



Breaking Down Barriers to Science Education: Evaluating the Readability of Science Textbooks for second-grade Secondary Students in Jordan

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This study investigated the readability level of second-grade secondary school scientific stream Chemistry and Physics textbooks in Jordan, determining the effect of gender on the degree of readability, in addition to knowing the order of the textbooks according to the degree of their readability in both books. The current study was conducted to determine the readability level of chemistry and physics textbooks by involving 300 second-grade secondary school students of the public schools affiliated with the Directorate of Education, Jordan. Four Cloze tests were prepared from different topics of both textbooks to measure their readability. The test included four texts with 20 words omitted from each text, and the texts were presented in the same format as in the textbooks, with clear instructions provided for the students. A pilot sample outside the study sample was administered with the test-retest method to confirm the reliability of the four tests for both textbooks. The findings revealed that physics textbooks had a higher level of readability than chemistry textbooks. A significant difference ($p \leq 0.05$) was observed based on the type of textbook in the readability of chemistry and physics textbooks. The scientific texts in the chemistry textbook were ordered in light of their readability level. In contrast, the scientific texts in the physics textbook were not ordered in light of their readability level. The study concluded that the readability level of Jordanian Chemistry and Physics textbooks of the second grade of the scientific stream differed significantly ($p \leq 0.05$). The study recommends that the Jordan Ministry of Education should appoint a panel of experts to review the textbooks and make the necessary changes to improve their readability level.

Keywords: readability level, scientific stream, cloze test, science, secondary students

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INTRODUCTION

The progress of the educational sector is an accurate indicator of development in the other sectors; therefore, considered a feasible measure of society's progress as a whole. There is no doubt that the secondary stage mirrors the success of the previous educational stages and is the cornerstone of the university stage, targeting creating morally, scientifically, and academically competent citizens able to actively participate in the sustainable development of their country (Michelsen & Wells, 2017). Textbooks are considered essential in most schools through the knowledge presented to students enhances their interest in learning materials (Puspitarini & Hanif, 2019). Textbooks containing insufficient knowledge or information negatively affect students' learning abilities (Nwafor et al., 2022). Textbooks are the primary tools in the teaching-learning process, and these are not just an educational aid for the student but a fundamental pillar in the educational process (Tárraga-Mínguez et al., 2021). Textbooks are regarded as the most valuable curriculum component, despite the technological development and deployment of more sophisticated sources of information (Al-Dulaimy, 2019; Bansiong, 2019; Gyasi & Slippe, 2019).

Since textbooks are regarded as the primary tool in the teaching-learning process, the Jordanian Ministry of Education has shown remarkable interest in the quality of textbooks used in teaching students and attempted to develop them in the different stages of learning in a way that corresponds with students' levels and abilities, bearing in mind that textbooks are a fundamental resource for both teacher and student (Abu & Khataybeh, 2020; Amer, 2021). One of the most important goals that school science textbook authors seek is the learners' success in realizing scientific texts' main concepts and ideas. This necessarily requires their ability to read the content, as the learners' ability to read scientific texts is the key to building a meaningful understanding, especially comprehending scientific concepts and extracting their meaning (Al-Kellani & Al-Shraifeen, 2011; Bawaneh & Moumene, 2020). Readability can be defined as the appropriateness of the book's verbal and non-verbal language for the student's understanding level and the conformity between the written material and the reader's reading ability for which it was prepared (Al-Watban, 2019). There is a dire need to address the readability of science books to ascertain their positivity and the extent of their inclusion of basic skills, concepts, and activities that are commensurate with students' level and level of education, achieve the learning objectives on the one hand, and to identify the gaps, negativities, and shortfalls that may hinder the way of achieving these objectives, and overcome them (Alkhatatneh, 2022; Hamzeh et al., 2022).

The importance of the readability of school textbooks has been one of the main interests in the educational field of study (Kintsch & Vipond, 2014). The readability of school textbooks is essential for effective learning and academic success. It also ensures that any technical terms or jargon used in the material can be understood by a wide range of people, including those with limited literacy skills. Difficult textbooks lead to frustration, disinterest, poor performance, and low academic achievement (Lovett et al., 2019). Poor readability levels can have a negative impact on students. On the other hand, a good readability level helps make understanding easier for readers and

encourages them to continue learning by providing an enjoyable experience (Abu & Khataybeh, 2020; Fanny, 2022). Moreover, the importance of addressing textbook readability lies in its role in developing a set of standards related to the readability of texts and their suitability for students at the different learning stages, facing the reading weakness of students, solving problems related to academic delays and learning difficulties; connecting the subjects and understanding their contents; providing textbooks that are consistent with the student's reading levels in each grade, and helping teachers by defining the sources of difficulty in formulating texts in a simplified manner (Miroud, 2021; Toriki, 2012).

Several factors impact the success of the reading process and understanding of the presented text. The main factors that influence the readability level of a text include lexical density (the number of unique words used per sentence), grammatical complexity (such as long sentences with many clauses), and vocabulary difficulty (uncommon words that may be unfamiliar to some readers at certain reading levels) (Amer, 2021). Some other crucial factors comprise the reader's interest and motivation, the legibility of both the print and the illustrations, and word and sentence complexity (Nwafor et al., 2022; Walkington et al., 2018). Readability also depends on other elements such as font size and typeface used in writing texts, making them easier or harder for people with certain visual impairments like dyslexia (Miskiyah, 2021). Additionally, vocabulary and sentence selection, ideas and their presentation, students' reading ability and their developmental characteristics, and the design and production of the printed material, pictures, and drawings related to the educational process are among the crucial factors that impact the readability level of a textbook (Al-Watban, 2019).

