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Investigating barriers to math performance as viewed by teachers: Emphasis on textbook content and students' performance in junior high school

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ABSTRACT

The present study aimed to investigate the barriers to math performance as viewed by teachers based on the content of mathematics textbook and students' performance. The study adopted a survey design. The population of the study consisted of all math teachers and junior high school students in Karaj city as well as three mathematics textbooks in the educational year 2011-2012. A researcher-made questionnaire was developed to investigate teachers' attitudes towards the difficulty level of mathematics textbooks, students' level of performance and lessons order and arrangement. The researcher developed a test to examine students' math performance. Descriptive statistics was used to analyze the data. The results revealed that some math lessons in each junior-high-school mathematics textbook could function as inhibiting factors in students' math performance. In this regard, dividing decimal numbers, triangle equality, advanced division, exponent, fractions and symmetry of total were the most significant barriers to first graders' math performance. Symmetry of total and rational numbers were found to be the major barriers to second graders' performance, and sphere lessons and another form of linear equation posed the major barrier to third graders' math performance.

Keywords: Math performance barriers, teachers' opinion, mathematics textbook content, math performance, junior high school

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INTRODUCTION

In the modern technologic world, people are in critical need of mathematics to understand the information. In fact, mathematics is a symbol of relentless human efforts to acquire knowledge. Human has always sought better ways to facilitate the acquisition of mathematics. The formal learning of mathematics begins in school so that ministry of education, as one of the most fundamental social institutions, undertakes to develop mathematics knowledge beside its other responsibilities. School mathematics pursues two primary goals; first, to train the workforce for industrial and technologic positions to fulfill life requirements through increasing mathematics knowledge, and second, to train people who would choose mathematics as their job since an early age – such as mathematicians [3]. Despite its superb goal, school mathematics poses performance problems to students so that they suffer poor math performance across all levels of education from school to university. Many studies have so far addressed low math performance in students and reported a variety of barriers from cognitive to behavioral reasons that prohibit math performance

[5]. We often consider mathematics as a subject that is difficult to both learn and to teach. Students consider mathematics as a boring, difficult and uninteresting subject, and teachers believe that it is difficult to teach and uninteresting to learn [3]. Learning beliefs toward oneself, learning, mathematics, teacher and so on constitute part of informal knowledge and an essential component of learning [6]. Meanwhile, barriers to math learning and consequent poor math performance can be studied at three levels: textbook, teacher, and students. Each one of these variables may considerably affect math performance. If we consider these three components as the three vertices of a triangle, we may notice that they stand opposed to each other so that each one may individually or collectively affect students' math performance. Teachers are one of the vertices whose teaching methods have been investigated by researchers. For example, research has shown that, comparing with traditional teaching methods, collaborative teaching significantly affects students' educational achievement and improves students' positive attitudes toward mathematics [12]. Generally, teachers' teaching methods affect students' performance [16]. Students occupy another vertex of our proposed triangle. As the users of math knowledge, they may affect their own math performance through endeavor, interest, anxiety, motivation, learning style, attitude, gender and economic status. Ahmadi and Khezri (2006) showed that male students used active experimentation learning style in mathematics more than female students did. Textbook is the third vertex of the triangle that affects students' math performance due to its key role in math learning. A good textbook can help an inexperienced teacher make teaching decisions and direct students toward a certain path. Students spend the majority of their time in the classroom studying and using the textbook [19]. The teacher needs to cover the textbook within a specified time and content. Indeed, the teacher does not have enough time to cover the textbook within the specified time so that he may not cover other subjects beyond the scope of the textbook [16]. As a centralized educational system, Iran's schooling system comprises three main components including textbook, planning and teacher. In most cases, the textbook is the only teaching tool available to the teacher and teaching-learning process depends primarily on the textbook content and concepts. Since evaluations and assessments are carried out based on the textbook and curriculum, the textbook bears a crucial role as it contains the content of the curriculum [13]. Indeed, the textbook is considered as the main goal and the motivating factor for both the teacher and students. The educational achievement is measured based on textbook lessons. Realization of educational goals indicates that the curriculum has been successful in facilitating the learning-teaching process [22]. There is a close relationship between the curriculum and the textbook as it is the product of the developed curriculum. Thus, curriculum modifications begin with the textbook that is written to modify or adapt changes in the curriculum. The textbook makes up a bridge between the intended curriculum and the applied curriculum. That is why mathematics textbooks are so crucial for teaching and learning mathematics [11]. However, once the content and objectives of the textbook do not correspond to students' mental capacity, would it be considered as a barrier to students' math performance?

