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The readability level of the 9th grade new mathematics course book

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Abstract

The current study aimed to identify the readability level of the 9th-grade new mathmatics course book and its relation to mathematical thinking in the Kingdom of Saudi Arabia. The study sample consisted of two categories: the first was the sample of 300-female students, and the second was the lesson-based sample consisting of (10) lessons from the mathematics book. The results of the study showed that the average readability of the 9th-grade new mathematics course book was (37%); that is, it falls in the frustration level, where the average readability of the first unit was (67.2%).

Keywords: Readability; Mathematics; Mathematical Thinking; 9th Grade.

El nivel de legibilidad del libro del curso de matemáticas nuevas de noveno grado

Resumen

El presente estudio tuvo como objetivo identificar el nivel de legibilidad del nuevo libro de cursos de matemáticas de noveno grado y su relación con el pensamiento matemático en el Reino de Arabia Saudita. La muestra de estudio consistió en dos categorías: la primera fue la muestra de 300 estudiantes femeninas, y la segunda fue la

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muestra basada en lecciones que consta de (10) lecciones del libro de matemáticas. Los resultados del estudio mostraron que la legibilidad promedio del nuevo libro de cursos de matemáticas de noveno grado fue (37%); es decir, cae en el nivel de frustración, donde la legibilidad promedio de la primera unidad fue (67.2%).

Palabras clave: Legibilidad; Matemática; Pensamiento matemático; Noveno grado.

1. INTRODUCTION

Reading, which is an intellectual process, is difficult to separate from thinking. Reading and reading comprehension are two closely interrelated processes assisting the learner to understand what he reads because the ability to read is one of the most central skills that an individual can possess in contemporary societies. Besides, it is one of the key methods of understanding and communication, the way to expand the rational horizons of the individual, the multiplication of opportunities for human experience, a means of perception and enjoyment, and a key factor in the mental and emotional development of the individual. It also has a social value, as the cultural and social heritage of man is transmitted from generation to generation, and from individual to individual through written, authored, and printed or books.

Among the profound indications of discovering the significance of reading for science and knowledge is called for by our true religion in the Holy Qur'an, as the first word addressed to the Holy Prophet,

Mohammad by Gabriel, was read. The Qur'an says "Read! In the Name of your Lord Who created. He has created man from a clot. Read! And your Lord is the Most Generous. Who has taught by the pen? He has taught man that which he knew not" (AL-ALAQ, 96). Of note, the first surah was revealed in the Holy Qur'an shows the great importance of the reading process in life.

ABU SAEEDI and ARAIMI (2004) asserted that reading is one of the most essential learning skills in all scholastic subjects, and therefore the responsibility to provide students with the ability to read is no longer the responsibility of language teachers, but that teachers of all other subjects are required to work to help their students acquire the ability to read and understand the content of the text they read. GILYON (2008) maintained that reading the scientific and academic text indicates the skill in understanding the meanings of this text; otherwise, the reading will lose its meaning if the intended reader does not understand the text.

Achieving agreement and harmony between the reader and the read text has led to increasing importance to the matter of readability today.

> Not only interest in reading is limited to the field of education, but also includes all books, and in this regard readability is one of the most useful methods and criteria in developing school textbooks and identifying their level of difficulty (MOMANI, p.817, 2011).

As the textbook is an interpretation and a reflection of an essential part of the curriculum content, it is one of its most central tools, and one of the inputs to the educational system.

> It is the most widely circulated and effective educational source of the educational situation, for it is the process that embraces an important part of the content of the educational material, which translates the curriculum objectives and their implementation tools (JAWARNA, p.96, 2008)

For that reason, the textbook for mathematics teachers is considered a fertile field for developing reading skills for his/her students. There is no doubt that there are specific criteria for authoring and directing the textbook, guiding curriculum designers, and among those criteria is the readability of the book, where readability is one of the most important factors that must be taken with consideration when authoring, analyzing, and evaluating the textbook.

