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Developing a Mathematical Achievement Instrument for the 8th Grade Students in Saudia Arabia

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Abstract

The main objective of this paper is to establish the best mathematical approach for achievement that is valid and consistent to assess knowledge and skills in mathematics for 8th-grade students (first semester) in Saudi Arabia. The test served as a post-test in the first author's dissertation and was based on the content of the mathematics curriculum in Saudi Arabia. To check the reliability of the test, thirty-one 8th grade students from Saudi Arabia partook in the study.

The development of the instrument involved the following;

a) Examining the content and the objectives of the mathematics curriculum

b) Scheming table of provisions and a blueprint based on these studies,

c) Producing the items of the instruments,

d) Examining the appropriateness of the administration instructions and the items' phrasing,

e) Examining the rationality and consistency of the test.

The assessment was sent to evaluators to ensure that their rationality. Additionally, the evaluation of the evaluator's sheets revealed that the test had a satisfactory level of content reasonableness. The analysis of the experimental study revealed that Cronbach's alpha value was 0.86, which showed that the internal reliability was entirely tolerable.

Keywords: Mathematical, Achievement, Instrument, Measurement, 8th grade, Saudi Arabia

INTRODUCTION

The main aim of this research was to come up with a rationale and a consistent tool to evaluate the achievement in mathematics for the 8th-grade students in Saudi Arabia. The instrument was to be used in the 1st author's dissertation study at Florida Institute of Technology as a post-test. The research problem of the study was; *what is the significant impact of taking through mathematics contents to students in the middle schools using the gifted additional curriculum 'Mawhiba' on learners' academic accomplishment and boldness towards the subject in all public schools in Saudi Arabia? The* independent variable of this research was the use of the new math curriculum called "Mawhiba," and the dependent variables were the attitudes and academic achievements students had towards mathematics. Practical and reliable evaluations were applied to test the Attitude toward Math (Aiken, 1979). Even though an instrument for the attitude toward math was readily available, no comparable tools were available to measure academic achievement in 8th-grade students. As far as the authors knew, there were no instruments for academic performance that measured the contents of the 8th (first semester) grade math curriculum in Saudi Arabia that were checked for validity and

tested for reliability. Therefore, it was compulsory to come up with a valid and consistent instrument that may act as posttest of the researcher's dissertation and to be used in a future study.

RELATED LITERATUR

In Saudi Arabia, the primary objective of the educational system has been working towards cultivating the curriculum in the country with attention to refine the math and science curricula collectively (Saeed, Abdel Hamid, & Al-Shalhoub, 2011). This objective was begun and implemented by the Ministry of Education. The Ministry has been working on a more massive project to bring up-to-date and nurture the curriculum in the country. The ministry has provided essentials textbooks for Mathematics and science (Ministry of Education, 2006). The content of the 3-5 grades math test-books "matched 93.7% with NTCM standards in 5 mathematical topics: number and operations, algebra, geometry, measurement, and data analysis and probability, which was not the case with the old math textbook" (Ali & Alshehri, 2016).

Ali & Alshehri (2016) argue that "the NCTM standards document NCTM (2000) mentions six principles for school mathematics: equity, curriculum, teaching, learning, assessment, and technology. Moreover, there are 10 standards for grades pre-k-12 which can be separated into 2 parts. First, content standards, which describe what should be learned, covering standards for "number and operations, algebra, geometry, measurement, and data analysis & probability"; second, process standards, which describe how the material can be learned, and covered standards for "problem-solving, reasoning and proof, communication, connections, and representation" NCTM (2000)".

The standards mentioned above play an essential role when it comes to the development and expansion of teaching and learning that assists learners to improve their capability to comprehend and increase the chances to be successful. Almaghrabi (2005) adds that these morals and values assist curriculum developers and teachers in outlining the content to be learnt and how it can be taught (process). Alrwais and Saeed (2012) had assessed the 8th-grade math curriculum in Saudi Arabia and concluded that, "The results of the textbook evaluation, with respect to its adherence to how it is taught and the standards, indicated that the textbook given to learners could build mathematical knowledge through problem-solving, satisfied opportunities to connect with each other, and represent. However, the textbook has provided few opportunities for learners to reason and get motivated during lessons time".