As an educational tool assuming high importance, the textbook should have a good quality. The most tangible textbook is one that is particularly prepared for students and one that presents knowledge in detail, explains the association among different bodies of knowledge, encourages students to rehearse what they know and empowers students. The main questions, though, are that "what is a good textbook?", "how much should it be aligned with curricular objectives?" and "what should we expect of a textbook?" [3]. Some writers contend that a course book should address both the teacher and students. Mathematics textbooks are not written to replace the teacher in teaching math subject; rather they are developed so as to help the teacher transfer mathematics knowledge to students [15]. In Iran's textbook planning and compilation system, a textbook is not intended to replace the teacher so that it addresses both the teacher and students simultaneously. Both teachers and students have their specific problems in dealing with textbooks. The removal of these problems may considerably improve mathematics teaching and performance. In this regard, the present study aims to investigate the potential barriers within different topics and lessons in junior high school mathematics textbooks that may adversely affect students' math performance.

MATERIALS AND METHODS

The population of the study consisted of all math teachers and students at junior high school in Karaj in the educational year 2011-2012. In this regard, a number of 85 junior high school math teachers were selected as the participants from four educational districts in Karaj using cluster random sampling. A total of 433 male and female students were selected as the participants including 138 third graders, 151 second graders and 144 first graders. A researcher-made questionnaire was used to examine the teachers' attitudes toward mathematics textbooks. A test was administered to the students to measure their math performance. In fact, the teachers' opinions were first sought using the questionnaire. Then based on their opinions, a test was developed to examine students' math performance.

After the development of the first draft of the questionnaire, it was sent to Karaj Mathematics Group to be reviewed. The questionnaire was eventually approved by professors, math experts and experienced teachers after three revisions. The questionnaire addresses teachers' opinions on the level of difficulty of the textbook, students' performance in the lessons and order and arrangement of lessons. The subscale addressing the level of difficulty had three options: easy, fair, and difficult. The math performance subscale comprised three options: good, average, and poor. The subscale addressing the order and arrangement of lessons in the textbook included 5 options: changing the order of lessons, consistent lessons in each grade, move to a higher grade, move to a lower grade, omission of the lesson. The teachers were instructed not to choose any option if they agreed with the arrangement of lessons.

The questionnaire was developed to cover the three grades of junior high school. Because the questionnaire was developed based on the math lessons and syllabus in each grade, the number of items in each subscale differed. In this regard, 51, 35 and 44 items were developed for the first, second and third grades, respectively. From among 85 questionnaires administered to the teachers, a number of 73 were completed and returned to the researcher. Following the analysis of teachers' opinions on the level of difficulty of lessons in each grade, the textbooks lessons were divided into difficult, fair or easy. Subsequently, three lessons were selected from each level of difficulty. Then one to two test items were written to cover each lesson. In this regard, three tests were developed for the three grades, each containing 20 items. The reliability of the tests were calculated to be 0.97 for the first grade, 0.96 for the second grade and 0.97 for the third grade using Cronbach alpha formula.

Data analysis

Descriptive statistics including frequency and percentage was used to analyze the data. In order to investigate the teachers' opinions on the level of difficulty of textbook lessons, certain criteria were used to facilitate the description of the data. The criteria to decide the difficulty level of lessons are as follows. (1) When 67 percent and over of the responses were given to either "easy", "fair" or "difficult", the difficulty level of the lesson was considered either "easy", "fair" or "difficult", respectively. (2) When over 67 percent of the responses were provided on the options "easy" and "fair" with the majority of responses being to the option "easy", the difficulty level of the lesson was considered to be "easy". (3) When over 67 percent of the total percentage of responses were provided to the options "easy" and "fair" or "difficult" and "fair" with the majority of responses being to "fair", the difficulty level of the item was considered to be "fair". (4) When over 67 percent of the Reponses were provided to the options "difficult" and "fair" with the majority of responses being to "difficult", the difficulty level of item was considered to be "difficult".

The following criteria were used to analyze the answers to the second research question. (1) When 67 percent and over of the responses to students' performance in a lesson were given to either "easy", "fair" or "difficult", the level of performance on that lesson in terms of teachers' opinions was considered either "good", "fair" or "poor", respectively. (2) When 67 percent and over of the responses to students' performance in a textbook lesson were provided to the options "good" and "fair" with the majority of responses being to the option "good", the level of performance on that lesson was considered "good". (3) When over 67 percent of the responses were provided to the options "good" and "fair" or "poor" and "fair" in a textbook lesson with the majority of responses being to "fair", the level of performance on that lesson was considered "fair". (4) When over 67 percent of the responses were provided to the options "poor" and "fair" in the textbook lesson with the majority of responses to the option "poor", the level of performance on that lesson was considered "poor".