> Readability has several implications, one of the most important of which is the ease or difficulty of the material being read, regardless of the field of that material. That is, it is a meaning that indicates the readability of the material at a certain age level (NJADAT, p. 5, 2000).

Teaching of mathematics has been transformed from a process in which the student is passively receiving information that he/she stores in the form of small elements, and easily retrieves after some degree of repeated training and exercise into an activity in which the student himself/herself builds mathematical data that fits his/her

educational needs. This student, in his/her way, adds meaning to the mathematical information consistent with his/her cognitive structure and processes it in a strong scientific style, investing all his/her knowledge and creativity capabilities. With that, the student shall focus on designing and selecting flexible mathematical contents that allow a wider choice to fit with the needs of students and create a balance between the abstract method and other methods of presenting information (KHAWAJA and et al., 2008).

"From this standpoint, it is clear that the relation of reading and its connection to mathematics is extremely important, as general reading differs from mathematical reading" (BELL, p.232, 2009). In detail, mathematical reading requires accuracy, flexibility, and concentration. When reading a newspaper or novel, a person may not completely pay attention to details, may not focus on the meaning, may read sequentially, or may mentally overlook it. Whereas, when reading a part of a mathematics course book, the reader must know the precise meaning of every mathematical term, and for every mathematical symbol, and there is not much room for the implicit meanings, intuition, and contemplation. For example, when the student tries to understand the theory or write a proof, he/she cannot quickly overlook and pass a word that he/she does not understand, so every mathematical concept has a specific meaning and plays a specific role in understanding a principle or solving a problem.

Contemporary trends in mathematics curricula and teaching methods assert that it is a method of thinking based on understanding and logic, and adopts the method of analysis and discussion to attain

the solution. One of the most important types of thinking in the educational process is mathematical thinking, as it increases the learner's ability to understand mathematics and some other subjects. It also helps in acquiring sound thinking methods that accompany the students throughout their life.

Moreover,

> Mathematical thinking is seen as the way contributing to the development of mathematical thought to realize the significance of mathematical processes, abstraction, the tendency to use applications, and the growth of mathematical abilities to understand mathematical structures (IBRAHIM, p. 300, 2005).

Therefore, the mathematical thinking is essential in helping female students solve math problems and exercises, realize relations, and understand the dimensions of the math problem or exercise, necessitating being attentive to the readability of mathematics, which is suitable for female students who have learning weaknesses, to develop their mathematical thinking.

To address the learning weaknesses of female students, it is necessary to follow modern educational methods in providing scientific lessons appropriate to the level of understanding of female students. This can only be achieved by measuring the readability of the scientific lessons assigned to female students and explaining the importance of their relation to mathematical thinking to facilitate the process of providing appropriate scientific material to the level of female students' understanding and strengthen female students'

communication with that subject. The relationship between reading and thinking is close, as the reader, while reading a text, uses all the mental processes involved in thinking, as she factors in several processes i.e. organization, understanding, analysis, combination, evaluation, inference, criticism, data comparison, connection, conclusion, and generalization. Thus, reading can be considered thinking, for it includes all the processes involved in thinking (ALWAN and TAL, 2010, 368).

2. METHODOLOGY

Due to the nature of the study, its questions, and its objectives, the correlational descriptive approach has been used in this study for its appropriateness.

The study sample consists of:

1. The Female Sample: The study sample was selected from the 9th-grade students in government schools in the city of Hail for the academic year (2018/2019). The middle schools were numbered, and three schools were randomly selected, where the sample consisted of (300) female students. Table 1 shows the distribution of the study sample.

School	School Name	Number of Students
1	The Eighth Middle School	115
2	The Thirty-Sixth Middle School	125

3	The Thirty-Third Middle School	60
Sum		300

Table 1: Distribution of Study Sample among Middle Schools

2. The Lesson Sample: (10) lessons were selected from the 9th-grade mathematics course book for the first semester as follows: two lessons from each school unit in the course book in a total of (10) scientific lessons.