METHODS

Population and Sample

The main material of the post-test covered the content of the already developed mathematics textbook of the 8th grade in the academic year 2016. Around, thirty-one students from an 8th grade class from a middle school partook in the experimental study.

Procedure

The development of the tools of study involved five stages, namely;

(1) Examining and studying the content and the goals of the 8th grade mathematics textbook.

(2) Creating tables of specifications and blueprint for the tools based on the first stage and guided by the levels of Bloom's Taxonomy.

(3) Writing the first draft of the tools based on the first and second steps.

(4) Scrutinizing the suitability of the administration instructions and the items' wording by sending the test to specialists in measurements and language.

(5) Inspecting for the rationality and consistency of the test by sending the test to specialists and experimenting it.

Stage 1: analyzing the content and the goals of the 8th (first semester) grades mathematics textbooks.

As described in table 1, the 8th-grade "first-semester" math curriculum in Saudi Arabia consisted of five units: Algebra: Relative Numbers, Real Numbers and Pythagoras Theory, Similarity and Proportionality, Percentage & Ratios, and Engineering and Spatial Reasoning. These five units had 42 objectives which were taken from the 8th-grade first-semester math textbook and were then mapped into the corresponding levels of thinking based on Bloom's Taxonomy Bloom (1956). Students completed 85 class sessions during the semester.

Table 1: Analysis of the 8th grade math text-book (1st semester) - Ministry of Education in Saudi Arabia

Unit1	1- Rational Numbers 2- Comparing Rational Numbers 3- Multiply Rational Numbers 4- Rational Numbers Division 5- Adding and Subtraction Rational Numbers with Common Denominator 6- Adding and Subtraction Rational Numbers with uncommon Denominator 7- Solving Equations Involving Rational Numbers 8- Problem Solving 9- Powers 10- Scientific Formula	*1-* *2-* *3-* *4-* *5-* *6-* *7-* *8-* *9-* *10-*	*Express Rational Numbers to decimal Numbers and from decimal to fractions* *Compare and Arrange Rational Numbers* *Multiply Rational Numbers* *Divide Rational Numbers* *Add and Subtract Rational Numbers with Common Denominator* *Add and Subtract Rational Numbers with uncommon Denominator* *Solve Equations Involving Rational Numbers* *Solve a strategy problem* *Use powers to express sentences* *Express numbers in a Scientific Formula*	Knowledge Comprehension Knowledge Knowledge Knowledge Comprehension Comprehension Application Comprehension Application
Unit2	1- Square Roots 2- Estimating Square Roots 3- Problem Solving using shapes 4- Real Numbers (discovering Pythagoras Theory) 5- Pythagoras Theory 6- Applications on Pythagoras Theory 7- Representing Irrational Numbers 8- Engineering: Dimensions	*1-* *2-* *3-* *4-* *5-* *6-* *7-* *8-*	*Find square roots for squares* *Estimate square roots* *Solve a problem by using shapes* *Define and classify Real numbers* *Find relationship between the sides of triangle* *Use Pythagoras Theory-solve a problem* *Represent Rational Numbers in Coordinates* *Find the distance between 2 points in Coordinates*	Knowledge Comprehension Comprehension Knowledge Comprehension Application Comprehension Application
Unit3	1- Relationships between proportional & non-proportional Numbers 2- Ratio of changes 3- Constants of Ratio 4- Solving similarity equations 5- Problem Solving: Drawing 6- proportionality of Quadrilateral shapes 7- Resizing	*1-* *2-* *3-* *4-* *5-* *6-*	*Find Relationships between proportional & non-proportional Numbers* *Find Ratio of changes* *Find the liner Relationships between proportional & non-proportional Numbers by using ratio* *Use proportional to solve a problem* *Solve a strategy problem* *Find Quadrilateral shapes and find the missing side length*	Comprehension Comprehension Application Knowledge Comprehension Comprehension

