetitions and the lowest percentage (0.95).

Frequencies, percentages, and degree of availability of sub-criteria for the sports communication standard were calculated as shown in Table(7)

**Table 7:** Results of the Content analysis of the Mathematics Textbook for the Eighth Intermediate Grade According to the Mathematical Communication Standard.

Sub-standards of the Mathematics Communication Standard and their manifestations	Repetition	percentage %	Rank
a. Organizing and Promoting Mathematical Ideas			
1. The Textbook enables students to express mathematical ideas in correct ways	121	9.59	4
2. The Textbook can enable students to identify equivalent formulations of mathematical text	60	4.75	10
3. The Textbook presents modeling of situations	140	11.09	2

<b>Sub-standards of the Mathematics Communication Standard and their manifestations</b>	<b>Repetition</b>	<b>percentage %</b>	<b>Rank</b>
using written, pictorial, graphical, or algebraic methods			
<b>B. Communicating Mathematical Ideas in a Coherent and Explicit Way</b>			
4. The Textbook explains the mathematical generalizations	87	6.89	6
5. The Textbook includes situations that make students communicate mathematically with each other and with others	48	3.80	12
6. The Textbook explains the mathematical relationships included in the mathematical text	126	9.98	3
7. The Textbook provides students with opportunities to use mathematical representations to communicate mathematical ideas to others	148	11.72	1
<b>C. Analyze and Evaluate other People's Thinking and Strategies</b>			
8. The Textbook provides opportunities for students to evaluate others' solutions	70	5.55	9
9. The Textbook enables students to analyze and interpret mathematical situations based on their previous knowledge	92	7.29	5
10. The Textbook introduces students to their colleagues' strategies for thinking and solving mathematical problems, analyzing them and comparing them with their own strategies	121	9.59	4
11. The Textbook uses mathematics vocabulary to express ideas and represent relationships in mathematical language	79	6.26	8
12. The Textbook enables students to formulate definitions of mathematical concepts inductively	59	4.67	11
13. The Textbook enables students to formulate mathematical generalizations inductively	83	6.58	7
14. The Textbook allows the use of technological tools (pocket calculator, computer,...) in developing mathematical language, shapes, and symbols, and communicating mathematical ideas to others.	28	2.22	13

It is noted from Table (7) that the aspects belonging to the sub-standards of the mathematical communication standard came in different percentages, as the seventh aspect (the book provides students with opportunities to use mathematical representations to communicate mathematical ideas to others) came in at a rate of (11.72%), while the aspect came (it provides The book covers the use of technological tools (pocket calculator, computer,...) in developing mathematical language, shapes, and symbols, and communicating mathematical ideas to others) with the least frequency (28) of repetitions and the lowest percentage.(%2.22)

## Recommendations

1. Benefiting from current research and taking the results into account.
2. The interest of school mathematics designers, planners, and authors in the results of research and studies related to analyzing the content of textbooks, and the need to be guided by these results that will develop mathematics textbooks.
3. The research found that there are sub-aspects that are not adequately applied in mathematics books, including:
4. Applying mathematics in contexts outside the scope of mathematics, and using the language of mathematics to express mathematical ideas accurately and precisely. Accordingly, researchers recommend the necessity of adopting these aspects in the book to ensure its effectiveness.
5. Conducting more academic studies on the subject of the American National Council of Teachers of Mathematics' standards for mathematics textbooks for other grades and the extent to which books take into account these standards due to their importance.
6. Conducting studies and research that include a specific NCTM standard across a number of primary, middle or secondary grades.
7. Working to hold conferences and seminars to discuss the strengths and weaknesses of mathematics textbooks, and the problems of their application by teachers and supervisors in order to develop the Kuwaiti curricula to keep pace with modern trends in curriculum construction, to cover their shortcomings, and to maintain the strengths.
8. Working to integrate technology, such as computers and various mathematical programs that specialize in mathematics, so that they are appropriate for the intermediate stage in mathematics curricula.

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