Given that reading has a vital role in students learning at different stages, it evokes their abilities, enriches extracurricular opportunities, increases their knowledge, and earns a linguistic tally of vocabulary and compositions through them. There is a need to pay attention to textbooks' readability for their essential role in facilitating the content learning process and achieving the objectives of the teaching-learning process (Alnahdi, 2014; Alnahdi et al., 2020; Al-Kandari, 2016). The readability level of scientific textbooks is a major issue for students in the science stream. Research has indicated that science textbooks are typically written at a higher reading level than what is appropriate for most students. This results in students struggling to understand the material, ultimately leading to poor grades. The problem is compounded by the fact that chemistry and physics textbooks are even more difficult to read than other scientific textbooks. This is because these subjects require a higher level of understanding to grasp the concepts. As a result, students already struggling with the material are even more disadvantaged in these subjects. The readability of scientific textbooks is an essential aspect of education. However, little research has been conducted on the readability of these textbooks, particularly in chemistry and physics. This research seeks to fill that gap by investigating the readability of textbooks in the scientific stream of second-secondary grades in Jordan.

Literature Review

Importance of readability

Many authors have emphasized the importance of "readability" in textbook selection because of the longstanding recognition of written materials, especially textbooks, as a fundamental medium for conveying knowledge in our educational institutions (Choi, 2009; Smedbøl et al., 2017). Science educators have been studying the accessibility of scientific literature since the 1920s (Davis & Walters, 2011; Gaulé, 2009; Hill, 2013). Many modern publishing houses employ readability tests to evaluate the success of their publications. The text's readability affects the reader's understanding which goes beyond the reading level (Adamska-Mieruszewska et al., 2021; Phani et al., 2019). If you want to know how easy or difficult a piece of writing is for the average person to understand, look no further than the text's readability (Bozkurt, 2020; Gül, 2021; Gül & Kargin, 2021). For this reason, readability is an important property in reading instruction (Bozkurt, 2020; Öksüz & Keskin, 2022) as "the degree to which a student at a given level can read and understand a text", as children and young adults cannot read all texts and, even if they do, may not be able to accomplish the goals expected of them (Gyasi & Slippe, 2019; Sultan et al., 2020). Exam difficulty is determined by readability, which considers factors like sentence and word lengths and the number of new terms—evaluation of textual complexity to select choices (Davis & Walters, 2011; Gaulé, 2009; Hill, 2013). There are three levels of readability: The independent level, where students can read the text and accommodate it without the teacher's help. The second level is the educational level, at which students can read and accommodate the text, but with the help and supervision of the teacher. The final level is the frustration level, where the student cannot read and accommodate the text even with the teacher's help (Al Shaye & Al Dhefeiri, 2021; Al-Khaza'leh, 2021).

Factors affecting readability level

Font, font size, spacing, and layout; reader factors like prior knowledge, reading ability, interest, and motivation; vocabulary difficulty; text structure; text coherence and cohesion; and syntax are just some of the factors that affect readability (Gyasi & Slippe, 2019; Hidayatillah & Zainil, 2020; Omer & Al-Khaza'leh, 2021). Many believe high-achieving pupils read more easily than low-achieving students (Sherafati & Ghafournia, 2019). When students discover that a science textbook is written at a higher level than their own, they are less likely to be engaged with reading (Deveci, 2018; Djudin, 2021; Stoffelsma & Spooren, 2019). Learning simple, short words are more straightforward than learning complex, lengthy ones (Kansizoglu & Akdogdu Yildiz, 2022; Yıldırım & Özdemir, 2022). Therefore, it is essential to consider the target audience's age while selecting textbook material, as word and sentence length tend to increase (Batur & Özcan, 2020; Turkbent, 2019). A book's chapters should be organized to build upon one another and serve as necessary preconditions (Balak et al., 2021; Sonmez & Gokmenoglu, 2022). The information delivered in such a text is straightforward to retain. Leading, or the gap between lines, can also impact the readability and speed of a paragraph. Using wide gutter margins allows for incredible speed. Ample white space

within the letter is preferred. An article's readability is directly proportional to the quality of its writing. Readers tend to have an easier time following a piece of writing that more closely mimics the rhythms of spoken language (Chen & Meurers, 2019; Wells et al., 2019).

Impact of readability on students' outcomes

According to previous findings, there are strong and positive associations between student ability and achievement measures (Ahmad et al., 2020; Thompson et al., 2018; Zulkipli et al., 2020). Although some other researchers observed that most students read at a frustration level, they concluded that the high school science curriculum was written at an appropriate level of difficulty for the student's level of competence. More precisely, the findings showed a positive and statistically significant association between students' reading levels and their success in science (Ismail & Yusoff, 2022; Nunoo et al., 2021). After administering a cloze exam and utilizing an online software tool, it was determined that the textbooks suggested to students were excessively challenging (Odo, 2018; Omer & Al-Khaza'leh, 2021). Fatoba (2014) and Fatoba (2015) demonstrated that the readability of textbooks had a substantial effect on student performance in the science disciplines of chemistry and biology, respectively. Instone (2011) warns that "alternative reading materials may be used" if a textbook's readability level is too high for the pupils. If children cannot read novels written for their age group, there is cause for concern. Secondary school pupils in Nigeria generally have a pessimistic attitude toward reading; this is where the problem begins.

Determinants of readability level-Cloze test

There are various indicators of how well a student can read a textbook. Common formulas used in readability studies include the Fry, Gunning, Cloze, Flesch-Kincaid, and Simplified Measure of Gobbledygook tests (SMOG). Research on readability has shown conflicting results (Fatoba, 2014; Instone, 2011; Ismail & Yusoff, 2022). The SMOG equation represents ten opening sentences that flow into one another. The final ten sentences are the ones that matter (which gives you 30 sentences in all). Each time the phrase appears three or more times in a row of sentences, regardless of whether it is the same word each time, sum up those occurrences (Grabeel et al., 2018; Shneyderman et al., 2022). Readability analysis with the SMOG formula was performed using the online readability calculator called "Analyze my Writing" (<http://www.analyzemywriting.com/index.html>). Cloze is the most effective readability formula (Nwafor et al., 2022; Udu et al., 2017). The premise of cloze testing is that, as a reader's comprehension increases, so will their ability to fill in the blanks (Akmedovna, 2022; Dhyaldian et al., 2022; Torki, 2021). The researchers decided to utilize Cloze since it is a reliable and valid tool for gauging both textual complexity and student comprehension (Chung & Ahn, 2019; Lam, 2022; Zare & Boori, 2018).