	8- Indirect measurement	*7- Draw and resize a picture*	Application
	9- Graphic measurement	*8- Use software to resize shapes*	Knowledge
		9- Solve a problem by using symmetric triangles	Application
		10- Solve a problem by using measurement	Comprehension
Unit4	1- Finding the percentage by Estimating	*1- Find the percentage by Estimating*	Comprehension
		2- Estimate by using ratio and fractions	Knowledge
	2- Estimating the ratio	*3- Solve a strategy problem*	Application
	3- Problem Solving Strategy	*4- Solve a problem by using a percentage Equation*	Application
	4- Algebra: Ratio Equation		
	5- Changing Ratio	*5- Find the percentage after changing the price and use it*	Comprehension
Unit5	1- Relationships between angles and lines	*1- Determine the new angles resulting from cutting parallel lines*	Comprehension
	2- Problem Solving strategy	*2- Use parallel lines to deduct the total measurement of triangle angles*	Analysis
	3- Angles and Polygons shapes		
	4- Symmetry of Polygons shapes	*3- Solve a strategy problem*	Analysis
	5- Symmetry	*4- Find the total measurement of Polygons angles & the interior angle of an even Polygons*	Knowledge
	6- Reflection		
	7- Dragging shapes	*5- Determine the Symmetry Polygons*	
		6- Deduct Symmetry Polygons	Knowledge
		7- Determine Symmetry upon line and a point	Comprehension
		8- Draw the reflection of the shapes	Comprehension
		9- Draw and drag a shape	Application
			Application
Total	39 Topics	42 objectives	

Stage 2: creating tables of specifications and blueprints based on the first stage.

The objectives of the lesson in table 1 were built on the 8th grade in the mathematics curriculum. Knowledge, Comprehension, Application, and Analysis were the levels of Bloom's Taxonomy used to guide learner. Besides, various math problems in the

instruments were developed to correspond to these four levels. This was done in comparison to how the course objectives mapped on each level.

A- Knowledge

Knowledge signifies the lowest level of learning in Bloom's Taxonomy and is defined as "Retrieving relevant knowledge from long-term memory" (Krathwohl, 2002). This may require a learner to review information from specific events, such as knowing terms, proofs, definitions, methods, and notions. Such Verbs define, describe, list, and outline can be to assess knowledge (Herr, 2007).

As listed in table 2, 4 out of these 11 lesson objectives (36%) were in the first unit (Algebra: Rational Numbers) while two out of these 11 lesson objectives (18%) were in the second unit (Real numbers and Pythagoras Theory). Another two out of these 11 lesson objectives (18%) were in the third unit (Similarity and Proportionality). One out of these 11 lesson objectives (9%) was in unit 4 (Percentage & ratios). The last two out of these 11 lesson objectives (18%) were in unit 5 (Engineering and spatial reasoning).

Table 2: 8th grade math textbook-1st semester lesson objectives (knowledge level) in 5 units

Lesson objectives reach the knowledge level in the 5 units		
Units	**Objectives**	**Reason of level**
Unit 1	*1- Express Rational Numbers to decimal Numbers and from decimal to fractions* *2- Multiply Rational Numbers* *3- Divide Rational Numbers*	Require knowing the *relationship between decimal & fractions*

	4- Add and Subtract Rational Numbers with Common Denominator	2,3&4 Require knowing how to multiply, divide, add and subtract
Unit 2	*5- Find square roots* *6- Define and classify Real numbers*	5 Require knowing the concept of square roots 6 Require knowing Real numbers
Unit 3	*7- Use proportional to solve a problem* *8- Use software to resize shapes*	7 Require knowing *proportional* 8 Require knowing of using a software
Unit 4	*9- Estimate by using ratio and fractions*	9 Require knowing the concept of fractions and ratio
Unit 5	*10- Find the total measurement of Polygons angles & the interior angle of an even Polygons* *11- Determine the Symmetry Polygons*	10 & 11 Require knowing the Characteristics of *Polygons*

