



Jordanian Elementary Math Curriculum and Geometry Content along with National Council Teachers of Mathematics (NCTM) Grades (1-6) as Case Study

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ABSTRACT

This study aimed to analyze geometry content of math text books for first grade to sixth grade in Jordan, along with the National Council of Teachers of Mathematics (NCTM). The researcher analyzed the content of these text books for geometry subject, trying to ally these standards to (NCTM) standards. 21 standards determined and divided into four categories. Four categories ranged between not available to highly available reflecting inconsistency geometry content to some extent in accordance with geometry standards of the National Council Teachers of Mathematics (NCTM). This result agreed with Gonzalezgomez study (Gonzalezgomez, 1994). Pickreign and Capps (2000) reported that more attention and professionalism should be applied when writing math curricula.

Keywords:

Geometry, Content Analysis, National Council Teachers of Mathematics (NCTM)

INTRODUCTION

Geometry represents one of the relevant branches and key components in mathematic. It provides learners with necessary basic skills for working life, such as spatial awareness exploration skills, problems solving ability, Deductive reasoning, guess, and includes all aspects of learning knowledge needed to understand and interpret learned aspects of other knowledge involving different branches of mathematics. (NCTM) Conference held in 1989 pointed out the necessity of growth emphasis on Geometry at all levels in the nineties up to the twentieth century to think about leading standards; because knowledge and the relationship grasp of Geometry linked to the personal daily life, as well as closely allied them to understand other scientific issues, which leads to paying much attention to methods of teaching geometry. Many countries, especially developed ones, seeks to develop methods and means of teaching mathematics including Geometry. The important role of this field in societal development fit into the competitive world of science and technology. United States shocked in 1957 when the Soviet Union launched Sputnik Rocket; that event sparked the scientific conflict at the international level and was a living proof of mathematical power. United States blamed schools curriculum and rushed to develop this curriculum. For that reason, the report "A Nation at Risk" and a number of mathematics reports appeared such as Agenda for Action, and "Everybody counts" highlights the crucial role of geometry. Geometry describes it as one of the most prominent faces of human civilization since mankind began to build houses. Geometry has a significant role in logical thinking. In 1986, a committee of directors of the National Council of Teachers of Mathematics (NCTM) establishes a working group to develop mathematics teaching standards to improve school mathematics skill and, evaluate the curriculum and methods of teaching mathematics to be consistent with what must be to face the future (Michael, 2001). This committee in 1989 has emerged what professed curriculum standards document and School Mathematics Curriculum plan and, Standards Evaluations, which represents the initial effort by the educational institution specializing in mathematics, this document reflected early visions attitudes and perceptions of those interested in, and mentors mathematics school teachers, as well as educators and researchers (Olsan and Berk, 2001). The role of both student and teacher has changed the student role; it has changed from negative recipient of information to an active participant in the educational process. The teacher's role has also changed from the carrier container of knowledge to the sender runs on the educational experience.

Strenuous and straining efforts made to formulate these standards. The initial standards drafting took three years of lengthy effort research, lengthy meetings of all sectors of mathematics education to gain access to best

fit of knowledge and development era (Zollman and mason, 1992). Clarity, objectivity, and comprehensiveness are features that characterized both 1989 standards and 2000 standards. Many studies were conducted including these standards (Jetton, 1991; Irvin, 1993; Cooper, 1996; Westberry, 2000; Joyner and Bright, 2001, 1999; TIMSS, 1999). 5,052 students selected from forty-seven (47) schools in Jordan, the Jordanian students ranked thirty-two (32) in terms of achievement of the thirty-eight (38) Countries participated in this study. The Jordanian students' performance is as follows; 3% Excellent, 8% Good, 21% Acceptable, 30% Average and 38% "Poor" meaning that 68% of them failed to reach the level of international Average performance (Adas Abu Lebda, 2000). An international study in 2003 results announced in 2004, as (4489) eighth grade students participants from Jordan rank 32 among 45 Countries, Jordanian students rank (242) with a standard deviation of 4.1, which is lower than the international average.

