

## The Compatibility of Developed Mathematics Textbooks' Content in Saudi Arabia (Grades 6-8) with NCTM Standards

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### Abstract

This study aimed to investigate the compatibility of developed mathematics textbooks' content (grades 6-8) in Saudi Arabia with NCTM standards in the areas of: number and operations, algebra, geometry, measurement, data analysis and probability. To achieve that goal, a list of (NCTM) standards for grades (6-8) were translated to Arabic language, and a content analysis card was developed in the light of standards list for mathematics textbooks for the academic year 1434-1435 AH / 2013-2014 AD. The study results revealed that the content of developed mathematics textbooks for grades (6-8) is compatible with 96.3% with NCTM standards, since the content anticipate 52 expectations from the standards list, while 3.7% from the NCTM standards expectations list were not achieved in the mentioned five areas.

**Keywords:** compatibility, NCTM Standards, developed curriculum, mathematics textbooks

### Introduction

With overall development of the education in Saudi Arabia in various fields and with the aspirations of the Ministry of education to practice all new authentic paradigm in the teaching and learning area, there have been many developments and changes in the curricula, particularly mathematics and science curricula (Saeed; Abdel Hamid & al-Shalhoub 2011). Therefore, Mathematics curricula development was essential part of a major project to develop the curriculum of mathematics and natural sciences in Saudi Arabia. This project was based on ten principles which are: student-centered learning, multimedia-based thrills, multiple entries learning, knowledge sharing, connection and representation in multiple ways, learning through collaborative, active learning based on survey and exploration, development of thinking skills, decision-making skills, development of planned initiatives, linking the learner with real life contexts (Ministry of education 2006)

The movement of global standards that have emerged since the 1980s is one fundamental of Mathematics teaching and learning development (Obaid 2010). The issuing of the National Council of teachers of Mathematics (NCTM) the mathematics standards document in 1989 and reissued in 2000, was clearly pointed out to what extend should be the basis of mathematics education in the current era, and call for a general basis in mathematics learning for all students with recognition of the differences among them, and give them a chance to show different abilities and talents keeping in mind varied achievements, needs and interests in Mathematics, however, all students must be able to receive instruction in mathematics at a high level. (Abbas & Al-Absi 2007).

The NCTM standards document (NCTM 2000) have included six principles for school mathematics: equity, curriculum, teaching, learning, assessment, technology, as well as 10 standards for grades pre-k-12 were divided into two parts; content standards, which describes clearly what students must learn, and comprise standards for number and operations, algebra, geometry, measurement, and data analysis & probability. Process standards, which describes the ways of acquiring and using the knowledge and comprise standards for problem solving, reasoning and proof, communication, connections, and representation.

The standards have an important role in the development of educational process such as increasing the capacity of learners and their chances of success, describing what must be teaching and learning processes follow to improve learning outcomes and increase the confidence of the community in education, emphasizes the quality of education, provide the education systems with foundations for clear evaluation accepting accountability (Almaghrabi 2005).

There are a numerous studies (Ardisana 2006; Heitmann; 2006; Wood2006; Blackwell 2001) had applied mathematics programs based on NCTM standards in some USA States and declared that the importance of applying standards would: raise the level of student achievement in mathematical knowledge and skills who have learned from teachers who received support in the light of the standards-based education programs, improve students ' academic language skills particularly writing skill, address the low level of students in learning mathematics, and improve the professional growth of teachers and educational leaders.

Considering the importance of standards, several studies has evaluate the content of mathematics in the light of NCTM standards in different educational levels, like the study of (Ali & Alshehri 2013) in which revealed that the content of developed mathematics textbooks in grades (3-5) in Saudi Arabia has matched by 93.7% with NCTM standards in the areas of: number and operations, algebra, geometry, measurement, and data analysis & probability. Also, (Nassar 2011) showed that there is a lack of (18) algebra concepts in Palestinian mathematics curriculum content in grades (6-8) in terms of NCTM standards, moreover, the study of(Shatat

2009) assured that the construction of mathematics curriculum standards in grades (1-6) are consistent with Egyptian national standards indicators.

(Assaf 2008) study results showed that the NCTM standards matching in the area of geometry and measurement in grades (3-5) in Saudi Arabia are varying in proportions and the lack of sub standards were 43.24% in the content of geometry and 25% in the content measurement. The study of (Hilal 2009) had showed that the content of algebra in middle school in Saudi Arabia considers only three standards of the NCTM standards, on the other hand, (Bayoumi 2008) study results indicating deficiencies in geometry content that compatible with Egyptian standards indicators for mathematics education.