B- Comprehension

Comprehension characterizes the lowest level of understanding in Bloom's Taxonomy and is defined as "Determining the meaning of instructional messages, including oral, written, and graphic communication" (Krathwohl, 2002) which is an upper level that is beyond simple remembering, such as understanding principles, facts, and interprets charts and graphs. Some terms can be used that relate to Comprehension, such as estimate, explain, give examples, and summarize (Herr, 2007).

As described in table 6, there were 18 out of 42 lesson objectives (43%) that required the Comprehension level of learning. As listed in table 3, 4 out of these 18 lesson objectives (22%) were in the first unit (Algebra: Rational Numbers). Another 4 out of these 18 lesson objectives (22%) were in the second unit (Real numbers and Pythagoras Theory). Another five out of these 18 lesson objectives (28%) were in the third unit (Similarity and Proportionality). Two out of these 18 lesson objectives (11%) were in unit 4 (Percentage & ratios). The last three out of these 18 lesson objectives (17%) were in unit 5 (Engineering and spatial reasoning).

Table 3: 8th grade math textbook-1st semester lesson objectives (comprehension) in 5 units

Lesson objectives reach the Comprehension level in the 5 units		
Units	**Objectives**	**Reason of level**
Unit 1	*1- Compare and Arrange Rational Numbers* *2- Add and Subtract Rational Numbers with uncommon Denominator* *3- Solve Equations Involving Rational Numbers* *4- Use powers to express sentences*	1 Require *Understanding the concept of Rational numbers* 2&3 Require *Understanding of the problem* 4 Require *Understanding of powers*
Unit 2	*5- Estimate square roots* *6- Solve a problem by using shapes* *7- Find relationship between the sides of triangle* *8- Represent Rational Numbers in Coordinates*	5 Require understanding of *square roots* 6 Require *Understanding of shapes* 7 Require *Understanding of the*

		relation 8 Require *Understanding of Rational*
Unit 3	9- *Find Relationships between proportional & non-proportional Numbers* 10- *Find Ratio of changes* 11- *Solve a strategy problem* 12- *Find Quadrilateral shapes and find the missing side length* 13- *Solve a problem by using measurement*	9, 10& 11 Require understanding of *proportional & non-proportional Numbers and Ratios* 12 Require understanding the *characteristics of shapes* 13 Require understanding *of the problem*
Unit 4	14- *Find the percentage by Estimating* 15- *Find the percentage after changing the price and use it*	14 & 15 Require understanding *the idea of percentage*
Unit 5	16- *Determine the new angles resulting from cutting parallel lines* 17- *Deduct Symmetry Polygons* 18- *Determine Symmetry upon line and a point*	16 Require understanding the *characteristics of parallel lines* 17 & 18 Require understanding the *characteristics of Symmetry shapes*

C- Application

Learning outcomes in the application level signify a higher level of understanding than that in the intellectual capacity level. The application may be defined as "Carrying out or using a process and technique in a given circumstance" (Krathwohl, 2002), which may include implementations of rules, principles, methods, and theories. Some questions

reach the application level which includes solve mathematical problems and draw charts and graphs. According to Herr (2000), the terms such as discover, modify, operate, predict, address, and use are some terms that can be used in problems that require an application.

As described in table 6, there were 11 out of 42 lesson objectives (26%) that required the Application level of learning. As listed in table 4, 2 out of these 11 lesson objectives (18%) were in the first unit (Algebra: Rational Numbers). Another 2 out of these 11 lesson objectives (%18) were in the second unit (Real numbers and Pythagoras Theory). Three out of these 11 lesson objectives (27%) were in the third unit (Similarity and Proportionality). Two out of these 11 lesson objectives (18%) were in unit 4 (Percentage & ratios). The last 2 out of these 11 lesson objectives (18%) were in unit 5 (Engineering and spatial reasoning).