In order to investigate the fourth research question – the consistency between teachers' opinions and students' performance on the test, certain criteria were used to evaluate students' performance on each topic on the test. Then the results were compared with teachers' opinions. The criteria used to describe students' performance on the test are as follows. (1) When over 67 percent of the mean correct responses were provided to the questions covering a topic, the students' performance on that topic was considered "good". (2) When over 67 percent of the mean wrong responses were provided to the questions covering the same topic, the students' performance on that topic was considered "poor". (3) When the mean percentage of wrong and/or correct responses to the questions covering the same topic was inconsistent with the criteria 1 and 2, the students' performance on that topic was considered "average".

RESULTS

The results of measuring the difficulty level of different lessons in each textbook based on math teachers' opinions showed that teachers considered the following topics in the first grade textbook as easy topics: divisibility, natural multiples of a number, reviewing line and dots, half-line and line segment, conformity, comparison and measurement of line segments, reviewing angles, comparison of two angles, statistics, data tabulation, types of diagrams, drawing an angle bisector, divisors of a number, exponent, exponentiation, proportion, circle, integer, integer vector, summation corresponding to vector, orthogonality, drawing a vertical line, vertical bisector, distance between dot and line and drawing the vertical bisector of a line segment. The teachers reported that the following lessons in the first grade mathematics textbook were "fair" in terms of difficulty: diagram of divisors of a number, the largest common divisor, adding and subtracting two numbers, prime numbers, lowest common multiple, fractions, multiplying and dividing fractions, multiplexing in proportion, decimal numbers, decimal summation and subtraction, complements, drawing triangles, summation properties, subtraction corresponding to vector, estimation, crossing, rounding off, drawing vertical lines using a compass, summation and subtraction of fractions, decimal multiplication and division and drawing an angle equal with the known angle. Finally, the teachers reported that triangle equality, division of decimal numbers, advanced division and symmetry of total were the difficult topics covered in the first grade mathematics textbook. The results of measuring the difficulty level of different lessons in the second grade mathematics textbook based on math teachers' opinions showed that the teachers considered integers, parallels, multiplication symmetry, integer division, Euclid principles, types and characteristics of squares as "easy" topics. They reported that the following topics were "fair" in terms of the difficulty level: problem solving, systematic table, numerical value of an algebraic expression, equation, summation and subtraction of integers, exponent, enumeration systems, square root, multiplication square and division, drawing a rectangular triangle, oblique and parallel lines, solving problems and subproblems, drawing squares, introducing rational numbers, summation and subtraction of rational numbers, multiplication and division of rational numbers, simplification of algebraic expressions, coordinates of a point, summation corresponding to a vector, area, volume, calculating prismatic volumes, symmetry of total, approximate calculation of square root, problem solving, eliminating undesirable modes, equation of two rectangular triangles, problem solving and equation formation, coordinates of transfer vector and problem solving, guessing and experiment. Finally, they reported that demonstration of properties was a difficult topic covered in the second grade mathematics textbook. The results of measuring the difficulty level of different lessons in the third grade mathematics textbook based on math teachers' opinions revealed that the teachers considered the following lessons as "simple" topics: prime numbers, the relative status of a circle to a line, rotation symbols, column chart and mean, inverse proportion, testing root square results, introducing rational numbers, summation and subtraction of rational numbers, multiplication and division of rational numbers, circle, regular polygons, and dividing line segments into equal parts. The teachers reported that the following topics were "fair" in terms of the difficulty level: solving system of linear equations, problem formation strategy, lines crossing off the source, drawing lines, equation formation strategy, exponent, square root of decimal numbers, approximate square root, coordinates, summation of vectors, multiplying a number by a vector, coordinate unit vectors, algebraic expressions, numerical value of algebraic expressions, simplification of algebraic expressions, problem solving methods, central angle, contained angle, dividing a circle into equal arches, Pythagoras, using Pythagoras theorem, real numbers, the relationships between width and length in points, slope of a line, lines paralleled with vectors, parallel lines with equal distances, Thales' theorem, pyramid, cone, sphere, distributability of multiplication in terms of addition and subtraction, another form of linear equation and similarity of two triangles. The results of describing the first graders' math performance on different topics based on the math teachers' opinions showed that the teachers considered the students' performance on the following topics to be "good": divisibility of divisors of a number, natural multiples of a number, reviewing line and dots, half-line and line segment, conformity, comparison and measurement of line segments, reviewing angles, comparison of two angles, defining a circle, summation corresponding to a vector, data tabulation, types of diagrams, drawing an angle bisector, prime numbers, introducing exponent, exponentiation, fractions, proportion, integer, summation properties, orthogonality, drawing a vertical line, vertical bisector, distance between dot and line and drawing the vertical bisector of a line segment. The teachers reported that the first graders had "average" math performance on the following topics: diagram of divisors of a number, the largest common divisor, multiplying and dividing decimal numbers, complements, drawing triangles, adding two numbers, subtraction corresponding to a vector, subtracting two numbers, estimation, crossing, estimation, drawing vertical lines using a compass, largest common divisor, summation and subtraction of fractions, rounding off, and drawing an angle equal with the known angle. Eventually, the teachers reported that the first graders had a poor performance in dividing decimal numbers, advanced division, symmetry of total and equality of triangles. The results of describing the second graders' math performance on