The same results appear in 2007 and almost the same percentage. The importance of the textbook, as a translation of a functional curriculum, is the main key upon which the student, the teacher and supervisors are base. There was a serious need to detect the extent of inclusion of the National Council of Teachers of Mathematics (NCTM Standards). Further research investigates the standards association in mathematics textbooks in Jordan as this study attempts to reveal mathematics curriculum identity and its relationship to the global trends. The importance to this study came from the importance of the Geometry content analysis through mathematics books for elementary grades according to geometry curriculum standards contained in the National Council of Teachers of Mathematics (NCTM Standards).

Study Objective

The aim of this study is to analyze mathematics books /geometry content for the elementary grades in Jordan according to the National Council of Teachers of Mathematics standards (NCTM), to determine to what extent these standard matches.

Study Questions

This Study attempted to answer the following questions:

1. What are the standards issued by the National Council of Teachers of mathematics (NCTM) in Geometry subject of elementary grades mathematics books in Jordan (grades 1 to 6)?
2. What is the availability of these standards in elementary grades mathematical books (Geometry subject) in Jordan (grades 1 to 6)?

The Study Importance

1. Provide the concerned people by a planned curriculum according to global standards in order to be taken into account when building developing curricula and writing textbooks.
2. Open the way for further researches and studies in a different area's development.
3. Help in analyzing the fourth grade curricula due to inadequate performance in TIMSS exam.

Study variables

1. Content analysis: A technique used along with other methods, to evaluate and develop curriculum. Based on determining the objectives, goals, unit content analysis.
2. Content: detailed topics to be in the books, as goals and objectives had identified and placed in the index of the book, elaborating on these topics as contained in the textbook called the curriculum content, and usually includes facts, knowledge, concepts and generalizations, principles, rules, and theories, problems and exercises.
3. Geometry content: is part of the scientific material contained in mathematics books, which intended to explore: concepts, geometry skills, facts and activities contained in these books.
4. The National Council Teachers of Mathematics (NCTM, 2000) considered being the main criteria used in many countries when writing math curriculum.
5. The National Council Teachers of Mathematics (NCTM, 2000) considered for this study.

Study Limitations

The study results determined and limited by the following:

1. Math books of the elementary school of basic education in Jordan.

2. Analysis process of Geometry subjects of mathematics books only for the elementary education in Jordan.

Study sample and population

The study conducted on the written students' school mathematics books assessed on Elementary education 2006/ 2007, the study sample included all of mathematics books of grade(1-6) of basic education in Jordan.

METHODOLOGY

A descriptive method used in this study through the content analysis technique, which is A structured series of steps that seek to discover the meanings inherited in the content, connectivity and relationships of these meanings, through quantitative research design and categorization features of the phenomenon in this content. Content analysis is a research tool used to determine the presence of certain words or concepts within texts or sets of texts. Researchers quantify and analyze the presence, meanings and relationships of such words and concepts, then make inferences about the statements and expressions within the texts, the writer(s), the audience, and even the culture and time of which these are a part. Texts in a single study may also represent a variety of different types of occurrences.

The Study Tools

Geometry standards of the National Council of Teachers of Mathematics (NCTM) reviewed for all stages from kindergarten to the second grade (k-2), the third grade to fifth grade (3-5), and sixth grade. List of (21) criterion for the geometry content for the elementary stage (math books) were divided into four categories as in Table (1).

Table 1: List of Geometry standard

First, Analyze the geometric properties of two-and three- dimensional.	1	Identify and Compare the geometric shapes in 2D and 3D
	2	Draw geometrical shapes in 2D and in 3D
	3	Analysis of the properties of geometric shapes in 2D and 3D
	4	Classification of geometric shapes in 2D and 3D according to their properties
	5	Develop a vocabulary and definitions of types of shapes and their properties
	6	Predict the results of split or merge or convert forms
	7	Explore the congruence or similarity
	8	Test geometrical properties and relationships to develop logical arguments to justify the results by conjectures
Second, using the GPS coordinate geometry and other systems of representation	9	Describe the locations of objects and spatial movement in the space
	10	Interpretation of the direction and distance of spatial objects in a space
	11	The use of coordinate systems or networks or maps to determine locations and description of the tracks and find the distance between the points
Third, the application of engineering to the analysis of transfers attitudes.	12	Identify withdrawal or rotation or reflection
	13	Application of the withdrawal or rotation or reflection
	14	Describe the movement or series of movements that show the two forms match
	15	Set the line of symmetry or rotation of geometric shapes
	16	

