

## A Content Analysis of the Ninth Grade High School Math Textbook based on NCTM Content Standards

### Abstract

This study aims to investigate the state of NCTM content standards in the ninth mathematics textbook of the first year of high school, released in 2015. These standards included numbers and operations, algebra, geometry, measurement and data analysis, and probability. In this respect, the researcher used descriptive research and the content analysis method to analyze the degree of conformity of the book with the components of content standards. All of the ninth-grade math textbook topics are included in the statistical population. As a result, the study sample was chosen based on the whole population. The research instrument used in the analysis is a checklist. The outcomes of the study are based on descriptive statistical techniques. The NCTM standard checklist for the content analysis of ninth to twelfth-grade mathematics was used to determine the checklist. The findings revealed that in the field of numbers standard and operations of number perception component, in the field of standard algebra factor of using mathematical models to express and understand quantitative relations, concerning the standard geometry of the component analysis of properties and properties of multidimensional geometric shapes in the standard data analysis and probability, understanding and applying the basic concepts of the most likely adaptation and in the components of understanding the meaning of applying and examining the relationship with other elements of the standard of numbers and operations, in changing the content analysis of different algebra standard, in the field of geometry standard, analyzing the display systems and in the selection component of the standard, it had the least probability of adaptation. It was equally adhered to in both components when it came to the measuring standard.

**Keywords:** *content analysis, ninth-grade math textbook, NCTM, content standards, curriculum*

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### Introduction

The development of exceptional cognitive qualities such as understanding, reasoning, thinking, creativity, problem-solving, and judgment has been stressed in human civilizations from the beginning of formal schooling (Delgado 2009). In this respect, one of the objectives of public education in any society, including ours, is to develop interested, inquisitive, inquiring, and scientifically-technologically educated individuals capable of solving their everyday difficulties (Shahrtash, Filsafi, Rahbar and Hajian, 2005). The major elements of the school curriculum are textbooks, which are one of the essential sources of learning in the educational system. Because many teachers and students use textbooks, analyzing them is a useful undertaking (Dogbey, 2010).

Because of the rapid advancement of information technology, there is a need to evaluate textbooks once a year. One of the ways to accomplish this is to conduct a content analysis of textbooks, which may be done in a variety of ways today (Sahebi and Hosseini, 2010). The curriculum's substance is particularly important in terms of its role in accomplishing the objectives. Because textbook development, compilation, modification, and updating are one of the educational system's necessities, scientific analysis and study is very important. This research aids textbook supervisors and writers assemble, choosing, and selecting textbook content to improve learning and offer students academic success. Indeed, content analysis aids in the scientific examination of concepts, principles, attitudes, opinions, and all other aspects of textbooks (Yar

Mohammadian, 2002). Using content analysis, the material's flaws become more evident, and the requirement to adhere to or construct a standard program becomes more apparent. Countries that passed the Thames test were those that were pioneers in adopting educational standards or curricular frameworks (Badrian, 2006).

The qualities of a textbook may be understood through content analysis, and deficiencies in textbook material can be recognized and addressed (Rasooli, 2011). The content should be structured in such a way that pupils can understand it. There are a variety of learning theories that can assist us in doing so in the most effective way possible (Fathi Vajargah, 2015).

Today, a textbook that is founded on contemporary learning theories like epistemology and constructivism that allows for open and active learning can have a stronger influence on the audience. As a result, according to Roger, textbooks can play one of two roles, depending on the learning objectives: instructional knowledge transfer, which shows the textbook's limited influence, or open education. This sort of instruction helps learners increase their abilities for observation, reasoning, and independence in their learning activities (Roger, 1989). Karami et al. (2012) used William Rumi's approach to examine the content of a first-grade high school math textbook. The text engagement coefficient of 0.53 was discovered in the research, indicating that the text of the first high school math textbook was written in an active manner. Sedighi (2009) attempted to investigate the location of NCTM subject requirements such as standards and numbers, algebra,

geometry, measurement and analysis of data and statistics in a first-year high school mathematics textbook released in 2009. The findings revealed that in the sphere of standard numbers and operations, the component of knowing and comprehending numbers received the greatest attention, while the component of understanding the meaning of operations received the least attention.

Based on Bloom's cognitive domain, Nosratabadi et al. (2010) examined the content of the first high school math book published in 2008. The findings revealed that when designing the book's aims, more emphasis was placed on the low levels of the cognitive domain (comprehension and understanding), and less emphasis was placed on the high levels of the cognitive domain. According to the findings of Tawfiqi (2008), various misunderstandings regarding the idea of function have developed in the minds of students as a result of the high school math textbook, and some of these misunderstandings may be avoided or remedied by creating education based on Bruner theory.

Special attention should be paid to the textbook in the centralized Iranian education system since the book's faults, and defects hurt the whole student population of the country, and a proper book will provide many benefits in return (Marufi, 2010). Iran, as one of the 45 nations participating in the Thames, did not achieve the anticipated outcomes, with third-grade middle school children doing worse than kids in 37 other countries. Following the publication of the School Mathematics Assessment and Curriculum Standards (1989), the Teaching Standards (1991) and the School Assessment Standards (1995) by the Supreme Council of Mathematics Teachers (NCTM), the council remained committed to supplying the standards that play a main role in familiarizing with the mathematics education and published its most complete document: Principles and Standards of School Mathematics (2000), Chapter 7 of which deals with high school standards ( Karimi, 2004). In the 2015-16 academic