different topics based on the math teachers' opinions showed that the teachers considered the students' performance on the following topics to be "good": symmetry, integers, multiplication and division of integers, parallelism, Euclid principles, oblique and parallel lines, types and characteristics of squares and simplification of algebraic expressions. The teachers also reported that the second graders showed "average" performance on the following topics: problem solving, systematic table, summation and subtraction of integers, exponent, enumeration systems, square root, multiplication square and division, drawing a rectangular triangle, drawing squares, introducing rational numbers, summation and subtraction of rational numbers, multiplication and division of rational numbers, numerical value of an algebraic expression, coordinates of a point, summation corresponding to a vector, area, volume, approximate calculation of square root, problem solving, eliminating undesirable modes, solving problems and subproblems, problem solving and equation formation, coordinates of transfer vector, guessing and experiment, calculating prismatic volumes, equation of two rectangular triangles, and problem solving. Finally, the teachers reported that the second graders had a poor performance in demonstration of properties and symmetry of total.

The results of describing the third graders' math performance on different topics based on the math teachers' opinions showed that the teachers considered the students' performance on the following topics to be "good": prime numbers, circles, the relative status of a circle to a line, rotation symbols, column chart and mean, proportion, testing root square results, introducing rational numbers, algebraic expressions, central angle, regular polygons and dividing line segments into equal parts. The teachers contended that the third graders had average performance on the following topics: exponent, approximate square root, square root of decimal numbers, summation and subtraction of rational numbers, multiplication and division of rational numbers, coordinates, summation of vectors, , multiplying a number by a vector, coordinate unit vectors, numerical value of algebraic expressions, simplification of algebraic expressions, equation formation strategy, dividing a circle into equal arches, Pythagoras, using Pythagoras theorem, real numbers, the relationships between width and length in points, drawing lines, lines paralleled with vectors, parallel lines with equal distances, pyramid, cone, sphere, distributability of multiplication in terms of addition and subtraction, problem solving methods, contained angle, lines crossing off the source, slope of a line, another form of linear equation, solving system of linear equations, equation formation strategy, Thales' theorem and similarity of two triangles.

The results of describing teachers' opinions on the order and arrangement of lessons in mathematics textbooks showed that most teachers believed that the order and arrangement of the first grade textbook lessons was acceptable while some of them reported that the lessons should be presented consistently. However, smaller numbers of teachers considered the order and arrangement of the following lessons as appropriate. In this regard, 10-24 percent of the teachers believed that multiplication of exponential numbers and equality of triangles should be presented in higher-grade textbooks while 37.7 percent believed that symmetry of total needed to be omitted from the textbook. Displacement of dividing decimal numbers and drawing triangles was approved by 16.4% and 25.4% of teachers, respectively.

As to the order and arrangement of lessons, the teachers believed the second grade textbook was well-organized while some of them reported that the lessons should be presented consistently. However, smaller numbers of teachers considered the order and arrangement of the following lessons appropriate. These topics included problem solving and elimination of undesirable modes, the concept of square root, exponent, integer, summation and subtraction of integers. Accordingly, 14.7% to 30.9% of the teachers believed that these topics needed to be presented consistently in the same grade. Besides, 23.4% to 41.2% of the teachers believed that demonstration of properties, symmetry of total and calculation of approximate square root should be omitted from the textbook.