Table 4: 8th grade math textbook-1st semester lessons objectives (application) in 5 units

Lesson objectives reach the application level in the 5 units		
Units	**Objectives**	**Reason of level**
Unit 1	*1- Solve a strategy problem* *2- Express numbers in a Scientific Formula*	*Require solving problem* *Require solving problem*
Unit 2	*3- Use Pythagoras Theory-solve a problem* *4- Find the distance between 2 points in Coordinates*	*Require solving a theory* *Require solving*

		problem
Unit 3	*5- Find the liner Relationships between proportional & non-proportional Numbers by using ratio*	*Application work*
	6- Draw and resize a picture	*Require Drawing*
	7- Solve a problem by using symmetric triangles	Require *solving a problem*
Unit 4	*8- Solve a strategy problem*	Require *solving a problem*
	9- Solve a problem by using a percentage Equation	*Require solving an equation*
Unit 5	*10- Draw the reflection of the shapes*	*Require Drawing*
	11- Draw and drag a shape	*Require Drawing*

D- Analysis

Learning outcomes in this level need a higher level of intelligence than in the previous levels because it demands for a deep understanding of both the content and the operational form of material. An analysis may be defined as the "Breaking material into its component parts and determining how the parts relate to one another and to an overall structure or resolution" (Krathwohl, 2002). Lesson objectives include distinguishing between proofs and implications, assessing the relevancy of data, and studying problems are some of the examples of objectives that reach the level of analysis. Verbs such as distinguish, point out, and break down are good examples of terms that reach the analysis level (Herr, 2007).

Table 5: 8th grade math textbook-1st semester lesson objectives (analysis) in 5 units

Lesson objectives reach the analysis level in the 5 units		
Units	**Objectives**	**Reason of level**
Unit 5	*1- Use parallel lines to deduct the total measurement of triangle angles* *2- Solve a strategy problem*	*Require analyzing both triangles and parallel lines*

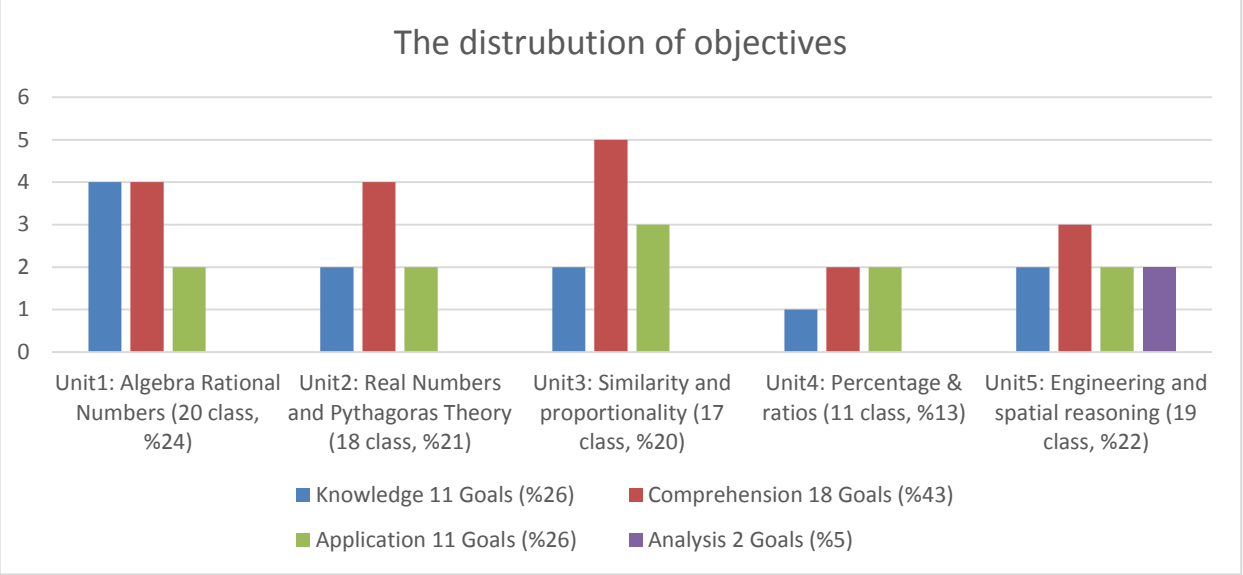
Table 6: Blue Print for the 8th grade (1st semester) math text-book