Table 1. Content of book chapters by activity

Chapter title	Activity
Chapter one	The first counter names and defines the set and kinds of sets, membership, subset, community, subscription, set difference, probability and event review, which calculates the likelihood of occurrence in simple circumstances and forms a sample space (throwing dice, coins, children and balls)
Chapter two	Real numbers on intervals and axes, rational numbers, comparing rational numbers, showing numbers, introducing obscure numbers, comparing obscure and rational numbers, absolute value, and approximate value of absolute value
Chapter three	The concept of reasoning, centrality, conformity, coherence, method of hypothesis and sentence recognition, presentation of coherence methods of the triangle, training of reciprocal angles to vertices with practical examples, recognition of unknown angles and sides in coherence shapes, step by step presentation of the problem-

year, the Ministry of Education wrote a ninth-grade mathematics textbook and taught it for the first time in the 94-95 academic year, with the goal of further improving thinking, reasoning, and creativity, as well as using the material of the mathematics textbook. Nevertheless, beginning in 1994, and in accordance with a Ministry of Education resolution, high school pupils will be selected in two phases and across two years. As a result of the uniqueness of this textbook, extensive study in the field of content analysis has not been conducted. However, given the relevance and function of content analysis in developing textbooks, it is vital to study the content standard's conformity with the book content. Accordingly, the present study aims to use the NCTM content standard to examine the content of the text and visuals in the ninth grade math textbook from the first year of high school in 2015.

### Method

In terms of goal and outcomes, this study belongs to the applied research category, whereas in terms of data collection and control, it belongs to the non-experimental research category. In the meanwhile, this study is retrospective. The current study is descriptive in nature, and the content of the book was analyzed using a survey approach in accordance with the NCTM standard. The statistical population in this study is the eighth high school math textbook, originally released in 1994. All chapters of the book are included in the statistical sample, as are NCTM standards such as numbers and operations, algebra, geometry, measurement, and data analysis, as well as the possibility of segmenting activities, classwork, and book exercises, and the degree of compliance of the book content with these standards in general.

In the ninth math book, the material of the whole book is divided into three sections: activity, work class, and practice. We collect all of the material mentioned in the book in the following tables to be aware of the content in these three sub-sections.

	solving strategy, proof of equations in the circle, the use of technology for similar shapes, similarity ratio training
Chapter four	Scientific symbol, large-number knowledge, rooting conditions, third root, radical simplification, addition and subtraction, and articulation
Chapter five	Introduction to polynomials, detection of similar polynomials, degree of polynomials, one-variable sorting, calculation of polynomials for numerical values, algebraic unions, geometric proof of the first union, introduction to the multiplicative property of addition to the sum, geometric proof of conjugate union, introduction to common sentence unity, introduction to the unequal application, comparison of numbers on the axis, implementation of properties of inequalities t
Chapter six	Introduction to Cartesian coordinates, preparation of equation solution preparations, introduction to the first-degree equation, introduction to slope concept, gradient perception through practical examples, the general outline of linear equations, how to write them, drawing linear equations, learning the elimination method of solving the device
Chapter seven	Introduction to expressive expressions, calculating the value of expressive expressions in the value of the domain to identify the idea of the domain, arithmetic operations on expressive expressions, and step-by-step and recursively training of splitting polynomials into polynomials.
Chapter eight	Introducing three-dimensional prismatic, spherical, and pyramidal volumes; contrast cylindrical and spherical volumes by example; practical experiment to analyze hemisphere; real examples of the pyramid; create an illustration to understand the volume of prism and cone; determine the sides of volumes in a wide state; train circulation to form three-dimensional shapes, and create cross-sectional sections of three-dimensional shapes.

Table 2. Content of book chapters based on classroom activity

Chapter title	classroom activity
Chapter one	Empty and single-member set, subset and membership, display of famous number set, different set display, van diagram, main set difference
Chapter two	Inserting the Rational and Gang numbers respectively between the Rational and Gang Numbers, the concept of real numbers, the representation of sets, inequalities and their properties, the initial properties of the absolute value
Chapter three	Teaching drawing acute triangles, comparing the senses with the reasoning in science, proving basic theorems, comparing the arguments presented by individuals, recognizing hypotheses and sentences, examining similarities in Cartesian coordinates, transferring shapes in a two-dimensional system
Chapter four	Investigating the power properties of numbers, simplifying power expressions, converting very large and small numbers into scientific symbols, rooting in the third and second stages, simplifying radicals, explaining
Chapter five	Standardization of algebraic equations, unions of the first, second and conjugate types, common sentence, presentation of decomposition methods, training of decomposition through numerical values, the relation of intervals and inequalities, detection of inequality properties, calculation of the set of inequality answers,
Chapter six	Determining the coordinates of a point in the Cartesian device, drawing line equations in different situations, drawing an equation using the slope and width of the origin, writing a line equation with a slope of a point, solving the device by drawing, teaching alternative method
Chapter seven	Recognize rational expressions, arithmetic operations on rational expressions, practical application of arithmetic operations on rational expressions, calculating the area and circumference of shapes with polynomial sides, performing polynomial divisions on polynomials step by step
Chapter eight	Calculating the volume of spheres, cylinders and hemispheres, calculating the surface area of the hemisphere, expressing the relationship between the area of the hemisphere and the hemisphere, examining the

	perpendicularity of the pyramids, calculating the volume of the pyramid, introducing the regular pyramid, calculating the volume of a two-dimensional shape
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Table 3. Content of book chapters based on exercises