Study Instruments

1. Complement Test

a. Test Construction

The following steps were used in constructing the complement test:

- Reading the 9th-grade mathematics course book for the academic year (2018/2019).
- The school units in the course book were divided into five units, and each unit was considered a scientific text without any change in terms of formulation or meaning.
- Each selected text consists of a title as it is in the course book, so that it is an integrated text when the student reads it.
- Divide each unit title into two questions (two texts), expressing the topic of the unit, which has not been taught to the students yet.
- The seventh word has been deleted from each text, whenever the count is begun from the last deleted word with the first and last

sentence in the text remaining unchanged. The seventh word has been selected because it is the most common trend in omitting vocabulary.

- The number of deleted words reached (109) words and the deleted word may be a scientific term or any other word that gives a correct meaning when reading the sentence, taking into account that numerically written numbers are not counted within the words that can be deleted. Therefore, they should not be counted, as well as the matter in mathematical equations.
- Insert forms and graphics with every question.
- Put deleted words before the text in a table in an unordered manner, and the number of them is more than the number of blanks so that the student does not give a key that may help her anticipate the deleted word.
- Leave a blank space with points in the place of each deleted word, provided that all blanks are of equal length.
- Prepare an answer sheet for the test, where new instructions were set for the female exam.

b. Validity and Reliability of the Test

To verify the validity of the test, it was presented in its initial form to a group of experts and specialists in the curricula and teaching methods of mathematics, and some mathematics supervisors and teachers to check the consistency of the steps in constructing the completion test, the suitability of texts with the level of female students, the number of scientific texts, and the number of words deleted from the text, and the preparation and design of the test. The

opinions of the raters were considered, and the test was modified based on their observations, as the test was completed in its final application form.

The validity of the internal consistency of the test was also verified by applying it to a 50-student survey sample other than the study sample. Then, the correlation coefficient among the scores of each unit of the test units and the total score of the test were calculated as shown in Table 2.

S	**School Unit**	**Correlation Coefficients Value**
1	Linear Equations	0,54
2	Linear Functions	0,46
3	Linear Functions Analysis	0,43
4	Linear Inequalities	0,57
5	Linear Equations Systems	0,65

Table 2: The Correlation Coefficients between Degree of Each Unit of the Units of Complement Test and the Overall Degree of the Test

Table 2 shows that correlation coefficients for test units are acceptable, as they ranged between (0.43-0.65), indicating the validity of the test and its applicability to the study sample. To calculate the reliability of the test, it was applied to a 50-student survey sample, and the reliability was calculated using the Cronbach Alpha Coefficient to

find the internal consistency of the items of the texts separately and for all the texts combined as shown in Table 3.

Unit	Text	Cronbach Alpha Coefficient
First (Linear Equations)	First	0,80
	Second	0,76
Second (Linear Functions)	First	0,73
	Second	0,77
Third (Linear Functions Analysis(	First	0,84
	Second	0,72
Fourth (Linear Inequalities)	First	0,81
	Second	0,82
Fifth (Linear Equations Systems)	First	0,71
	Second	0,77
Test as a Whole		0,89

Table 3: Reliability Coefficient Values (Cronbach Alpha) for Test Texts and Test as a Whole.

Table 3 shows that the values of the Cronbach Alpha Coefficients for each text separately were acceptable, as they ranged between (0.71-0.84). However, for the whole test, the Cronbach alpha coefficient reached (0.89), which is considered an acceptable reliability coefficient, indicating that the complement test is featured with acceptable and applicable reliability to the study sample.

2. Mathematical Thinking Test

a. Test Construction

The following steps were adopted in preparing the mathematical thinking test:

- The mathematical thinking test was prepared for the mathematics 9th-grade new mathematics course book, and consisted of (32) items of multiple-choice test type, fill in the blank, put a true or false sign, and essay questions.
- The criterion for assessing the student's mathematical thinking skills was determined through her answer to the test, where one degree was given for each of the test items so that the final degree of the test becomes (32) degrees. The test included (7) skills which are induction, inference, generalization, symbol expression, logical thinking, problem-solving, and mathematical proof.

b. Validity and Reliability of the Test

To verify the validity of the test, it was presented in its initial form to a group of experts and specialists in the curricula and teaching methods of mathematics, and some mathematics supervisors and teachers to check the validity of the test to measure mathematical thinking skills among 9th female students, the suitability of the questions to measure each skill of the mathematical thinking skills, the validity of the linguistic and grammatical formulation of the question, and degree of consistency of the questions with the objectives. The opinions and guidance of the raters were considered, as the test was completed in its final application form.