Table 1 Continues

Fourth, the use of mental visualization to solve problems.	1 6	Differentiate geometric shapes through different dimensions
	1 7	Describe the mental perceptions of things or tracks or patterns using the spatial Body building
	1 8	Three -dimensional representations of the two dimensions of the object
	1 9	Two -dimensional representation of three-dimensional body
	2 0	Use of models or ideas in a number of geometry and measurement
	2 1	Identify shapes and geometric structures in the space

The following standard applied to consider the degree of availability; 100-85 (very high), 85-70 (high), 70- 55 (moderate), 55-40 (low), 40 -0 (not available). The validity, reliabilities, and stability of the tool confirmed by the arbitrators using the Holisti equation which is equal to 0.93. Geometry content analysis procedure:

Three of each, mathematics supervisors, best in-service teachers, PhD students who are teaching mathematics in high schools due to their competencies and experience were chosen. Geometry content analysis went according to the following steps:

- 1) Review and determine the units of the study.
- 2) Review Geometry Standard of NCTM.
- 3) List every paragraph, every training activity or issue, or a problem and examples.
- 4) Find the availability of the standard in each subject and standardize it.

5) Count the number of repeated standard in the analyzed subjects.

6) Tabulating these outcomes.

Study Findings and discussion

To answer the first question which is "What are the standards issued by the National Council of Teachers of Mathematics (NCTM) related to Geometry subject contained in elementary grade mathematics books of basic education in Jordan (grades 1 to 6)". The answer to this question was the starting point for the rest of all other study steps and procedures. The standard divided into four main categories, each category contains a number of geometry standards as in Table 1. To answer the second question: which is "What is the availability of these standards in the Geometry subject of elementary grade mathematics' books for basic education in Jordan (grades 1 to 6))" and to what extent. The arithmetic mean computed to determine the percentage degree of standards availability in the study sample, as in table 2.

Table 2: Arithmetic averages in percentage of analysts' estimates for each of the standards for category (I) for the elementary grades

	Standard	1 st	2 nd	3 rd	4 th	5 th	6 th	Average
First, analyze the geometric properties of two- and three-dimensional	1 Identify and Compare the geometric shapes in 2D and 3D	62.3	94.8	92.5	99.8	100	100	91.5
	2 Draw geometric shapes or build in 2D and in 3D	67.5	69.5	80.3	87	88.5	90	80.5
	3 Analysis of the properties of geometric shapes or 2D and 3D	46	42.8	52.5	96.3	97	99.3	72.5
	4 Classification of geometric shapes in 2D and 3D according to their properties.	30	29.3	66.8	91.8	93.3	96.8	68
	5 Develop a vocabulary and definitions of types of shapes and their properties	37.5	51.3	69.3	52.5	60	66.8	56.3
	6 Predict the results of split or merge or convert forms	32.5	30	51	80.5	85.8	87.8	61.3
	7 Explore the congruence or similarity	18	19.8	30.3	80.8	88	91.5	54.8
	8 Test conjectures about geometric properties and relationships to develop logical arguments to justify the results	12.3	33.5	54.5	37.3	40	43	36.8
Average		38.3	46.4	62.3	78.3	81.5	84.5	72.8

Table 2 shows that, the overall average availability of standards in the first category was 72.8; this means that the degree of availability of standards related to this category of geometry content standards distributed according to the degree of availability varies from extremely high to low. For example, the criterion "Draw geometric shapes or build in 2D and 3D," with a high degree of availability, "To identify and compare geometric shapes in 2D and or 3D," extremely high degree of availability. There are four standard moderately available "Classification of geometric figures two or three dimensions according to their characteristics", "Analyze the properties of geometric shapes 2D and 3D", "Predict the results of split or merge or convert forms and objects", "Develop a vocabulary and definitions of types of shapes and their properties". "Explore the congruence or similarity", with a low degree of availability, it must be pointed out to the need for increasing attention to their availability in the content. "Test conjectures about geometric properties and relationships to develop logical