Chapter title	Exercises
Chapter one	Different representations of major collections, community concepts, commonalities, differences, van charts, arithmetic operations and their reminders, calculation of the probability of events
Chapter two	Comparison of rational numbers and properties of rational numbers, comparison of odd numbers with other sets
Chapter three	Expressing the difference of reasoning in real problems and the degree of trust in people's reasoning, reviewing the definition of convex polygons, application of reasoning in different forms, similarity with practical applications
Chapter four	Negative power, modes for displaying power numbers, power properties, simplifying power expressions, using a scientific symbol, calculating the root of numbers, absolute value, simplifying radicals and rationalizing the relationship of radicals to geometry
Chapter five	Simplifying algebraic expressions, calculating expressions with the help of the union, decomposing algebraic expressions, using geometric tools to understand the common sentence, constructing equations from verbal expressions,
Chapter six	Drawing line equations, the relation of slope to angle, concept of width from origin and length from the origin, solving the system of linear equations, forming a set of two unknown equations with verbal expressions,
Chapter seven	Performing arithmetic operations on expressive expressions, perform polynomial division on polynomials
Chapter eight	Visualizing real three-dimensional objects, comparing the volume of different shapes, calculating the volume of a pyramid by creating a visualization, calculating the volume and area of various shapes

The material of the ninth math book is based on the NCTM standard due to the requirement of research. As a result, the components and subgroups connected to the standard of numbers and operations, algebra, geometry, and measurement based on NCTM standards for the ninth through twelfth grades

are shown in the tables below. The primary goal of these tables is to examine scientific books in order to identify the degree of active presentation of textbook material and conformity with NCTM standards.

Table 4. Standard components of numbers and operations

Main components	Sub-components	Naming
Understanding numbers	Develop a deeper understanding of very small numbers	A
	Developing a deep understanding of very large numbers	B
Methods of presenting numbers, the relationship between numbers and the number system	Providing different views of numbers	C
	Comparing and contrasting the properties of numbers and number systems, including rational numbers and real numbers	D
	Understanding complex numbers as roots for quadratic equations that have no real roots.	E
	Understanding vectors and matrices as devices that have some properties of real number systems	F
	Use the number theory discussion to validate the relationships between all numbers.	G
Understanding the meaning of actions and examining the relationship with other elements	Understanding the concepts and effects of the four basic operations on decimal, fractional and integer numbers	H
	Using the properties of mobility and participatory addition and multiplication	I
	Using the multiplicative distributivity property to simplify calculations on integers, fractions and decimals.	J
	Understanding and using the inverse relation of addition, subtraction, multiplication, division and square	K
	Finding the square root to simplify calculations and solve problems.	L

Fluid calculation and proper estimation	Smoothing the distribution of arithmetic operations to real numbers using mental calculations	M
	Smooth distribution of arithmetic operations on vectors and matrices using mental calculations	N
	Existing conditions for extended operations to perform calculations with the help of paper and pen for simple cases	O
	Providing examples of the use of technology for more complex computations in the use of extended arithmetic operations	P
	Rational judgment of numerical calculations and their results	Q

Table 5. Standard components of algebra

Main components	Subcomponents	Naming
Understanding patterns, relationships and functions	Generalizing patterns using explicit definitions and recursively defined functions	A
	Understanding relationships and functions and choosing to convert flexibility between them	B
	Using different representations to express relationships, functions	C
	Analyzing the functions of a value in terms of the amount of change	D
	Analyze the functions of a value by examining the intersection, zeros	E
	Investigating the function in terms of asymptotes and their specific and general behaviors	F
	Understand and perform transformations such as arithmetic synthesis	G
	Examine the common structure and inverse used for functions	H
	Using technology to construct such actions in a more complex symbolic way	I
	Understand and compare the properties of categories of functions, including exponential, polynomial, rational, logarithmic, and alternating functions	J
	Interpreting the functions display for two variables	K
Mathematical expression and analysis of situations and structures using algebraic symbols	Understanding the concept of equivalence consisting of expressions, equations, inequalities and relations	L
	Writing equivalences consisting of equations, inequalities, and systems of equations and solve them explicitly mentally or with paper and pen in simpler cases	M
	Expressing and presenting methods for solving equations and inequalities and their apparatus using technology	N
	Using symbolic algebra to represent and explain mathematical relationships	O
	Using various representational symbols such as recursive and parametric equations for functions and relationships	P
	Judging the concept, tools, and rationality of the results of symbolic manipulation by people skilled in technology.	Q
Using mathematical models to express and understand quantitative relationships	Determining the essential quantitative relationships in a situation	R
	Determining the category or classes of functions that may model these quantitative relationships.	S
	Using symbolic expressions such as recursive or repetitive shapes to represent relationships resulting from different contents	T
	Designing logical assumptions about a situation to be modeled	U
Changing the analysis in different contents	Approximation and interpretation of the roots of changes from numerical and visual data.	V