Considering the order and arrangement of lessons, the teachers believed the third grade textbook was well-organized while some teachers contended that the lessons should be presented consistently. However, smaller numbers of teachers considered the order and arrangement of the following lessons as appropriate. These topics included approximate square root, exponent, introducing rational numbers, summation and subtraction of rational numbers, multiplication and division of rational numbers, lines crossing off the source, another form of linear equation, solving system of linear equations. Accordingly, 13.4% to 31.3% of the teachers believed that these topics should be covered consistently in the same grade while 14.9% of them agreed that lines crossing off the source and another form of linear equation should be covered in a higher grade. The results of describing teachers' opinions on the correspondence between the difficulty level of textbook lessons and students' math performance showed that the first graders' performance was poor in exponent, fractions, subtraction of two numbers and symmetry of total. However, they showed average performance in proportion, division of decimal numbers, rounding off, drawing

triangles, multiplication of decimal numbers and equality of triangles. The results showed that teachers' opinions matched students' performance in rounding off, drawing triangles, multiplication of decimal numbers and symmetry of total. However, teachers' opinions on division of decimal numbers and equality of triangles did not correspond to students' math performance. In this regard, while the teachers considered these topics as difficult lessons in which students were expected to show poor performance, the students' actual test performance on these topics was average. Considering the topic of proportion, the teachers believed that the difficulty level of the topic and students' performance were "simple" and "good", respectively, while the students' actual test performance on the topic was average. There was also inconsistency between teachers' opinions and students' actual test performance in fractions and subtraction of two numbers so that while teachers reported that these topics were fair in terms of difficulty and expected students' performance to be good and average, respectively, students' actual test performance was poor. The results of describing teachers' opinions on the correspondence between the difficulty level of textbook lessons and students' math performance showed that the second graders' performance was good in equation lessons, poor in symmetry of total and rational numbers and average in integer, parallelism, quadrilateral, approximate square root, coordinates, algebraic expressions, prism and numerical value of algebraic expressions. Teachers' opinions corresponded to students' actual test performance in integer, parallelism, quadrilateral, approximate square root, coordinates, algebraic expressions, prismatic volumes, symmetry of total, prism and numerical value of algebraic expressions. However, teachers' opinion on calculating prismatic volumes and rational number did not correspond to students' actual test performance. In this regard, the teachers considered these topics as fair in terms of difficulty and expected students to show average performance while students' actual performance was poor in these topics.

The results of describing teachers' opinions on the correspondence between the difficulty level of textbook lessons and students' math performance showed that the third graders' performance was good in prime numbers and real numbers, poor in sphere lessons and another form of linear equation and average in rational numbers, Pythagoras, exponent, angles, circles, cone, distributability of multiplication in terms of addition and subtraction and similarity of two triangles. Teachers' opinions corresponded to students' actual test performance in rational numbers, prime numbers, Pythagoras, exponent, angles, cone, distributability of multiplication in terms of addition and subtraction and similarity of two triangles. However, teachers' opinions were inconsistent with students' actual test performance in real numbers, sphere and another form of linear equation. That is, while the teachers believed that students' math performance and the difficulty level of these topics were average and fair, respectively, students' actual test performance was good. Besides, while teachers expected the difficulty level and students' math performance in sphere and another form of linear equation to be fair and average, respectively, students' actual math performance on these topics was poor.

Considering the barriers to students' math performance based on teachers' opinions and students' actual test performance, the results showed that while teachers believed that division of decimal numbers and equality of triangles were the barriers, the first graders' actual test performance showed that fractions, exponent and subtraction of two numbers were the barriers to students' math performance. Still, both teachers' opinions and students' actual test performance showed that symmetry of total was a barrier to students' math performance. In the second grade, students' poor test performance in rational numbers and calculation of prismatic volumes showed that these topics were significant barriers to math performance. However, teachers believed that symmetry of total was a barrier to second graders' math performance. Eventually, third graders' actual test performance showed that another form of linear equation and sphere were the topics that inhibited students' math performance.