arguments to and justify the results," is 36.8%. Considering the level of awareness and understanding of testing guesses and develop logical arguments to predict the results in the early age. Contrary to other countries like Singapore and the United States curricula which focus on training students even kindergarten children on how to predict and justify the results. The standard of this category in terms of availability gradually rises in sixth grade, the average availability of this category standards. The degree of availability standard for the first category was high, followed by the fifth grade with average availability of standards (81.5%). Fourth grade with average availability. The third moderate degree of availability, the second grade with no availability, finally not available in the first grade (38.3%); where the availability of standards over all is moderate, and this logical sequence takes into account the mental development of the pupil which is a cumulative in hierarchy process.

Table 3: Arithmetic averages in percentage of analysts' estimates for each of the standards for category II for the elementary grades

		Average calculated by analysts for grades	1 st	2 nd	3 rd	4 th	5 th	Th 6	Avges
Second, using the GPS coordinate geometry and other systems of representation.	1	Describe the locations of objects and spatial movement in the space.	8.3	4.3	8.3	20.8	10.5	8.5	10
	2	Interpretation of the direction and distance of spatial objects in the space	12.5	16.8	29.3	12.5	17.8	22.3	18.5
	3	Uses coordinate systems or networks or maps to determine locations and description of the tracks and find the distance between the points	8.3	66.8	83.3	25	56.3	63.8	57.5
		averages	23.5	29.3	40.3	19.5	28.3	31.5	28.8

Table 3 shows average of the availability of standards in the second category (28.75). Geometry subject standards for category II in the first to sixth grade were not available. This is an indication of the lack of enriching the geometry content with this standard. Also indicates that the availability of standards ranged between medium to not available. The standard "Use of coordinate systems, networks, maps to determine locations and description of the tracks, finding the distance between two points," was in moderate degree of availability. The degree of availability of this standard varies from not available in the first grade to highly available in the third grade. "Networks used frequently in solving activities", especially in the second grade and the fifth grade. There was high availability standard in the third grade. Though, it must be pointed out that, there is need for increasing attention to this standard to teach the students on how to use coordinated systems to find the distance between points especially in higher grades, the standard "Description of locations and objects movement in a spatial space" not available in first grades, sixth grade and exceptionally low of availability in the fourth grade,

despite the importance of these standards for the pupils to know directions and positioning (above, below, right, left, ...). The content should help pupils to use geometric concepts like distance, location, direction and movement of objects, maps in the classroom using drawing papers, for example, students should learn how to draw paths to get from home to school using axis and compare paths to determined the shortest distance. The same question can be asked to change the starting point and compute the path's length. This standard is not available. The standard "the interpretation of the direction and the distance of objects in a spatial space" with no degree of availability which is equal (18.5), in which the student can express himself to clarify reasons, to explain the direction and distance of objects in a spatial space, it should be pointed out to pay more attention to this standard. There are fluctuations in the presence of these standards in the geometry content for the first grade to sixth grade due to the authors' different levels of education and level of experience and perception as in table 4.

Table 4: Arithmetic averages in percentage of analysts' estimates for each of the standard for category III

		Standards	Average calculated by analysts for grades						Avg
			1 st	2 nd	3 rd	4 th	5 th	6 th	
Third, the application of Engineering for the analysis of transfers attitudes math	1	identify the withdrawal or rotation or reflection	0	0	0	0.5	7	8.3	2.8
	2	Application of the withdrawal or rotation or reflection	0	0	0	8.3	11.5	13	5.5
	3	Description of the movement or series of movements that show shapes congruent	8.25	25	25	33.3	42.5	25.8	27.5
	4	determine symmetry lines or geometric shapes' rotation	0	0	0	4.25	6.3	11.2	3.8
			0.25	6.25	6.25	11.5	16.8	14.5	9.5

Table 4 shows that, the overall standards average of availability in the third category was 9.5; which means that the standards of NCTM in this category are not available in the geometry subject for (the first grade to sixth grade) math text books. This therefore is an indication to the lack of these standards in general in the curriculum, where it is not available in the first grade, "Description of the movement or series of movements that show shapes congruent," not available for first to sixth

grade except for the fifth grade where the degree of availability was low. The standard, and "Determine symmetry lines or geometric shapes' rotation", with a low degree of availability which is equal to 3.8, which means that these standards are not available for grades one to six; and were not introduced logically as in the previous categories, perhaps this due to the different authors' academic backgrounds and experience.