In Jordan, researchers addressed the level of readability of science books and their relationship to sixth-grade students' acquisition of scientific concepts by employing the Cloze test for readability. It was found that students can read scientific texts and possess the reading skills that lie at the independent, educational, and frustrating levels (Ahmed

& Ahmed, 2022; Amir & Faisal, 2021). While other scientists aimed to identify the level of readability of English language texts for eighth-graders at Gates Nigerian School by determining the level of readability of English language texts for eighth-grade students and using the descriptive-analytical approach. Three reading texts were selected from the English language book, and the selection of 147 sample students for the study and the Cloze test was used to collect data from the study sample. The study found that the level of readability in the texts was moderately high (Lumepa et al., 2021; Mohammed et al., 2022).

The rationale of the study

Proceeding from the philosophy of education based on the educational development plan in Jordan targeting preparing a generation of learners who can keep abreast with developments in science and knowledge and link this knowledge to life, it is necessary to determine the extent to which the textbook has succeeded in all academic levels. The secondary stage, in particular, has a significant role in shaping learners for a sound understanding upon which scientific study at the university level is based (Al Odwan, 2012). This can only be achieved if the textbook is developed using a set of characteristics and standards, and readability level come at the forefront. In addition, related literature emphasized the essential role of learners' interaction with textbooks, thus, their academic achievement, a strong indicator of the success of the educational process and the quality of teaching outputs (Al-Dulaimy, 2019; Zaitoun, 2007). As the secondary stage is crucial for all educational and community institutions, evaluating textbooks for this stage is critical. Physics and chemistry textbooks were chosen in this study because they are one of the most prominent and influential sciences in applied sciences and one of the elements of scientific and technical progress in this era. Given that the achievement of students for the academic year (2020/2021) in chemistry was the highest, while the lowest success rate was in physics, this study tried to stand on the suitability of the two textbooks for students and the extent to which they conform to the standards of textbooks.

Research questions

1. What are the texts' readability levels in Jordan's second secondary grade/ scientific stream chemistry and physics textbooks?
2. Are there statistically significant differences at the significance level ($\alpha = 0.05$) in the readability of the texts included in the second secondary grade/ scientific stream chemistry and physics textbooks in Jordan due to the type of textbook (Chemistry vs. Physics)?
3. Are there any statistically significant differences at ($\alpha = 0.05$) in the second secondary grade/ scientific stream students' means scores towards the level of readability of chemistry and physics textbooks?
4. What is the readability order of texts in Jordan's second secondary grade/ scientific stream chemistry and physics textbooks?

METHOD

Study design

The researchers adopted a descriptive survey design based on describing the phenomenon as it is by monitoring and analyzing the reality of the research problem presented, using the Cloze Test to determine the level of the book's readability as a tool for research and study. For this purpose, several public schools and teachers were approached to identify the specific science textbooks used in second-grade secondary classrooms in Jordan. This involved contacting schools, obtaining permission to conduct the study, and working with teachers to distribute the textbooks to their students.

Study participants

The study population consisted of all second-grade secondary school students/ scientific stream (2267 male and female students) in the public schools affiliated with Irbid The First Directorate of Education in Jordan in the school year 2020/2021. Four schools were randomly selected from the study population - as the school was the unit of selection - with two schools for males and two for females. The study sample comprised 300 male and female students, including 185 male and 115 female students. Concerning the text sample, the researcher randomly selected four texts based on the text length and sentence structure from the two units of the chemistry textbook and then two texts from each study unit. Also, four texts from the physics textbook and one from each study unit were selected, as shown in Table (1).

Table 1

Scientific texts selected from the two books of Physics and Chemistry for the second year of secondary science

Textbook	Text Title change titles	Unit number	Chapter number	Pages
Physics	collisions	1	1	17
	Rotational motion	2	2	104
	Constant electric current	3	3	183
	The magnetic field	4	4	299
Chemistry	Acids and bases	1	1	29
	Reaction speed	2	2	52
	Oxidizing Agents and Reducing Agents	3	3	103
	Organic chemistry	4	4	24

Instrument

The researcher used the Cloze test to determine the readability level of four scientific texts in both textbooks because it is one of the best methods used to measure readability, as it is characterized by the accuracy of its structural nature based on the arrangement of omitted words. A cloze test is a standard measuring tool to assess the level of the book's readability. Cloze tests are often used to determine the level of the book's readability. The higher the number of words the test taker can correctly fill in, the higher the level of the book's readability. It can be used to find the ease with which a reader can read and understand the material. The cloze test is usually given to a group of people, and the

results are used to generate a readability score. This readability score can be instrumental in determining the level of the book's readability (Akmedovna, 2022; Sari, 2020). Cloze Tests are an essential assessment tool that can be applied in various fields such as medicine, law, and education. Cloze Tests have been used to assess students' reading comprehension, lawyers' legal knowledge, and doctors' medical knowledge (Dhadhodara & Joshi, n.d.; Omar et al., 2020; Yang et al., 2021; Yaseen & Rasheed, 2022). The application of the Cloze Test in chemistry and physics textbooks is something that has been employed for quite some time. This technique can help identify and extract the most important information from a text and determine what students need to know in order to understand the material (Nwafor et al., 2022; Rusilowatil & Marwoto, 2021). Furthermore, its honesty and objectivity depend mainly on reading ability and understanding, its ease of application, and saving time and effort.