In addition, (Aldhaib2007) study results showed that availability of mathematical procedures standards and mathematical content are weak in mathematics textbooks for the basic stage in Palestine in terms of NCTM standards. (Aldowairy & Alqudah 2006) study results showed that there is a difference between mathematics curricula content in Saudi Arabia and Jordan in terms of compatibility with NCTM standards in favor of Saudi curricula content in the area of representation and connections.

Study of (Alnatheer 2005) which showed that there is a lack of NCTM standards compatibility in mathematics curriculum standards document in Saudi Arabia in middle school in the area of geometry, and measurement, moreover, (Nissen 2000) study results showed that high school textbooks did not meet the standard in the area of geometry, whereas the intermediate and elementary textbooks succeeded in achieving these standards, and the study of (Pickreign & Capps 2000) results were clearly indicate that there is a substantial misalignment between the geometry presented in the textbooks, the geometry expected to be taught by groups such as NCTM.

From previous studies, It is clear that assessing mathematics textbooks content in the light of the NCTM standards represents an important pillar in the development of the teaching and learning of mathematics, especially in the primary and intermediate stages where the pupil's personality is formed and unfolds his mind to how much information haven't before and is paving his way to knowledge and integration with the community.

Hence, the problem of current research arise to study the compatibility of the content of developed mathematics textbooks for grades (6-8) in Saudi Arabia with the NCTM standards (2000).

## 2. The method and procedures

### 2.1 study population and sample

Content of developed mathematics textbooks for grades (6-8) in Saudi Arabia in the academic year 1434-1435/2013-2014.

### 2.2 study methodology and instrument:

In order to achieve the study objectives, content analysis method is used and two tools were setting up; a list of NCTM standards (NCTM 2000) for grades (6-8) after translated to Arabic language, and a content analysis card of developed mathematics textbooks in grades (6-8) in Saudi Arabia.

With regard to the standards, the translated list were in the areas of number and operations, algebra, geometry, measurement, data analysis and probability. The translation has been refereed by four specialists in English language, and mathematics education to validate scientifically linguistic translation. Table (1) shows the number of standards and expectations of (NCTM 2000) for mathematics textbooks for grades (6-8).

Table1. number of standards and expectations for grades (6-8).

Domain	Number and Operations	Algebra	Geometry	Measurement	Data Analysis and Probability	Total
Standard	3	4	4	2	4	17
Expectations	14	9	12	9	10	54

For content analysis card, it has been prepared in the light of topics' content of the developed mathematics textbooks at grades (6-8), and the expectations of NCTM standards in which identified the analysis objective, and the stability analysis has been calculated using Cooper equivalent and the percentage agreement were 92.6%.

## 3. The results of the study:

### 3.1. Results related to the first question

To answer the first question, which stated ' To what extend the developed mathematics textbooks for grade (6-8) in Saudi Arabia are compatible with NCTM standards in terms of number and operations? Analysis of developed mathematics content have been done in the domain of number and operations using the prepared tools and table (2) shows the results of the analysis.

Table2. the compatibility of the developed math content in grades (6-8) with expectations of NCTM standards in the field of number and operations.

Domain	Number and Operations													
Standard	(1-1)							)2-1(			)3-1(			
Expectations	)1-1-1*(	)2-1-1(	)3-1-1(	)4-1-1(	)5-1-1(	)6-1-1(	)7-1-1(	)1-2-1(	)2-2-1(	)3-2-1(	)1-3-1(	)2-3-1(	)3-3-1(	)4-3-1(
Achieved	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓
Not Achieved	-	-	-	-	✓	-	-	-	✓	-	-	-	-	-

\* The first digit refers to the domain and the second digit refers to the standard number and the third digit refers to expectation number.

Table (2) revealed that the content of the textbooks of developed mathematics in grades (6-8) agreed with (12) expectations out of (14) from the NCTM standards expectations which indicate that 85.7% are compatible in terms of number and operations.

### 3.2. Results related to the second question.

To answer the second question, which stated ' To what extend the developed mathematics textbooks for grade (6-8) in Saudi Arabia are compatible with NCTM standards in terms of Algebra?

Analysis of developed mathematics content have been done in the domain of Algebra using the prepared tools and table (3) shows the results of the analysis.

Table 3.The compatibility of the developed math content in grades (6-8) with expectations of NCTM standards in the field of Algebra.

Domain	Algebra									
Standard	)1-2 (			(2-2)				)3-2 (	)4-2 (	
Expectations	)1-1-2(	)2-1-2(	)3-1-2(	)1-2-2(	)2-2-2(	)3-2-2(	)4-2-2(	)1-3-2(	)1-4-2(	
Achieved	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Not Achieved	-	-	-	-	-	-	-	-	-	

It is shown in table (3) that the content of the textbooks of developed mathematics in grades (6-8) have agreed with all (9) expectations of NCTM standards in the domain of algebra with 100% compatibility.