DISCUSSION AND CONCLUSION

It seems that the first step in improving math performance is to recognize the barriers. In fact, both teachers and students need to know the potential barriers to and weaknesses of math performance. Without such knowledge, the instruction would not fulfill its goals and the students may not reach their educational goals. Teachers' unawareness of the topics that pose problems to students' understanding of mathematics would result in teachers' focus on the topics that are not significant barriers to students' math performance. Besides, Iranian mathematics textbook writers do not pay heed to teachers' opinions. It is, however, the teacher who is the facilitator of math learning and who can draw upon efficient teaching methods to recognize the weaknesses in the textbooks. Teachers may decide whether or not the order and arrangement of lessons in a textbook is a significant barrier to math performance. Down (1988) contends that textbooks – either suitable or not – dominate and influence what the students learn and that they are the first books that students typically study seriously. In regard to mathematics textbooks, Grows and Smith (2000) showed that most junior high school teachers most often used mathematics textbooks. Based on National

Assessment of Educational Progress (NAPE), they found that 75 percent of eighth grade teachers used mathematics textbooks based on their daily schedule (Dogbey, 2010). Tarr et al. (2006) addressed the question "does mathematics textbooks affects students' learning?" their results showed that mathematics textbooks considerably influenced not only what the students learned but also how they learned. Thus, the textbook was considered the primary source for both teachers and students. It is undeniable that Iranian students have poor math performance. Based on the results of TIMSS test, Iranian junior high school third graders' math performance has reduced by 15 scores between 1995 and 2007. In all TIMSS periodical studies, Iranian students have performed lower than international average performance. The mean score of Iranian junior high school third graders' math performance on TIMSS test (2007) was lower than 30 percent. The mean score of the same students on TIMSS (2007) on the items covering their textbook topics was lower than 45 percent [] (Karimi, 2008). Iranian eighth graders showed better performance in three content areas (geometry, numbers and algebra) though they performed below international average across all content areas [] (Karimi, 2005).

The present study focused on the mathematics textbooks to determine the topics that were barriers to students' math performance based on teachers' opinions and students' actual test performance. The results revealed that the teachers considered the majority of topics in junior high school mathematics textbooks to be fair in terms of the difficulty level. They also believed that students' math performance on textbook topics were average. Moreover, they reported that the order and arrangement of the majority of topics were acceptable. Still, they considered some topics as posing barriers to students' math performance. Aghapur (2010) contends that the language of the textbook and arrangement of lessons inhibit students' learning and math performance. Sadeghi (2010) investigated the causes of students' poor math performance based on TIMSS test and reported that the third grade mathematics textbook was one of the causes of students' misunderstanding of mathematics. Jalali Far et al. (2004) showed that teachers reported numerous problems with junior high school mathematics textbooks such that eliminating these problems could improve the quality of mathematics instruction and consequent improvement of students' math performance. Seyedi (1983) emphasized the necessity to revisit and remedy mathematics textbooks. The present study also revealed that some topics in these textbooks posed barriers to students' math performance. This is consistent with the findings of Aghapur (2010), Sadeghi (2010), Jalali Far et al. (2004) and Seyedi (1983). The teachers reported that the majority of textbook topics were fair in terms of the difficulty level. In the first grade textbook, the teachers reported triangle equation, division of decimal numbers, advanced division and symmetry of total to be difficult topics; thus, they expected the students to have poor performance on these topics. This is partly consistent with the findings of Sahar Khiz (1991) who investigated the junior high school first grade textbook and reported that triangle equation and symmetry of total were difficult topics for the unsuccessful group while division of decimal numbers was a difficult topic for both the successful and unsuccessful groups. The results of the present study showed that over 37 percent of the teachers agreed to eliminate symmetry of total from the mathematics textbook. They reported that symmetry of total was a non-functional, ambiguous and difficult topic for students so that they suggested its elimination from the textbook. Over 17 percent of the teachers believed that the topics and lessons should be presented consistently in every grade. They reasoned that symmetry of total is addressed in both the first and second grades; however, it could have higher efficiency if it was presented only in one grade consistently and efficiently. The students showed poor performance in symmetry of total on the test. This highlights the difficulty of this topic. The teachers recognized this deficiency, though. In fact, based on cognitive learning theory, this topic does not match students' level of understanding and mental abilities; thus, this mismatch may account for students' poor performance on this topic. Over 23 percent of the teachers agreed to move the topic of triangle equality to a higher grade textbook. This may indicate that the teachers thought this topic was not consistent with students' cognitive development so that they suggested that it would be presented in higher grade textbooks when the students are more cognitively adept to receive the concepts. Over 14 percent of the teachers believed that this topic should be presented adjacent to drawing triangles while 25 percent suggested that drawing triangles be presented together with triangle equation. In a section provided on the questionnaire for essay questions, the teachers considered that presenting these two topics next to each other could improve students' learning. In fact, these two topics have the same basis so that the data used for drawing a triangle may represent triangle equality. For example, having two sides and the intervening angle, we can draw a triangle so that S-A-S can be one mode of triangle equality. Here, we may notice the traces of Gestalt theory about the similarity and proximity of topics. In this regard, we may accept teachers' opinions about the adjacency of triangle equality and drawing triangles. As they thought triangle equality was a difficult topic, some teachers suggested that this topic be presented in a higher grade textbook. They may have thought that the difficulty level of this topic did not match first graders' cognitive development so that the topic could be presented in higher grades when the students are more cognitively developed. The results of the administered test showed that the students had an average performance on this topic. In other words, teachers'