Table 5: Arithmetic averages in percentage of analysts' estimates for each of the standard for category IV for the elementary grades

	Standards	Average calculated by analysts for grades						Average
		1st	2nd	3rd	4th	5th	6th	
Fourth, the use of mental visualization to solve problems.	1 Discrimination of geometric shapes through various dimensions	37.5	45.8	50	79.3	86.8	97.3	66
	2 Description of mental perceptions forms of paths , or patterns using spatial memory	16.8	45.8	57.5	37.5	41.3	38.8	39.5
	3 Building objects in 3D and its representations of 2D of that body	8.3	45.8	25	8.3	9.8	49.8	24.5
	4 Draw a representation of a two-dimensional objects in three-dimensional	8.3	12.5	21.3	4.3	3	3	8.75
	5 use of models or ideas in a number of geometry and measurement	50	75	80	90	100	100	82.5
	6 Identify the geometrical shapes and structures in the real world	32.5	50	72	75	83.5	97.5	68.5
		29	45.8	51	49	54	64.5	48.3

Table 5 shows that, the overall average availability of the standards reached in the fourth category was 48.3. The degree of availability of standards related to this category was low; it was found that two out of the six standard appeared in the first six grades in a moderate level, "discrimination geometric shapes through various dimensions identify the geometrical shapes and structures in the real world " and, "Description of mental perceptions and forms for paths or patterns using spatial memory" with low degree of availability. More attention must be given to these standards, especially linking the content of the real world of the pupil to satisfy their needs. This outcome agrees with Siepka (1999), and the study of the Arab Centre for Educational Research in Gulf States (2000), which shows that the geometrical content unrelated to students' real life problems. While the availability of standard "usage of modeling or ideas in a number of geometry and measurement" was extremely high of availability, also indicate its vast importance for later math courses and other area of science, meaning that the authors took a good care in this standard. It is

worth mentioning that the standard "building objects in 3D and its representations of 2D of that body, is only available in the second grade and sixth grade with low degree of availability. "Draw Representation of two-dimensional objects in three-dimensional" it is only available with low degree of availability in third grade and sixth grades and it is not available for the other grades.

he standards for the fourth category increased progressively starting from the first grade. Where the overall degree of availability was moderate, there may be a logical result as adding to geometrical knowledge gradually.

Findings and interpretation

availability of geometric standards identified in each class book separately. The comparison between the results for all classes in terms of standards' availability of four categories in each book, and in each category as in table 6.

Table 6: Average availability of standards in the four categories for each book and in each category

category	Average of availability of the standard						
	First	Second	Third	Fourth	Fifth	sixth	Average
First	38.25	46.3	62.3	78.3	81.5	84.5	72.8
Second	23.5	29.3	40.3	19.5	28.3	31.5	28.8
Third	0.25	6.25	6.25	11.6	16.8	14.5	9.5
Fourth	29	45.8	51	49	54	64.5	48.3
Accumulative average	22.75	31.9	39.9	39.6	45.1	48.8	39.8

Table 6 shows that, four categories ranged between not available to high, reflecting inconsistency geometry content to some extent in accordance with geometry standards of the National Council of Teachers of Mathematics (NCTM). This result agreed with Gonzalezgomez (1994), Pickreign and Capps (2000).

RECOMMENDATIONS

The following are strong recommendations made relative to the tendencies of students and their needs, when writing math books for the first sixth grades of the basic education.

- Increase the number of activities that encourage students to draw and build three-dimensional objects. Educational activities in first sixth grade books to the environment and the students Daily experience.. Pay more attention to the availability of the standards, "identification and characterization of sites", "tracks and change the direction", "distance of objects in a spatial space". Train academic, educational and authors of mathematics to technical approaches of the mathematics curriculum in the light of the standards of the National Council of Teachers of Mathematics (NCTM).

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