Table 6. Standard components of geometry

Main components	Subcomponents	Naming
Analysis of properties and features of two- and three-dimensional geometric shapes, expansion of the mathematical discussion of geometric relations	Analysis of properties of two-dimensional objects	A
	Analysis of the properties of three-dimensional objects	B
	Determining the properties of two- and three-dimensional objects	C
	Discovering relationships (including proportions and similarities) between classes of two- and three-dimensional geometric objects	D
	Test guessing about two- and three-dimensional geometric objects and solving problems related to them	E
	Establishing the validity of geometric conjecture using inference	f
	Proof of Critical Argument Theorems Made by Others	G
	Using trigonometric relations to determine the length and size of the angle	H
Determining location and describing spatial relationships using coordinate geometry and other representational systems	Using Cartesian coordinates	I
	Using other coordinate systems such as device, polar, spherical, and cylindrical to analyze the geometric position	J
	Investigating the conjecture and solving problems related to two-dimensional objects displayed with Cartesian coordinates	K
	Studying the conjecture and solving problems related to three-dimensional objects displayed with Cartesian coordinates	L
Applying transformations and using symmetry to mathematically analyze situations	Understanding and displaying the relations of reflection, rotation and transgression of objects on the page using designs, coordinates	M
	Understanding the representation of equivalence relations using vectors, function symbols and matrices	N
	Using different representations to help understand the effect of simple transformations and their combinations	O
Using visualization, spatial reasoning and geometric modeling to solve problems	Designing and constructing two- and three-dimensional geometric objects using various tools	P
	Visualization of three-dimensional objects from different perspectives and analysis of their definite section	Q
	Using the vertex-edge graph to model and solve problems	R
	Using geometric models to gain insights to answer questions in other areas of mathematics.	S
	Using geometric ideas to solve problems	T
	Gaining insights into other disciplines and other fields related to geometry, such as art and architecture	U

Table 7. Standard components of measurement

Standard components of measurement	Sub-components provided for grades 9-12
Understanding the measuring properties of objects, units, devices and measurement processes	Deciding on units and scales that are appropriate for situations of measurement issues.
Applying appropriate techniques, equipment, and formulas for sizing	Analysis of accuracy, precision and approximate error in measurement conditions.
	Understanding and using formulas for area, surface area, and volume of geometric shapes, including cones, spheres and cylinders.
	Applying the common concept of consecutive, upper and lower boundaries and limits in measurement situations.

	Using unit analysis to evaluate measurement calculations.
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Table 8. Standard components of data analysis and probability

Main components	Sun-components	Naming components
Asking questions that can be addressed by data, collecting, organizing and displaying information about them to answer questions.	Understanding the difference between different types of studies and the type of inference that logically designs each of the differences.	A
	Knowing the characteristics of well-designed studies, including the role of randomness in surveys and experiments	B
	Understanding the meaning of measurement data and definite data from univariate and bivariate data and variable expressions	C
	Understanding histograms, parallel bar charts, and scatter plots and use them to display data	D
	Calculating basic statistics and understanding the difference between statistics and parameters	E
Selecting and using appropriate statistical methods for data analysis.	Display distribution, shape description, selection and calculation of statistics summary for univariate measurement data	F
	Displaying scatter plots, shape descriptions, regression coefficients, regression equations and correlation coefficients using technology tools for bivariate measurement data	G
	Displaying and discussing bivariate data in which there is at least one definite variable.	H
	Recognizing how linear transformations of univariate data affect shape, center, and scatter.	I
	Identifying the trends in bivariate data and finding functions that model data or convert data in a way that can be modeled	J
Developing and evaluating inferences and forecasts based on data.	Using simulations to discover different statistical samples from a known community and to construct a sampling distribution.	K
	Understanding how sample statistics reflect the values of population parameters and using sampling distributions as a basis for non-formal inference.	L
	Evaluating published reports based on data studied by the pilot project.	M
	Understanding how basic statistical techniques are used to monitor process specificity in the workplace.	N
Understanding and applying the basic concepts of probability	Probability, construction of sample space and distribution in simple cases	O
	Using simulation to construct an experimental probability distribution	P
	Calculation and interpretation of mathematical hope from random variables in simple materials	Q
	Understanding the concepts of conditional probability and independent occurrence	R
	Understanding how to calculate the probability of a combined event	S
Total		

The components and subgroups of each topic standard are offered to a group of experts and educators in this book to confirm authenticity. SPSS software is used to analyze the data.

### Findings

Throughout the book, the book chapters are divided into three sections: activity, classwork, and practice, according to the approach utilized in this study. Then, according to NCTM standards, algebra, geometry, measurement and data analysis, and the possibilities of book chapters are studied in five parts of standard numbers and operations.

The geometry chapter has the biggest volume of the book in terms of the number of pages, with 19 percent, while the real numbers and volume and area chapters have the lowest volume, with 10%. The remaining chapters account for around 13% of the book's total volume. In addition, the part with the most sections is about activities. To put it another way, the entire book is divided into three categories: activity class, work class, and practice, totaling 164 sections. Activity accounts for 44%, work class for 38%, and practice for 18% of the total. As a result, the majority of the book's instructional content is comprised of exercises. In addition, the third and sixth seasons have the biggest amount of activities, the fourth and seventh

seasons have the highest number of labor courses, and the third season has the highest number of exercises.

*Research Question 1:* Is the ninth math book's content consistent with the components and criteria of NCTM numbers and operations?

Each component has a maximum score of 5 and a minimum value of 1. Furthermore, the greatest possible score for each of the key components of the standard of numbers and operations is 10, 25, 25, 25, and so on. When a book's content in the field of numbers and operations receives a total of 85 points on the NCTM checklist, it meets the NCTM standard.