opinion about students' performance on this topic did not correspond to students' actual performance on the test. Thus, the results showed that triangle equality was not a barrier to students' math performance. We may say that the teachers were not sufficiently aware of their own students' performance on this topic so that they underestimated their performance. The present findings showed that though the teachers considered division of decimal numbers as a difficult topic and expected students' poor performance, the students' actual test performance was at an average level. This inconsistency between teachers' expectations and students' actual performance may indicate that the teachers did not recognize their students' weaknesses. Over 16 percent of the teachers suggested the topic should be displaced. In essay section, the teachers suggested that the topic had better be presented along with the concept of decimals and multiplication of decimal numbers. The poor performance on this topic, as the teachers contend, may be remedied by such rearrangement. Advanced division was a topic that posed difficulty to students' math performance, suggested both by teachers and through students' actual test performance. The teachers considered this as a difficult topic and 10.4 percent of them suggested that the topic be presented in a higher grade. They thought this topic did match students' cognitive abilities. According to cognitive learning theory, the relocation of this topic to a higher level would facilitate learning. 14.9 percent of the teachers believed that this topic should be presented consistently in the same grade, though. Some teachers (11.9%) believed that the topic should be relocated. Accordingly, in the essay section, they contended that advanced division and division of decimal numbers should be presented together with the concept of decimal as well as decimal summation, subtraction and multiplication. Considering the Gestalt learning theory of similarity and proximity, this suggestion seems reasonable. In fact, when all decimal concepts are taught together, the learning will be facilitated; thus, the learning would be meaningful as proposed by Ausubel theory of learning. Though the students had a poor test performance on exponentiation, the teachers considered the topic as easy and expected their students' performance to be good. The inconsistency between teachers' opinions and students' actual test performance on this topic may indicate that the teachers did not recognize their students' real weaknesses. Moreover, it seems that based on the principles of similarity and proximity in Gestalt theory, the consistent presentation of exponent topic in one grade may facilitate learning and bring about better math performance. Presenting the exponent topics all together may prevent the interference of other topics so that it may shape the exponent schema and its related concepts all at once, hence reducing the potential misunderstanding. The present findings are partly consistent and partly inconsistent with the findings of Sahar Khiz (1991) about exponentiation topic. She reported that the exponentiation topic was a suitable topic in terms of both students' performance and teachers' opinions for two groups of students: the successful and the unsuccessful group. In the present study, the teachers' contended that exponentiation was a simple topic while students' actual test performance showed the reverse of this expectation. Rais Dana (1995) contended that exponentiation topic had no vertical relationship with the elementary school fifth grade, which may account for students' poor performance. Summation, subtraction and multiplication of fractions were the topics that the teachers rated as fair in terms of the level of difficulty and expected their students to have good performance on these topics. However, students' actual test performance was poor on these topics. Again, this may reveal that the teachers did not recognize their students' actual weaknesses so that they considered their students performance much better than it actually was. The present findings about summation and subtraction of fractions partly correspond to the findings of Sahar Khiz (1991) as she reported that this topic was difficult for the unsuccessful group. With regard to students' poor test performance on this topic, the present study revealed that the topic was difficult for students. However, the teachers contended that the topic was fair in terms of the difficulty level, which is inconsistent with the findings of Sahar Khiz (1991). Yang et al. (2010) investigated the fractions topic in three mathematics textbooks in Singapore, Taiwan and the U.S and found a significant difference among them. In Singapore, not only does fraction topic (all rules and four main operations) are totally covered in the fifth grade but the main focus turn to proportions that is totally covered in the sixth grade. In fact, this topic is covered in Singapore schools two years earlier than it is covered in the other two countries. The results of TIMSS showed that Singaporean students outperformed the students from the other two countries in mathematics. Nevertheless, does this mean that Singaporean students have a better inherent talent for learning mathematics than other students? And, does curricular objectives mean that the more topics be sooner taught to students? Iranian students are introduced into the concept of fraction at elementary school and learn it more comprehensively at junior high school, but they have poor performance on the topic of fractions. There is inconsistency between teachers' opinions and students' actual performance on subtraction of two numbers. In other words, while the teachers reported that the topic was fair in terms of the difficulty level and expected the students to have average performance, the students' actual test performance on this topic was poor. Again, we may notice that teachers did not realize the true weaknesses of their students. In the second grade textbook, symmetry of total, rational numbers and calculation of prismatic volumes were considered as barriers to math performance. Both teachers' opinions and students' actual test performance showed that symmetry of total was an inhibiting factor so that the teachers considered this topic difficult and the students' actual test performance was