Test administration

The researcher prepared a sequel test consisting of four sub-tests for both textbooks. These were developed based on the textbooks units. These were two units for each textbook. Four texts were selected from both textbooks so that the tenth word from each text was deleted regardless of its type or function. The first and last sentences of each text were left without deletion. To help students understand the context of the text, the number of omitted words reached 20 words in each text. In addition, the researcher considered that the lengths of the spaces for the omitted words are equal so that students do not link the space between the space and the length of the omitted word. The texts were presented in a manner identical to the student's book regarding letter size, font type, and spaces between words and lines. A set of instructions included primary data for students, the purpose of the test, and how to answer.

The validity of the test

To ensure that the texts of the two textbooks selected from the material study are represented by the scientific texts in the two books and the consistency of the test steps with the conditions for preparing the tests in general, and the Cloze tests in particular, the tests were presented to a panel of 10 experts. They agreed that these texts represent the textbook's readability level. Its consistency with the conditions of the feature tests prepared to measure readability and all their notes and instructions were taken into account. The reliability of the four tests for both textbooks was confirmed by test-retest, where the test was administered to a pilot sample outside the study sample. Then it was administered another time to the same sample two weeks later. The results of the reliability coefficients of the four tests for each textbook are presented in Table 2. The total reliability coefficient, as it is clear from Table 2 concerning the four Cloze tests, was 82.3 for the chemistry textbook and 82.9 for the physics textbook, which is a high-reliability coefficient of the Cloze tests used in this study to measure the level of readability of the two books in question.

Table 2
Reliability coefficients for the four supplementary tests for the two books of Chemistry and Physics

Textbook	Text Title	Reliability coefficient
Chemistry	Acids and bases	84.5
	Reaction speed	76.8
	Oxidizing Agents and Reducing Agents	81.3
	Organic chemistry	86.2
	Total	82.3
	collisions	78.6
Physics	Rotational motion	82.8
	Constant electric current	85.8
	The magnetic field	84.6
	Total	82.9

Test scoring

After collecting the test papers for all study sample students, they were scored by adopting the corresponding scoring method, which stipulates giving one score to the original word that was in the text before being deleted while refusing any word that does not match it even if it is synonymous with it in meaning. Linguistic and grammatical errors were ignored if the word written by the student matched the original word. After summing the scores, the total score was transformed into percentages so that the score for each of the four tests for each textbook was a hundred.

Data analysis

Means and standard deviations were calculated to answer the first and fourth questions, t-test for independent samples was employed to answer the second and third questions using IBM SPSS v 25.0 (Corp, 2017).

FINDINGS

Mean comparison for the readability level of chemistry and physics textbooks in Jordan

Means and standard deviations of the scores of the study sample were calculated on the four tests for the two textbooks, as shown in Table 3. There is a statistically significant difference between the level of readability of chemistry and physics textbooks in favor of physics textbooks. Table 3 shows that all the completion tests to measure the level of the readability of the four texts of the Chemistry book fell within the educational level ($M=40.9$, $SD=24.1$). All the completion tests to measure the level of readability of the four texts of the physics textbook fell within the frustrating level ($M=33.5$, $SD=23$). Despite the continuous efforts to develop secondary school textbooks, textbook authors and supervisors lack appreciation for the importance of the readability level, as it is an essential factor in the success of students' interaction with the textbook as it is appropriate to their reading level. Furthermore, they do not regularly assess students' readability levels, which makes them detached from their real readability level, especially in science books such as physics and chemistry. This result may also be

because students still lack the needed language skills to help them comprehend vocabulary and understand texts, which facilitates the knowledge of deleted words presented to them in the Cloze test. Finally, it can be argued in this respect that students report a low level of Arabic, which is the language employed in the textbooks, as it is the official language in Jordan, and this made it difficult to get high scores on the Cloze test needing high level of reading comprehension skills; something students lack.

Table 3
Readability of my Chemistry and Physics textbooks

Textbook	Text Number	Text Title	N	Mean	SD
Chemistry	1	Acids and bases	300	43.5	25.3
	2	Reaction speed	300	42.2	23.2
	3	Oxidizing Agents and Reducing Agents	300	39.10	23.5
	4	Organic chemistry	300	38.8	24.3
		Total		40.9	24.1
Physics	1	Collisions	300	30.5	23.8
	2	Rotational motion	300	37.6	23.8
	3	Constant electric current	300	39.3	19.6
	4	The magnetic field	300	26.7	24.8
		Mean	Total		33.5

Impact of type of textbook on the readability level

There was a significant difference in the level of readability of the texts of the second secondary grade/ scientific stream chemistry and physics textbooks in Jordan due to the type of textbook, in favor of chemistry textbook ($M=40.9$, $SD=24.1$, $df=299$, $sig.=0.04$) (Table 4). The result may be attributed to the nature of the chemistry content compared to physics, as it is noted that the chemistry book was presented in a manner that preserved the continuity of the text. The reader notices the link between the previous chapter and the next one. This helps students move between textbook chapters more smoothly and makes understanding the text presented easier. Also, the result may be attributed to the different beliefs of chemistry and physics teachers about the teaching methods they employ, as what teachers believe is primarily reflected in their interaction with the textbook, which is translated by activating its role in the teaching process. This contributes significantly to increasing the readability level of the textbook texts as students engage in group interactions on permanent bases, not being satisfied with what the teachers explain in the class as the only source of information. This encourages them to review the textbook texts when explaining the topics. Also, teachers' beliefs have a significant impact on the degree of readability of the textbooks, and this is true for students' beliefs; it can be claimed in this respect that students' beliefs about the difficulty of the physics content, concerning the content of chemistry, which in turn has a direct reflection on the ways of learning and interacting with the content. This led to that students' holding negative attitudes towards the readability level of the physics textbook compared to the chemistry text, which is clear by the scores on the cloze test.