3. RESULTS and DISCUSSION

Results related to the first sub-question: What is the readability level of the-9th grade new mathematics course book?

To answer this question, the grades of all female students in the complement test were calculated, and then changed into a percentage to identify the readability level of the-9th grade new mathematics course book, and the readability of each of its units as shown in Table 5.

No	The School Unit	Number of Students	Percentage	Readability Level
1	Linear Equations	300	67,2%	Independent
2	Linear Functions	300	43,5%	Educational
3	Linear Functions Analysis	300	31,3%	Frustration
4	Linear Inequalities	300	24,3%	Frustration
5	Linear Equations Systems	300	21,3%	Frustration
Book as a Whole		300	37,3%	Frustration

Table 5: The Readability Level of the 9th Grade New Mathematics Course Book and the Course Book as a Whole

Table 5 shows that the average of the overall percentage for the readability of the 9th-grade mathematics course book is 37.3%, that is,

it falls in the frustration level, and that the student gets a percentage less than (41%) in the complement test. Accordingly, it was found that the texts of the 9th-grade mathematics course book are not appropriate for the reading levels of female students.

To distribute the female students in the study sample to the readability level of the 9th-grade new mathematics course book, the readability levels were formatted as follows and as shown in Table6.

1. The independent level: It includes female students whose degrees range between (61-100%).

2. The education level: It includes female students whose grades range between (41-60%).

3. The frustration level: It includes female students whose grades are less than (41%).

Readability Level	Number of Students	Percentage
Independent	37	12٪
Educational	122	41٪
Frustration	141	47٪
Sum	300	100٪

Table 6: The Distribution of Female Students in the Study Sample at the Readability Levels

Table (6) shows that (12%) of female students got more than (60%) of the overall degree in the complement test, which is a small percentage, and that (41%) got a percentage ranging between (41-60%) of the overall degree in the complement test, and that (47%) got

less than (41%) of the overall degree in the complement test. Thus, it is noticed that the readability level of female students of mathematics course book comes between the educational and frustration levels, which means a low level of the readability level of the 9th-grade new mathematics course book. In other words, it is not suitable for most students of this class and does not agree with their abilities and levels, that is, it falls in the frustration level.

4. CONCLUSION

The researchers concluded that the effect of the read text is not only limited to developing mathematical thinking skills, but its effect extends to the student's motivation to learn. This indicates that the ability of female students to understand what they read in mathematics course books will help them in understanding scientific knowledge and increase their mathematical thinking skills, which ultimately leads to achieving the desired learning outcomes.

The result of the study differs from the study of (KATHLEEN & ANN, 2001) that showed a strong correlation between student achievement in mathematical skills and mathematical thinking. It also differed from the study of (OSTERHOLM, 2012) that asserted that there is a strong correlation between higher levels of readability on the one hand, and increased achievement and acquisition of mathematical skills on the other hand.

Recommendations

In light of the aforementioned results of the study, the following has been recommended:

1. Adopting the readability measure of mathematics course book using one of the modern readability measurement methods such as the complement test, checking its suitability for the student's level, and determining its readability degree before generalizing it.

2. Incorporating the teacher preparation programs with information that explains and shows them how to read mathematics course books, and that the knowledge and use of the language of the mathematics in expressing the ideas of female students is a primary objective of mathematics teaching process.

3. Conducting studies to measure the readability of mathematics course books and other school subjects at different levels.

4. Conducting studies to monitor the obstacles in front of the readability of the mathematics course books to reduce these obstacles.

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