### 3.3. Results related to the third question.

To answer the third question, which stated ' To what extend the developed mathematics textbooks for grade (6-8) in Saudi Arabia are compatible with NCTM standards in terms of Geometry?

Analysis of developed mathematics content have been done in the domain of Geometry using the prepared tools and table (4) shows the results of the analysis.

Table 4. the compatibility of the developed math content in grades (6-8) with expectations of NCTM standards in the field of Geometry.

Domain	Geometry											
Standard	)1-3(			)2-3(		)3-3(		)4-3(				
Expectations	)3-1-1(	)3-1-2(	)3-1-3(	)3-2-1(	)3-2-2(	)3-3-1(	)3-3-2(	)3-4-1(	)3-4-2(	)3-4-3(	)3-4-4(	)3-4-5(
Achieved	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Not Achieved	-	-	-	-	-	-	-	-	-	-	-	-

It is shown in table (4) that the content of the textbooks of developed mathematics in grades (6-8) have agreed with all (12) expectations of NCTM standards in the domain of Geometry with 100% compatibility.

### 3.4. Results related to the fourth question.

To answer the fourth question, which stated ' To what extend the developed mathematics textbooks for grade (6-8) in Saudi Arabia are compatible with NCTM standards in terms of measurement?

Analysis of developed mathematics content have been done in the domain of measurement using the prepared

tools and table (5) shows the results of the analysis.

Table 5. the compatibility of the developed math content in grades (6-8) with expectations of NCTM standards in the field of measurement.

Domain	Measurement								
Standard	)4-1(			)4-2(					
Expectations	)4-1-1(	)4-1-2(	)4-1-3(	)4-2-1(	)4-2-2(	)4-2-3(	)4-2-4(	)4-2-5(	)4-2-6(
Achieved	✓	✓	✓	✓	✓	✓	✓	✓	✓
Not Achieved	-	-	-	-	-	-	-	-	-

It is shown in table (5) that the content of the textbooks of developed mathematics in grades (6-8) have agreed with all (9) expectations of NCTM standards in the domain of measurement with 100% compatibility.

### 3.5. Results related to the fifth question

To answer the fifth question, which stated ' To what extend the developed mathematics textbooks for grade (6-8) in Saudi Arabia are compatible with NCTM standards in terms of measurement?

Analysis of developed mathematics content have been done in the domain of data analysis and probability using the prepared tools and table (6) shows the results of the analysis.

Table 6. the compatibility of the developed math content in grades (6-8) with expectations of NCTM standards in the field of data analysis and probability.

Domain	Data Analysis and Probability									
Standard	)5-1(		)5-2(		)5-3(			)5-4(		
Expectations	)5-1-1(	)5-1-2(	)5-2-1(	)5-2-2(	)5-3-1(	)5-3-2(	)5-3-3(	)5-4-1(	)5-4-2(	)5-4-3(
Achieved	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Not Achieved	-	-	-	-	-	-	-	-	-	-

It is shown in table (6) that the content of the textbooks of developed mathematics in grades (6-8) have agreed with all (10) expectations of NCTM standards in the domain of data analysis and probability with 100% compatibility.

## 4. Discussion

From the research questions results, it is clear that the content of the textbooks of developed mathematics for grades (6-8) in Saudi Arabia met with 96.3% of the NCTM standards expectations in the domain of: number and operations, algebra, geometry, measurement, and data analysis and probability. Moreover, this might be because of the ten development principles underlying the development of mathematics in Saudi Arabia are compatible with the standards of the National Council of teachers of Mathematics (NCTM).

On the other hand, the content of the textbooks of developed mathematics did not meet the standards expectations by 3.7% in the domain of number and operations, and these expectations were:

- Understanding big numbers, recognizing and using symbols and icons of scientific calculators.
- The grouping and substitution properties of addition and multiplication and distributive of multiplication over addition to simplify integers, fractions and decimals, and the reason for that might be due to achieving these standards expectations at grade (3-5).

## 5. Recommendations.

Based on the findings from the study, we recommend achieving the unmet standards expectations in the area of number and operations to fulfil complete compatibility, and enhance teachers training to teach new developed curriculum in appropriate way in order to achieve global standards of quality in the educational process. Finally, we suggest conducting a study to evaluate the content of developed mathematics for grades (9-12) in Saudi Arabia comparing with NCTM standards and other international standards.

## 6. Proposals.

Conducting a study to assess the content of developed mathematics textbooks for grades (9-12) in the light of the NCTM standards, as well as the assessment of teaching mathematics methodology in the light of the NCTM standards and other international standards.

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