Table 9. Distribution of points of the main and sub-components of the standard numbers and operations for activities

Sub-components naming	Sub-component score	Percentage of points	Main component point
A	4	10	8
B	4	10	
C	3	7	13
D	4	10	
E	1	2	
F	2	5	
G	3	7	
H	2	5	12
I	1	2	
J	2	5	
K	3	7	
L	4	10	
M	1	2	9
N	1	2	
O	3	7	
P	1	2	
Q	3	7	
Total	42	100	42

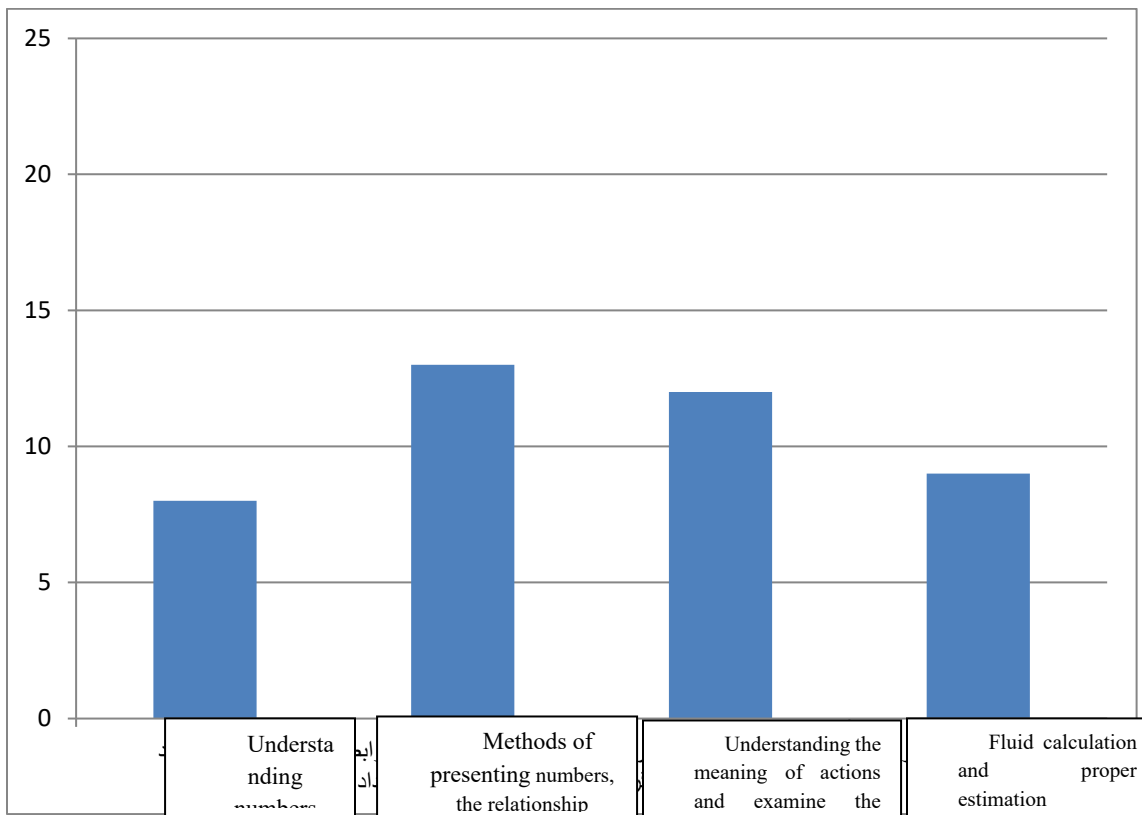


Chart 1. Chart of compliance of the main components with the content of the activities of the first, second and fourth chapters

Table 10. Distribution of points of the main and sub-components of the standard numbers and operations for classroom activities

Sub-components naming	Sub-component score	Percentage of points	Main component point
A	3	8	6
B	3	8	
C	4	11	13
D	5	13	
E	1	3	
F	1	3	
G	2	5	
H	2	5	11
I	1	3	
J	2	5	
K	2	5	
L	4	11	
M	1	3	8
N	1	3	
O	3	8	
P	1	3	
Q	2	5	
	38	100	38