Table 4

Results of the t-test for independent samples to measure the differences between the two reading scores for chemistry and physics textbooks according to gender

Textbook	N	Mean	SD	Df	Sig
Chemistry	300	40.9	24.1	299	0.04
Physics	300	33.5	23	299	0.00

Impact of gender on the readability level of chemistry and physics textbooks

Table 5 represents the result of the t-test concerning the difference in the level of readability of the texts based on gender.

It is clear from Table (5) that there is a significant difference at ($\alpha = 0.5$) between the level of readability of scientific texts in the four complete tests for the chemistry and physics textbooks due to gender, in favor of females, the mean score of the chemistry textbook readability level for females was ($M=43.4$, 43.4%). At the same time, the mean score of the chemistry textbook readability level for males was ($M=38.2$, 38.2%). The means score for the physics textbook readability level for females was ($M=32.1$ 32.1%), while it was for males ($M=29.5$, 29.1%), with (29.1%). The researchers attribute the superiority of females over males in the completion tests in both textbooks to several factors that led to this result, foremost of which is the students' beliefs about the importance of understanding-based learning in obtaining high marks that fulfill their aspirations and hopes for the necessity of excellence. There is no doubt that such beliefs result from the form of education in female classes and the beliefs of female teachers, which creates familiarity between female students and their textbooks, the superiority of females in Arabic grammar and reading skills, where the linguistic and spelling errors in female students' answers were much less than males may also be the reason why female students outperformed their male counterparts in the Cloze test.

Table 5

Ranking of scientific texts in the two books of Chemistry and Physics according to their degree of readability

Textbook	Gender	N	Mean	SD	df	Sig
Chemistry	Male	185	38.2	23.4	184	0.04
	Female	115	43.4	25.0	114	0.01
Physics	Male	185	20.43	20.42	184	0.00
	Female	115	20.21	20.21	114	0.02

Impact of readability order of text on the readability level of chemistry and physics textbooks

Table (6) shows that the scientific texts in the chemistry textbook are ordered in light of their readability level. In contrast, the scientific texts in the physics textbook are not ordered in light of their readability level. The result may be attributed to the fact that including scientific texts or being contained in light of their readability level is only a practical translation of the educational philosophy in Jordan, stressing the need for the texts included in the various textbooks to conform to students' development levels. In other words, the chemistry textbook texts were gradually ordered logically based on student's previous knowledge and their interaction with chemistry. By contrast, the texts

in physics textbooks were not logically ordered in their readability level in the way reflecting the developmental level of students. The result may be attributed to the fact that there are topics of scientific texts in the chemistry textbook that have been presented in previous classes. On the other hand, it can be said that this is not true for the texts of the physics textbook, as students are exposed to new forms of concepts and knowledge that are new to them.

Table 6

The readability level of the scientific texts in the books of Chemistry and Physics, according to their sequence in the book

Textbook	Number	Text Title	Mean
Chemistry	1	Acids and bases	43.5
	2	Reaction speed	42.2
	3	Oxidizing agents and reducing agents	39.10
	4	Organic chemistry	38.80
		Total	40.9
Physics	1	Collisions	23.8
	2	Rotational motion	23.8
	3	Constant electric current	19.6
	4	The magnetic field	24.8
		Total	23

DISCUSSION

The study compared the readability level of chemistry and physics textbooks in Jordan for second-grade secondary grade students and investigated the impact of the textbook type and gender on the readability level. The study also identified any significant differences between the two textbooks' readability levels and explored the factors that may contribute to these differences. Four completion tests were conducted to measure the readability level of the texts in the two textbooks. The sample's mean scores and standard deviations were calculated for each test. The results showed a statistically significant difference between the two textbooks' readability level, with Physics textbooks having a lower readability level than Chemistry textbooks. The results are consistent with the findings of Fatoba (2014) and Fatoba (2015), who use the cloze test to describe the relationship between the readability of chemistry and physics. Their findings show a significant and positive relationship between the readability of chemistry and physics, which influence students' achievements by understanding the language in Jordan. The results on levels of reading exceeding the age and developmental levels are similar to Yong (2010) and Cardak et al. (2016) on science textbooks such as chemistry and physics, which provides complete knowledge of the readability of these books.

The results obtained from the cloze test to evaluate the readability level of two science textbooks are in line with previous studies that observed the cloze test for readability by finding frustration levels formed due to the language barrier as well as the achievement level of students (Bahaa El-Din Ahmed Elshrabassee & Abdel-Latif Mostafa, 2021; Sari, 2020; Sjahrony et al., 2018). The introductory physics and chemistry textbooks for the secondary school system in Africa are frustrating, like in Jordan, as employed from the cloze test results (Ani et al., 2021; Nunoo et al., 2021; Omebe, 2015). Furthermore,

the intended students were frustrated by physics, biology, chemistry, and other science subjects (Gyasi & Slippe, 2019; Hakim et al., 2021; Sari, 2020). The students consider physics difficult as it is more comprehensive than chemistry, which contains chemical reactions (Yong, 2010). The low achievements of these science subjects are due to the lack of technology, poor assignment pedagogies, current issues, and lack of assessment of subject content in the Jordan curriculum subjects (Cole & Espinoza, 2008; Songer et al., 2002). This conflicts with the case of Jordan, that chemistry does not cover the aspects that can be used in daily life (Al-Amoush et al., 2014; Khaddoor et al., 2017).

Arabic language in our textbooks also causes problems because it can create a language barrier in understanding the basics of readability that could affect the achievement of students, as supported by several researchers (Al Shaye & Al Dhefeiri, 2021; Al-Khaza'leh, 2021; Sjahrony et al., 2018). Thus, introducing Arabic language textbooks for readability of physics and chemistry results in low readability content and is significantly different in favor of females. Moumni & Almoumni (2011) investigated the readability effect in the context of gender in Arabic in the fourth primary school textbook. Results indicate that the achievement level of students in the cloze test falls descriptively. Similar studies showed the readability level of textbooks in Arabic by the Jordan government based on gender, school type, and nature of knowledge, which indicated the readability of textbooks on an educational level and showed significant results in favor of female pupils, literacy texts, and type of knowledge (Abu & Khataybeh, 2020, 2020; Khalid et al., 2020).