Blue Print, 85 Class, 42 Class Objectives, 42 Items, out of 100 points					
Units/levels	Knowledge 11 Goals (%26)	Comprehension 18 Goals (%43)	Application 11 Goals (%26)	Analysis 2 Goals (%5)	Total
Unit1: Algebra Rational Numbers (20 class, %24)	4	4	2	-	10 (%24)
Unit2: Real Numbers and Pythagoras Theory (18 class, %21)	2	4	2	-	8 (%19)
Unit3: Similarity and proportionality (17 class, %20)	2	5	3	-	10 (%24)
Unit4: Percentage & ratios (11 class, %13)	1	2	2	-	5 (%12)
Unit5: Engineering and	2	3	2	2	9 (%21)

spatial reasoning (19 class, %22)					
Total 85 class %100	11	18	11	2	42 Items

The following figure represents the distribution and the percentage of objectives in every unit categorized by four levels as described in the blueprint provided above. As described in the figure, there are 11 goals (26 %) represent the knowledge level distributed in five units. The figure also shows that there are 18 goals (43 %) represent the comprehension level. There are 11 goals represent the application level, and only 2 goals represent the analysis level.

Figure 1: the distribution of objectives



Stage 3: writing the first draft of the instrument based on the second step.

The expansion of the post-test involved a number of stages: First, the contents and the goals of mathematics textbook were examined. Secondly, scholars designed a table of specifications and a blueprint as shown on tables 7 and 6 respectively. Thirdly, based on these studies, a first draft of the test was written. Lastly, the test was sent to assessors who hold Ph.Ds. in the field of mathematics education, and advisors to review the test. The researchers revised the test based on the specialists' comments. As defined in table 14, the test involved 45 items from 5 units (3 extra items were added); which was distributed into four different levels of learning based on the first 4 levels of Bloom's Taxonomy. The assessment had 10 questions of true and false (2 items from each unit), 15 items of multiple choice (3 items from the first unit, 2 items from the second unit, 4 items form the third unit, 2 items from the 4th unit, and 4 items from the last unit), 10 items of short answers (3 items from the first unit, 3 items from the second unit, 2 items from the third unit, 1 item from the 4th unit, and 1 item from the last unit) and 10 items of linking (3 items from the first unit, 1 item from the second unit, 2 items from the third unit, 2 items from the 4th unit, and 2 items from the last unit).

Table 7: Table of specifications of the post-test

Table of specifications of the post-test (8th grade, 1st semester math textbook)							
Unit	**Class sessions**	**Percentage**	**Numbers of items**	**points**	**Items location**		
Unit1: Algebra Rational Numbers	20	24%	10+1	22+2	type of Question	items	points
					True and False questions	2	24
					Multiple choice questions	3	
					short answers	3	
					Linking	3	
					total	11	
Unit2: Real Numbers and Pythagoras Theory	18	21%	8	18	type of Question	items	points
					True and False questions	2	18
					Multiple choice questions	2	
					short answers	3	
					Linking	1	
					total	8	
Unit3: Similarity and proportionality	17	20%	10	22	type of Question	items	points
					True and False questions	2	22
					Multiple choice questions	4	
					short answers	2	
					Linking	2	
					total	10	
Unit4: Percentage & ratios	11	13%	5+2	11+5	type of Question	items	points
					True and False questions	2	16
					Multiple choice questions	2	
					short answers	1	
					Linking	2	
					total	7	
Unit5: Engineering and spatial reasoning	19	22%	9	20	type of Question	items	points
					True and False questions	2	20
					Multiple choice questions	4	
					short answers	1	
					Linking	2	
					total	9	

Stage 4: examining the appropriateness of the administration instructions and the items phrasing.