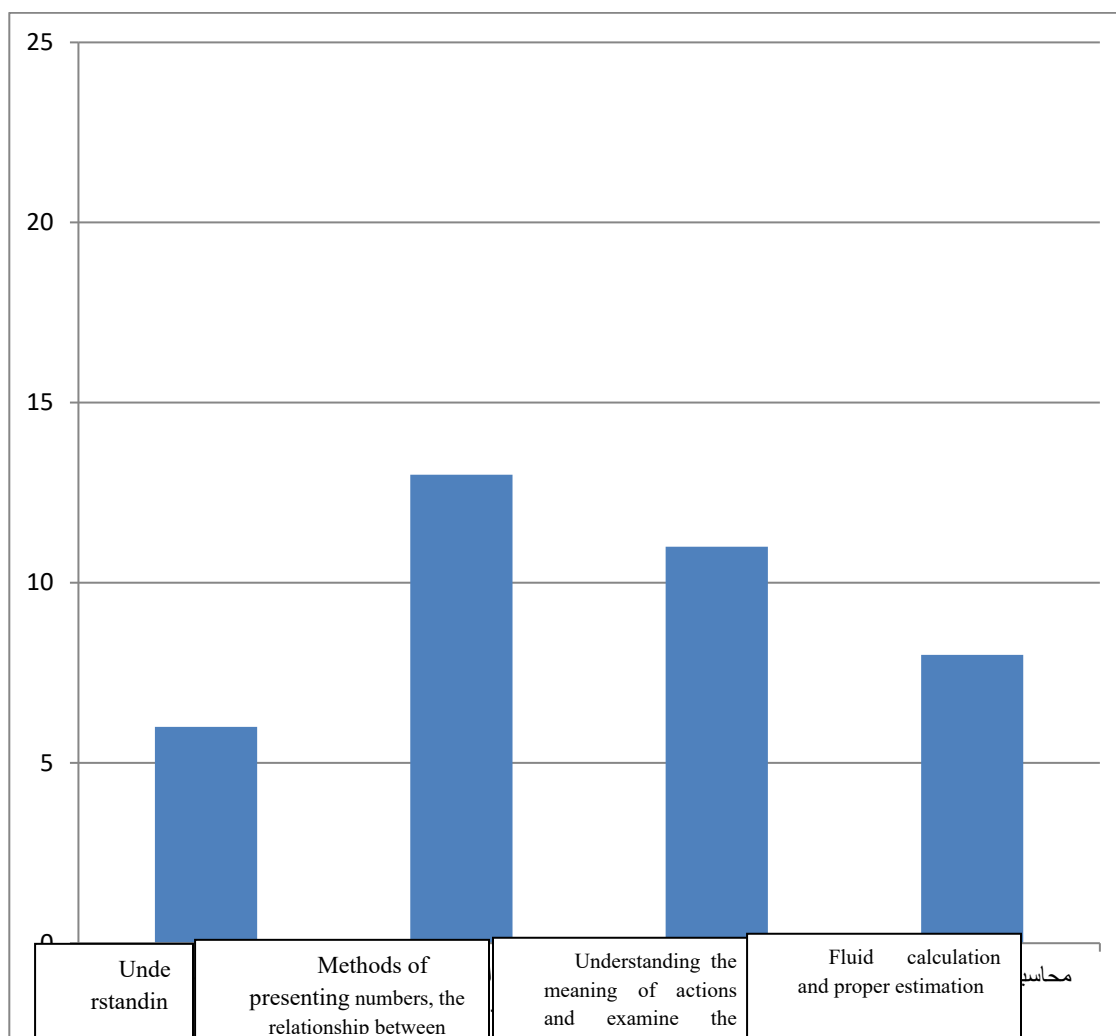


Chart 2. Chart of compliance of the main components with the content of the classroom activities of the first, second and fourth chapters

Table 11. Distribution of points of the main and sub-components of the standard numbers and operations for exercises

Sub-components naming	Sub-component score	Percentage of points	Main component point
A	4	8	8
B	4	8	
C	5	10	
D	5	10	17
E	1	2	
F	3	6	
G	3	6	
H	4	8	
I	1	2	13
J	1	2	
K	2	4	
L	5	10	
M	3	6	
N	1	2	11
O	4	8	
P	1	2	
Q	2	4	

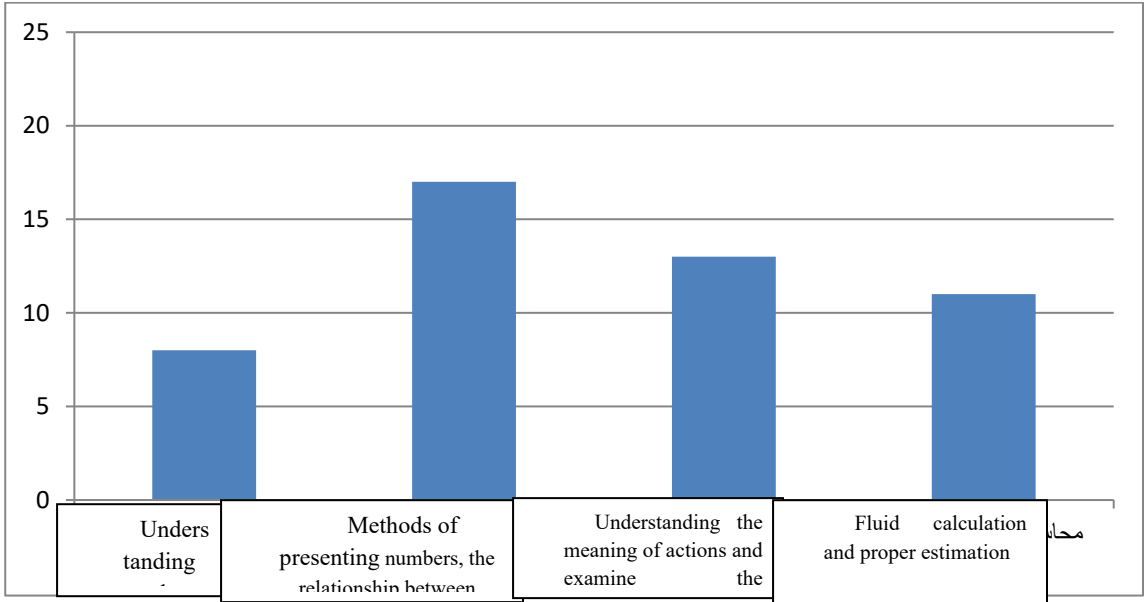


Figure 3. Diagram of the adaptation of the main components to the content of the exercises of the first, second and fourth chapters

*Research Question 2:* Does the content of the ninth math textbook adhere to the NCTM algebra components and standards?

Full compliance with the first component of the algebra standard is worth 55 points, the second component is worth 30,

the third component is worth 20, and the last component is worth 5. When a chapter receives a total of 110 points from the key components of the NCTM checklist, it meets the standard of algebra in all three circumstances of activity, work class, and practice.