As indicated in the present results, low achievement levels and a common understanding of textbooks in the Arabic language may be due to a lack of technology in using physics and chemistry in daily life (Fouad et al., 2015; Mansour, 2010). Jordan, among Arab countries, introduced western books in Arabic form, which would be the primary cause of low achievements of readability due to the lack of support from authors, teachers, and stakeholders, as shown in our findings (Dagher & BouJaoude, 2011; Mansour & Al-Shamrani, 2015). Students who learn more from pictures ultimately lead to low readability achievements (Armstrong, 2014; De Jong & Griffiths, 2006). The illustrative content in chemistry and physics textbooks to make it more readable is taken from routine work (Berkel, 2005; Vos et al., 2010), which shows the societal relationship between chemistry-physic technology society by showing more pictures and figures from daily life. The societal relation of textbooks with everyday life enhances the curriculum of chemistry and physic to improve the readability of these textbooks (Gess-Newsome et al., 2006; van Griethuijsen, n.d.). Students in Jordan tend to have a stronger connection to and interest in chemistry as a subject compared to physics because the Arabic language used in Jordan has a rich scientific vocabulary related to chemistry, making the subject more accessible and easier to understand for students. Also, Jordanian students tend to perform better in chemistry than physics, as shown in our findings (Dagher et al., 2010; Khaddoor et al., 2017).

CONCLUSION

Based on the current findings, it can be concluded that there is a significant difference in the level of readability of chemistry and physics textbooks in Jordan, with physics

textbooks being more challenging to read than chemistry textbooks. The authors and supervisors of the textbooks lack appreciation for the importance of the readability level, and students may lack the necessary language skills to comprehend the texts' content fully. Furthermore, the study found that the type of textbook significantly impacted the level of readability, with the chemistry textbook being more readable than the physics textbook. Finally, there was a significant difference in the level of readability based on gender, with females outperforming males in the completion tests for both chemistry and physics textbooks.

The current study highlights the need for textbook authors and supervisors to pay more attention to the readability level of textbooks, especially in science subjects such as physics and chemistry. They should ensure that the language used is appropriate for students reading levels and regularly assess students' readability levels to make necessary adjustments. The study also suggests that there may be gender differences in the readability level of textbooks, with females outperforming males in completion tests. Teachers and textbook authors should be aware of this and take steps to ensure that textbooks are accessible and understandable to all students, regardless of their gender.

Future research concerning the readability context should describe the complete socioeconomic benefits of readability to support children's attitudes towards textbooks and emphasizes increasing teacher support and achievement levels of students by adding more pictures in textbooks because a pictorial understanding of something is easier than theory. Also, the authors will explore the relationship between students' language skills and their ability to comprehend and interact with scientific textbooks. This will involve assessing students' language proficiency levels and examining how these skills impact their ability to understand complex scientific vocabulary and concepts presented in the textbooks.

RECOMMENDATIONS

In light of the review and discussion of the study results, the researchers suggest the following recommendations:

The importance of integration between the Ministries of Higher Education and Education, so that the recommendations of academics are responded to in their research on the elements of the curriculum to develop the academic reality in schools, foremost of which are the results of content analysis studies.

The need for the Ministry of Education to emphasize through periodic meetings with science teachers the importance of employing books in school classes and not only summarizing information for students.

Emphasizing the importance of reading textbooks based on student knowledge. It is necessary to inform authors of the concept of readability and its essential role in students' understanding of scientific concepts and textbooks to promote the readability level of science subjects textbooks such as physics and chemistry.

The importance of ordering topics and texts in science school subjects based on students' developmental level and in a manner that responds.

As teachers' beliefs directly impact the methods of teaching and learning that they adopt, it is vital to consider these beliefs when developing school textbooks.

Focus on the importance of Arabic in all school stages and create familiarity between students and textbooks by activating its role in classroom lessons by science teachers.

CONFLICT OF INTEREST / COMPETING INTEREST STATEMENT

As the three researchers are colleagues working at the same educational institution, there is no conflict of interest since the researchers are submitting this research as a part of their tenure for academic promotion and to fulfill the set forth by Al-Balqa'a Applied University requirements.

REFERENCES

- Abu, R., & Khataybeh, A. (2020). Analyzing the Readability Level of the English Textbooks Used in Jordan. *Research in English Language Pedagogy*, 8(2), 334–348.
- Adamska-Mieruszewska, J., Mrzygłód, U., Suchanek, M., & Fornalska-Skurczyńska, A. (2021). Keep it simple. The impact of language on crowdfunding success. *Economics & Sociology*, 14(1), 130–144.
- Ahmad, M., Shah, M., & Raheem, M. A. (2020). Scientific reasoning ability and academic achievement of secondary school students. *Global Regional Review*, 1, 356-363.
- Ahmed, F. K., & Ahmed, F. K. (2022). Analysis of the science books) chemistry units (for the first and second grades on the skills of the 21st century. *Journal of Education and Scientific Studies*, 1(19).
- Akmedovna, B. M. (2022). *The Effectiveness of Cloze Tests in Assessing the Reading of B2 Level Learners*.
- Al-Dulaimy, S. A. J. (2019). Readability level of the reading and texts books for the first middle grade in Iraq. *Journal of Tikrit University for Humanities*, 25(9), 375-391.
- Al Odwan, T. (2012). The effect of the directed reading thinking activity through cooperative learning on English secondary stage students' reading comprehension in Jordan. *International Journal of Humanities and Social Science*, 2(16), 138–151.
- Al Shaye, S., & Al Dhefeiri, M. D. (2021). Readability Level of Arabic Language Textbook of the Sixth Grade in the State of Kuwait. *Journal of Educational and Social Research*, 11(4), 197–197.
- Al-Amoush, S., Markic, S., Usak, M., Erdogan, M., & Eilks, I. (2014). Beliefs About Chemistry Teaching and Learning—A Comparison of Teachers' and Student Teachers' beliefs from Jordan, Turkey and Germany. *International Journal of Science and Mathematics Education*, 12(4), 767–792.
- Al-Dulaimy, S. A. J. (2019). Readability Level of The Reading and Texts Books for The First Middle Grade in Iraq. *Journal of Tikrit University for Humanities-مجلة جامعة تكريت للعلوم الانسانية*, 25(9), 391–375.