The test included true or false questions, multiple-choice questions, short answers, and other very involving questions. According to Bothell (2001), there are rules and regulations for writing multiple-choice questions. Bothell adds that the answers should be consistent, off-putting, and precise while the questions should be clear and in a question

format (not in a complete sentence format). The questions should change and stress on different level of knowledge. When it comes to lengths of choices, they should be related and placed in diverse and well-adjusted options (not tied to a specific choice). Besides, the questions and answers should be clear, comprehensible, and grammatically correct. Finally, the assessor should avoid negative questions and clues that lead to correct answers. Apparently, the rules and regulations for making an assessment were reviewed and followed when designing questions. Vibrant instructions were given to students before commencement of the test. After the final draft of the test was done, the test was sent to evaluators who have the required skills in measurements, math, and language to make sure that the terminology of the items was clear. Modifications and changes were made based on their assessments and reviews.

Results and Discussion

This section of the research involves quantitative and qualitative data analysis. To start with, a qualitative study was piloted to evaluate content validity proof while quantitative analysis was meant to test the consistency of the tools which will be explained in stage 5. JMP® for Mac, Version Pro12.SASInstituteInc., Cary, NC, 1989-2007 (http://www.jmp.com/support/notes/35/282.html) was used for these statistical analyses.

Stage 5: checking for the validity and reliability of the test.

Validity.

To ignite a satisfactory level of content validity for the test, the feedback that was given

by experts was solicited. As a result, experts' evaluation sheets for the test were created (see figure 2 as an example) and sent to evaluators who had experience in measurements, language, and mathematics. Most of these evaluators were teachers and professors who had to hold Ph.Ds. in mathematics or areas of education. The evaluation sheets involved had three parts. To begin with, the research question and information about the dissertation to give evaluators an idea about the tools required in the study. Secondly, there were several tables of specifications, the blueprint, and instructions for the test. Finally, each question and item was presented in a table as shown in figure 2 below.

As shown in the table below, each item had six sections. First, each item was written along with its objective. Second, the evaluators read each item along with their objectives to check whether they matched their objectives. Third, evaluators were to go through each item and verified whether the item matched the level of the objective. Forth, evaluators also reviewed if these items were matching with the content of the subject. Fifth, evaluators were also to check whether these items were written in the proper and flawless language. Finally, each item was placed in a suggestion box to cater for cases where the evaluators intended to improve on or remove any item.

Figure 2: Experts evaluation sheet example

#	Objective	Question	level	Expert opinion								
				Appropriateness of question to the objective		Appropriateness of question to the level		Appropriateness of question to the content		Clarity of question		suggestions
				Appropriate	Not Appropriate	Appropriate	Not Appropriate	Appropriate	Not Appropriate	clear	Not clear	
Q1	Put (T) front of the correct answer and (F) front of the wrong answer:											
1	*Remember the total measurement of a triangle angles*	The total measurement of a triangle angles is 150	Knowledge									
2	*Solve a problem related to percentage*	If Rami gave his brother 35% of his income and gave his sister 25% and still has 42$. We can say that Rami's income is 84$	comprehension									
3	*Estimate square roots*	If Sami has 196 plants and he wants to plant them in a square shape. There will be 13 plants in each side.	comprehension									

The 8th-grade mathematical achievement test (post-test) was sent to 7 evaluators who hold Ph.Ds. in the mathematics field, ten teachers and consultants who have taught mathematics before. Eventually, the final draft was written after evaluators made the adjustments.