Table 12. Distribution of points of the main and sub-components of the algebra standard for activities

Sub-components naming	Sub-component score	Percentage of points	Main component point
2	3	3	23
B	2	3	
C	3	5	
D	4	6	
E	4	6	
F	1	2	
G	5	8	
H	4	6	
I	1	2	
J	2	3	
K	5	8	
L	5	8	18
M	5	8	
N	1	2	
O	5	8	
P	1	2	
Q	1	2	
R	3	5	13
S	3	5	
T	4	6	
U	3	5	
V	2	3	2

Table 13. Distribution of scores of the main and sub-components of the algebra standard for classroom activities

Sub-components naming	Sub-component score	Percentage of points	Main component point
A	4	5	42
B	2	3	
C	4	5	
D	5	6	
E	5	6	
F	3	4	
G	5	6	
H	4	5	
I	1	1	
J	4	6	
K	5	6	
L	5	6	18
M	5	6	
N	1	1	
O	1	6	
P	1	1	
Q	1	1	18
R	5	6	
S	4	5	
T	5	6	
U	4	5	2
V	2	3	
	80	100	80

Table 14. Distribution of points of the main and sub-components of the algebra standard for exercises

Sub-components naming	Sub-component score	Percentage of points	Main component point
A	1	2	29
B	1	2	
C	1	2	
D	5	8	
E	5	8	
F	2	3	
G	5	8	
H	1	2	
I	1	2	
J	2	3	
K	5	8	
L	5	8	19
M	5	8	
N	1	2	
O	5	8	
P	2	3	
Q	1	2	

R	2	3	100
S	2	3	
T	2	3	
U	4	6	
V	4	6	4
Total	62	100	62

*Research Question 3:* Is the content of the ninth math textbook consistent with the NCTM geometry components and standards?

Full compliance with the first component is 40 points, the second component is 20, the third component is worth 15, and

Table 15. The distribution of points of the main and secondary components of the geometry standard for activities

the fourth component is 30 points, according to the main standards and their sub-components. When a textbook's content passes the NCTM criterion for geometry standards, it receives 105 points.

Sub-components naming	Sub-component score	Percentage of points	Main component point
A	4	7	27
B	3	5	
C	2	3	
D	4	7	
E	4	7	
f	4	7	
G	5	8	
H	1	2	
I	3	5	12
J	3	5	
K	3	5	
L	3	5	
M	3	5	5
N	1	2	
O	1	2	
P	4	7	17
Q	3	5	
R	3	5	
S	2	3	
T	4	7	
U	1	2	
	61	100	61

Table 16. Distribution of scores of the main and sub-components of the standard geometry for classroom activities

Sub-components naming	Sub-component score	Percentage of points	Main component point
A	3	5	26
B	3	5	
C	3	5	
D	4	7	
E	4	7	

f	3	5	
G	5	8	
H	1	2	
I	4	7	13
J	3	5	
K	3	5	
L	3	5	
M	4	7	
N	1	2	8
O	3	5	12
P	2	3	
Q	2	3	
R	2	3	
S	2	3	
T	3	5	
U	1	2	
Total	59	100	59

Table 17. Distribution of points of the main and sub-components of the standard geometry regarding exercises

Sub-components naming	Sub-component score	Percentage of points	Main component point
A	3	6	25
B	2	4	
C	2	4	
D	2	4	
E	5	11	
f	5	11	
G	5	11	
H	1	2	
I	1	2	6
J	2	4	
K	2	4	
L	1	2	
M	1	2	3
N	1	2	
O	1	2	
P	2	4	13
Q	2	4	
R	1	2	
S	2	4	
T	5	11	
U	1	2	

Total	47	100	47
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*Research Question 4:* Is the content of the ninth math book consistent with the NCTM measurement components and standards?

score of 5 and the second requiring a score of 20. As a result, the score is 25 in order to comply with the book's content and the measuring norm.

The two primary components of the standard components of measurement are given equal weight, with the first requiring a

Table 18. Distribution of scores of the main and secondary components of the standard of measurement for all book topics

Main components	Sub-components	Sub-component score	Score percentage	Main component score
Understanding the measuring properties of objects, units, devices and measurement processes	Deciding on units and scales that are appropriate for situations of measurement issues.	2	20	2
Applying appropriate techniques, equipment, and formulas for sizing	Analysis of accuracy, precision and approximate error in measurement conditions	1	10	8
	Understanding and using formulas for area, surface area, and volume of geometric shapes, including cones, spheres and cylinders	5	50	
	Applying the common concept of consecutive, upper and lower bound and approximation in measurement situations	1	10	
	Using unit analysis to check measurement calculations	1	10	
Total		10	100	10

*Research Question 5:* Is the content of the ninth math book congruent with the data analysis and NCTM probability components and standards?

component, the second component, the third component, and the fourth component, which requires 20 points to achieve a full score. As a result, the book's content is assessed against the standard, and it is likely that it will obtain a total score of 95.

This standard is broken into four main components, each of which requires 25 points to earn a complete score: the first

Table 19. Distribution of standard and sub-standard component points of standardized data and probability for the whole book

Components naming	Sub-component score	Score percentage	Main-component score
A	2	7	7
B	2	7	
C	1	3	
D	1	3	
E	1	3	
F	1	3	5
G	1	3	
H	1	3	
I	1	3	
J	1	3	
K	2	7	7
L	2	7	
M	2	7	

N	1	3	
O	3	10	11
P	3	10	
Q	1	3	
R	1	3	
S	3	10	
	3	100	30

Table 20. Summary of research results

NCTM standards	Content compliance rate
Numbers and operations standard	54%
Algebra standard	63%
Geometry standard	53%
Measurement standard	40%
data analysis and probability standard	31%