Al-Kellani, A., & Al-Shraifeen, N. (2011). *Introduction to research in educational and social sciences.*, Dar Almaisarah for publishing, distribution and printing. Amman, Jordan.

Alkhatatneh, S. K. (2022). Inclusion of 21st Century Skills in Mathematics Textbook for the Sixth Grade in Jordan. *International Journal of Special Education*, 37(3).

Al-Khaza'leh, S. T. J. (2021). The level of readability of the functional Arabic book for non-native speakers At Al al-Bayt University.

Alnahdi, G. H. (2014). Special Education Programs for Students with Intellectual Disability in Saudi Arabia: Issues and Recommendations. *Journal of the International Association of Special Education*, 15(1).

Alnahdi, G. H., Elhadi, A., & Schwab, S. (2020). The positive impact of knowledge and quality of contact on university students' attitudes towards people with intellectual disability in the Arab world. *Research in Developmental Disabilities*, 106, 103765.

Al-Watban. (2019). Readability level of the pictures included in My Beautiful Language Book for the 4th primary grade. 1(13), 79–125.

Amer, M. A. B. (2021). Lexical Density and Readability of Secondary Stage English Textbooks in Jordan. *International Journal for Management and Modern Education*, 2(2), 11–20.

Amir, N. A., & Faisal, H. A. S. (2021). Analysis of the Content of the Chemistry Book for the Third Grade is Average according to Controversial Issues. *Annals of the Romanian Society for Cell Biology*, 25(6), 9886–9900.

Ani, M. I., Ekeh, D. O., Obodo, A. C., Neboh, P. O., & Tafi, F. I. (2021). Readability of basic science textbooks for junior secondary schools in Enugu state, Nigeria. *Journal of Educational Research in Developing Areas*, 2(1), 13–23.

Armstrong, D. (2014). Educator perceptions of children who present with social, emotional and behavioural difficulties: A literature review with implications for recent educational policy in England and internationally. *International Journal of Inclusive Education*, 18(7), 731–745.

Bahaa El-Din Ahmed Elshrabassee, A., & Abdel-Latif Mostafa, M. (2021). Measuring Readability of Some Agricultural Extension Pamphlets Among Farmers in Some Villages in Assiut Governorate By using Cloze test. *Assiut Journal of Agricultural Sciences*, 52(5), 13–13.

Balak, N., Inan, D., Ganau, M., Zoia, C., Sönmez, S., Kurt, B., Akgül, A., & Tez, M. (2021). A simple mathematical tool to forecast COVID-19 cumulative case numbers. *Clinical Epidemiology and Global Health*, 12, 100853.

Bansiong, A. J. (2019). Readability, content, and mechanical feature analysis of selected commercial science textbooks intended for third grade filipino learners. *Cogent Education*, 6(1), 1706395.

Batur, Z., & Özcan, H. Z. (2020). *Readability levels of texts in the sixth grade Turkish text books.* 690(1), 217–230.

- Bawaneh, A. K., & Moumene, A. B. H. (2020). Flipping the Classroom for Optimizing Undergraduate Students' Motivation and Understanding of Medical Physics Concepts. *EURASIA Journal of Mathematics, Science and Technology Education*, 16(11).
- Berkel, B. van. (2005). *The structure of current school chemistry*. A quest for conditions for escape. Utrecht University.
- BOZKURT, M. (2020). Comparison of Turkish Course Books at Primary School's First Grade in Terms of Readability. *Advances in Social Science Research*, 157.
- Cardak, O., Dikmenli, M., & Guven, S. (2016). 7th grade science textbook readability and compatibility with the target age level. *International Research in Higher Education*, 1(1), 101–106.
- Chen, X., & Meurers, D. (2019). Linking text readability and learner proficiency using linguistic complexity feature vector distance. *Computer Assisted Language Learning*, 32(4), 418–447.
- Choi, E. Y. (2009). *The perception of high school instrumental music students regarding their musical leisure activities*. University of Southern California.
- Chung, E. S., & Ahn, S. (2019). *Examining cloze tests as a measure of linguistic complexity in L2 writing*. *어학연구 (Language Research)*, 55.
- Cole, D., & Espinoza, A. (2008). Examining the academic success of Latino students in science technology engineering and mathematics (STEM) majors. *Journal of College Student Development*, 49(4), 285–300.
- Corp, I. (2017). *IBM SPSS statistics for windows, version 25*.
- Dagher, Z., BouJaoude, S., & Alameh, S. (2010). *Analysis of nature of science coverage in Egyptian and Lebanese middle school science textbooks*. 21–24.
- Dagher, Z. R., & BouJaoude, S. (2011). Science education in Arab states: Bright future or status quo? *Studies in Science Education*, 47(1), 73–101.
- Davis, P. M., & Walters, W. H. (2011). The impact of free access to the scientific literature: A review of recent research. *Journal of the Medical Library Association: JMLA*, 99(3), 208–217.
- De Jong, T., & Griffiths, C. (2006). The role of alternative education programs in meeting the needs of adolescent students with challenging behaviour: Characteristics of best practice. *Journal of Psychologists and Counsellors in Schools*, 16(1), 29–40.
- Deveci, T. (2018). *Increasing students' interest in reading in a foreign language: A focus on skimming and scanning*. Dubai, UAE: Khalifa University of Science and Technology.
- Dhadhodara, N., & Joshi, B. (n.d.). *The Relationship of Grammatical Knowledge and Sentence Structure Knowledge with Cloze Test Based Reading Comprehension*. *Voices of Teachers and Teacher Educators*, 22.
- Dhyaaldian, S. M. A., Al-Zubaidi, S. H., Mutlak, D. A., Neamah, N. R., Albeer, A. A. M. A., Hamad, D. A., Al Hasani, S. F., Jaber, M. M., & Maabreh, H. G. (2022).