Reliability

At the end of the Fall semester in the year 2016, an experimental study was conducted in a school from the same population to measure the suitability of the test and to make sure that the tests were reliable. A total thirty-one (N=31) students partook in the experimental study as shown in table 8 below. The range of possible scores was set to

range from 0 to 100. The mean of scores and standard deviation of the study were fifty-five (M-55) and seventeen point seven (SD=17.7) respectively. According to the skewness and the kurtosis, the distribution of scores was normal (-1< skewness and the kurtosis <1) — the average time spent on mean scores 81.67 minutes and 16.68 minutes on standard deviation. To calculate the mode and the median of time distribution took 90 minutes. As shown in the figure below, the Cronbach's alpha was used to measure the test considering the consistency of the instrument and the value obtained was 0.86.

Table 8: pilot study for the 8th grade mathematical achievement test

groups	**N**	**N after removing**	**Mean**	**SD**	**Skewness**	**Kurtosis**	**Cronbach's alpha**
scores	31	31	55	17.7	0.05	-0.78	0.86
time	31	31	81.67	16.68	-	-	-

Conclusion

As discussed in this paper, research quality on measurements that were checked for validity and reliability were not applicable to mathematics achievement in Saudi Arabia. The primary goal of this research was to come up with a better tool for math academic results for students in the 8th grades and to function as a post-test in the dissertation mentioned earlier, as well as to fill gaps in the literary works. The process involved five phases to ensure that the items of the test were clear, suitable, and reliable in line with the Saudi mathematics contents and blueprint. Besides, the professionals who went through these tools noted the following:

a) The post-test methodically discussed the materials and practices found in the 8th grade

of the Saudi Arabia math curriculum.

b) Items of the tool were in line with the level of goals and blueprint.

c) Details were clear, appropriate and consistent for 8th graders.

Ultimately, these tools were directed to be tested for their consistency. Based on the results, the test met the requirement of content validity and had a satisfactory level of reliability “0.80 Cronbach’s alpha”.

References

Alshehri, M. A., & Ali, H. S. (2016). The Compatibility of Developed Mathematics Textbooks' Content in Saudi Arabia (Grades 6-8) with NCTM Standards. *Journal of Education and Practice, 7*.

Alrwais and Saeed. (2012). Assessing Saudi Arabia Middle School Mathematics Textbooks and Teachers' Instructional Practice Adherence to NCTM Process Standards. http://proxy.furb.br/soac/index.php/ictma16/ictma16/paper/viewFile/102/122

Almaghrabi, S, A. (2005), "Scientific disciplines for teacher preparation in light of the standards levels", 17th Scientific Conference of the Egyptian society for curriculum and instruction: curriculum and standard levels, 1, Cairo (26-27), pp. 257-276.

Bothell, T. W. (2001). *14 Rules for Writing Multiple-Choice Questions*. Retrieved from Brigham Young University 2001 Annual University Conference: https://testing.byu.edu/handbooks/14%20Rules%20for%20Writing%20Multiple-Choice%20Questions.pdf

Herr, N. (2007). *Bloom's Taxonomy*. Retrieved from The Sourcebook For Teaching Science: https://www.csun.edu/science/ref/reasoning/questions_blooms/blooms.html

JMP® for Mac, Version *Pro 12*. SAS Institute Inc., Cary, NC, 1989-2007 (http://www.jmp.com/support/notes/35/282.html)

Krathwohl, D. R. (2002). A revision of bloom's taxonomy: An overview. *Theory into Practice, 41*(4), 212. Retrieved from http://search.ebscohost.com.portal.lib.fit.edu/login.aspx?direct=true&db=a9h&AN=8550701&site=ehost-live

Ministry of Education in Saudi Arabia (2006), "Development of curriculum of

mathematics and natural sciences project in Saudi Arabia", the Secretariat of the project to develop the curriculum of mathematics and natural sciences, Rukin press.

Ministry of Education in Saudi Arabia. (2011). Mathematics Textbook for seventh-grade classroom, second semester, obeikan printing and publishing.

National Council of Teachers of Mathematics (2000)," Principles and Standards for School Mathematics", VA, Reston.