### Conclusion

The results are achieved by using the NCTM checklist on the standard compliance of numbers and operations in the ninth math book chapters. Thus, the book's activities on the main component "understanding numbers" account for 80% of the book's activities, with the component "methods of presenting numbers, the relationship between numbers, number system" accounting for 52 percent, and the main component "understanding the meaning of actions and examining the relationship with other elements" accounting for 48% of the book's activities, and finally, it accounts for 36% of the component "fluent calculation and proper estimation." The ninth-grade math workbook scores 60 percent on the main component "understanding numbers," 52 percent on the component "methods of representing numbers, the relationship between numbers, and the number system," 48 percent on the main component "understanding the meaning of operations and examining the relationship with other elements," and finally 32 percent on the component "fluent calculation and proper estimation." Exercises in the ninth math book are 80 percent consistent with the main component "understanding numbers," 68 percent consistent with the component "methods of representing numbers, the relationship between numbers, number system," 52 percent consistent with the main component "understanding the meaning of operations and examining the relationship with other elements," 44 percent consistent with the component "fluent calculation and proper estimation," and finally, 44 percent consistent with the component "fluent calculation and proper estimation." Finally, around 54% of the information in the first, second, and fourth chapters is based on NCTM's standard of numbers and operations. The results are achieved by using the NCTM checklist on compliance with the algebra standard in the ninth chapter of the math textbook. As a result, the book spends 60%

of its time on the main component of "understanding patterns, relationships, and functions," 60% on the component of "mathematical expression and analysis of situations and structures using algebraic symbols," 60% on the main component of "using mathematical models to express, and understand quantitative relations," 65 percent on the main component of "using mathematical models to express, and understand quantitative relations," and finally 40% on the component of "change of analysis in different contents." Class work consists of 76 percent on the main component "understanding patterns, relationships, and functions," 60 percent on the component "mathematical expression and analysis of situations and structures using algebraic symbols," 90 percent on the main component "using mathematical models to express and understand quantitative relations," and 40 percent on the component "change of analysis in different content." Book exercises are 52 percent compatible with the main component of "understanding patterns, relationships, and functions," 63 percent compatible with the component of "mathematical expression and analysis of situations and structures using algebraic symbols," 50 percent compatible with the main component of "using mathematical models to express and understand quantitative relationships," and finally 80 percent compatible with the component of "change analysis in different content." Finally, around 63 percent of the material in the ninth math book's chapters on the application of the key NCTM standards is based on the algebra standard.

Results are produced by using the NCTM checklist to verify conformity with the geometry standard in the chapters of the ninth math book. Thereby, the book's activities on the main components of "analysis of properties in the properties of two- and three-dimensional geometric shapes, expansion of the mathematical discussion of geometric relations" (67%), "locating and describing spatial relations using coordinate

geometry and other representational systems" (60%), and "using transformations and using symmetry to mathematically analyze situations" (34%) correspond to the main component of "using transformations and using symmetry to mathematically analyze situations" (34%). Classroom activity on the main components "Analysis of properties in the properties of two- and three-dimensional geometric shapes, expansion of the mathematical discussion of geometric relations" (65%), "Determining the location and description of spatial relations using coordinate geometry and other representational systems" (65%), with the major component of "using transformations and symmetry to mathematically evaluate circumstances" accounting for 53%, and the component of "using visualization, spatial reasoning, and geometric modeling to solve issues" accounting for 40%. "Analysis of qualities in the properties of two- and three-dimensional geometric forms, an extension of the mathematical discussion of geometric relations" are the primary component's exercises. 62.5 percent, 30 percent for "determining the location and description of spatial relations using coordinate geometry and other representational systems," 20 percent for "using transformations and using symmetry to mathematically analyze situations," and 43 percent for "using visualization, spatial reasoning, and geometric modeling to solve problems." Finally, the geometry standard accounts for around 53% of the material of the ninth math book's chapters on the application of the key NCTM standards.

Results are achieved by using the NCTM checklist on measurement standard compliance in all chapters of the ninth math book. As a result, the book's activities account for 40% of the main component, "knowing the measuring qualities of objects, units, devices, and measuring processes," and 40% of the main component, "applying suitable procedures, equipment, and formulae for measuring." Finally, around 40% of the material in the ninth math book's chapters on the application of the key NCTM standards is based on the measurement standard.

The results will be produced in all chapters of the ninth math textbook by using the NCTM checklist on standard compliance data analysis and probability. In such a way that the book's activities focus on the main component of "designing questions that can be answered with data, collecting, organizing, and displaying information about them to answer questions" 28 percent, "selecting and using appropriate statistical methods for data analysis 20 percent," "developing and evaluating inference and forecasting based on data" 35 percent, and finally, "understanding and applying inference and forecasting based on data" 35 percent. Finally, the content of the chapters of the ninth math book about compliance with the key NCTM

standards has been assessed to the tune of 31% in accordance with the standard, and the probability has been created.

With the answers acquired, it is now able to answer the major research issue of whether the content of the ninth-grade math textbook conforms with the NCTM standard. Based on the results, the highest level of compliance with the book's content is found in the algebra standard (63%), and the lowest level of compliance is found in data analysis and probability (31%), with the total compliance of the book's themes with all NCTM standards being about 53%.

Because the book's content analysis is based on NCTM standards, and this institute is the American-Canadian Teachers Association, it is not possible to join and study its latest achievements in content analysis, and the research should be based on the principles of NCTM standards for more accurate access to resources. According to the findings of a content study of other recently published first and second secondary school books using scientific methodologies, their strengths and flaws were identified

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None

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