poor on the topic. Consistent with Gestalt laws of similarity and proximity, covering the rules and concepts of rational numbers all together can facilitate learning and improve students' math performance, hence the meaningful learning. Rastegarpur and colleagues (2009) drew upon ADDIE technique to improve students' performance in rational numbers. The results confirmed the effectiveness of cognitive teaching methods in facilitating learning. Thus, this technique may be used to improve students' math performance. As to calculation of prismatic volumes, the teachers reported that the topic was fair in terms of the difficulty level and expected students to have average performance while the students' actual test performance on the topic was poor. This is, therefore, a barrier to second graders' math performance. The inconsistency between teachers' opinions and second graders' performance on rational numbers and calculation of prismatic volumes indicates teachers' unawareness of students' actual performance levels and weaknesses. Kaldavi (1998) reported that calculation of prismatic volumes in Geometry II textbook was inconsistent with students' cognitive development and already developed schema. Yang (2010) investigated geometry lessons in junior high school and reported that students considered mathematics topics important since they could felt the topics were applicable outside the class, hence the improvement of learning. Yang further suggested that cultural, ethnic and historical backgrounds should be addressed in teaching geometry. In fact, when students learn how to apply geometry rules in their real life, they may have less visualization problems with this topic and may learn better. There was consistency between teachers' opinions and students' test performance on approximate square root. Accordingly, 45 percent of the teachers considered this topic difficult and expected students to have poor performance whereas over 42 percent of students showed poor test performance on the topic. Approximate square root is covered both in the second and third grade textbooks; however, as teachers reported in the essay section, the method introduced to calculate approximate square root in the second grade textbook bears no rational association with the method introduced in the third grade textbook so that over 23 percent of the teachers suggested that the topic be omitted from the second grade textbook. Besides, 19 percent of the teachers suggested that the topic be covered consistently while 22 percent of the teachers recommended that calculation of square root be presented in one grade all at once. Over 17 percent of the teachers reported that this topic should be omitted from the second grade textbook to be presented in a higher grade. These comments indicate that students' poor performance may relate to some factors. Considering the difficulty level of this topic based on teachers' opinions and cognitive theories of learning, the covering of this topic in a higher grade may give students sufficient time to learn and improve their performance on the topic. With regard to the inconsistency between calculation method of square root in the second and third grades, one may contend that the square root schema developed in the second grade interferes with learning the same topic in the third grade. Since the topic is more practical in the third grade textbook than the second one, we may confirm the teachers' opinion about omission of this topic from the second grade textbook. In the third grade, the teachers reported no topic as a barrier to students' math performance. They, therefore, acknowledged that the topics were fair in terms of the difficulty level and expected the students to have average math performance. However, students' actual test performance showed lower performance on sphere and another form of linear equation comparing with teachers' expectation. Despite teachers' expectation, students showed poor performance on these two topics, which may indicate the high difficulty level of the topics. Based on cognitive learning theories, we may suggest that the topic be presented in a higher grade when the students are more cognitively adept to receive the lessons. The present findings correspond to the findings of Yazdani (2011) who investigated teachers' opinions on barriers to math performance in six to eight graders. Turkish teachers reported that students had poor processing abilities, particularly in rational numbers, multiplication and division of decimal numbers, fractions, geometrical concepts and shapes and equation. Teachers reported the following as potential reasons for students' poor math performance: teacher-centered math classes, students' lack of interest in mathematics, large classrooms, lack of parents' involvement in education, errors in mathematics textbooks, unelaborated explanations provided in the mathematics textbooks and insufficient examples and exercises. In the end, it is recommended that teachers' opinions be taken into account in developing junior high school curriculum and in writing mathematics textbooks. In-service training sessions may be provided for the teachers to recognize the application of cognitive learning theories in their practice. It is recommended that mathematics textbooks be modified based on the present and previous findings.

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