Psychometric evaluation of cloze tests with the Rasch model. *International Journal of Language Testing*, 12(2).

Djudin, T. (2021). Promoting students' conceptual change by integrating the 3-2-1 reading technique with refutation text in the physics learning of buoyancy. *Journal of Turkish Science Education*, 18(2), 290–303.

Fanny, A. P. (2022). *An analysis of readability level in english textbooks*.

Fatoba, J. O. (2014). Readability level of recommended chemistry textbooks and students' Academic performance in senior secondary schools in Ekiti state, Nigeria. *International Journal of Education and Research*, 2(9), 41–50.

Fatoba, J. O. (2015). Readability Of Biology Textbooks and Students'academic Performance in Senior Secondary Schools in Ekiti State Nigeria. *European Journal of Research and Reflection in Educational Sciences*, 3(3).

Fouad, K. E., Masters, H., & Akerson, V. L. (2015). Using history of science to teach nature of science to elementary students. *Science & Education*, 24(9), 1103–1140.

Gaulé, P. (2009). Access to scientific literature in India. *Journal of the American Society for Information Science and Technology*, 60(12), 2548–2553.

Gess-Newsome, J., Southerland, S. A., & Johnston, A. (2006). *Translation of teachers' views to students' understandings of the definitions of science: Examining a reform based college science course*.

Grabeel, K. L., Russomanno, J., Oelschlegel, S., Tester, E., & Heidel, R. E. (2018). Computerized versus hand-scored health literacy tools: A comparison of Simple Measure of Gobbledygook (SMOG) and Flesch-Kincaid in printed patient education materials. *Journal of the Medical Library Association: JMLA*, 106(1), 38.

Gül, S. (2021). Determination of the Readability Levels of the Texts Related to Biology Topics in the Science Textbook-6. *Open Journal for Educational Research*, 5(1), 77-90.

Gül, S., & Kargin, P. D. (2021). Text Readability Level Investigation about Biology Subjects-Related Units in Science 7 Textbook'. *Journal of Science Learning*, 4(4), 347-356.

Gyasi, W. K., & Slippe, D. P. (2019). Readability of English language textbooks for diploma students of the University of Cape Coast. *International Journal of Research Studies in Learning*, 8(1), 107–115.

Hakim, A. A., Setyaningsih, E., & Cahyaningrum, D. (2021). Examining the Readability Level of Reading Texts in English Textbook for Indonesian Senior High School. *Journal of English Language Studies*, 6(1), 18–35.

Hamzeh, M., Tabieh, A. A., & Mansour, O. N. (2022). Twenty-first-century skills acquired by mathematics teachers: School principals' perspectives. *Cypriot Journal of Educational Sciences*, 17(1), 41–55.

Hidayatillah, N., & Zainil, Y. (2020). The readability of students' textbook used in semantic and pragmatic course in english language education program of UNP. *Journal of English Language Teaching*, 9(1), 144–159.

- Hill, H. (2013). Disability and accessibility in the library and information science literature: A content analysis. *Library & Information Science Research*, 35(2), 137–142.
- Instone, E. A. (2011). *The Variance Amongst the Results of Readability Formulas Regarding*. U.S. History Textbooks.
- Ismail, M. F., & Yusoff, N. M. R. N. (2022). Textbook Technical Presentation Vs. Readability: An Analysis of Kbd Form Four Arabic Textbooks in Malaysia. *Journal of Nusantara Studies (JONUS)*, 7(2), 270–290.
- Kansizoglu, H. B., & Akdogdu Yildiz, E. (2022). Examining the Relationship between Prospective Teachers' Listening Skills, Reading Habits, Effective Speech Self-Efficacy, Writing Dispositions and Communication Skills: A SEM Approach. *International Journal of Contemporary Educational Research*, 9(2), 412–431.
- Khaddoor, R., Al-Amoush, S., & Eilks, I. (2017). A comparative analysis of the intended curriculum and its presentation in 10th grade chemistry textbooks from seven Arabic countries. *Chemistry Education Research and Practice*, 18(2), 375–385.
- Khalid, Q., Mohammed, K. M., & Sanaa, S. (2020). The level of readability of the computer sciences textbook among the eleventh-grade students in Jordan. *Educational Research and Reviews*, 15(2), 72–80.
- Kintsch, W., & Vipond, D. (2014). Reading comprehension and readability in educational practice and psychological theory. *Perspectives on Learning and Memory*, 329–365.
- Lam, R. (2022). Book Review: *Assessing Second Language Reading: Insights from Cloze Tests* by SADEGHI K.
- Lovett, J., Gordon, C., Patton, S., & Chen, C. X. (2019). Online information on dysmenorrhoea: An evaluation of readability, credibility, quality and usability. *Journal of clinical nursing*, 28(19-20), 3590-3598.
- Lumepa, R. A., Tuna, J. R., & Andries, F. A. (2021). Readability Assessment of Reading Texts in Pathway to English for SMA/MA Grade X. *KOMPETENSI: Jurnal Bahasa Dan Seni*, 1(04), 408–420.
- Mansour, N. (2010). Science teachers' interpretations of Islamic culture related to science education versus the Islamic epistemology and ontology of science. *Cultural Studies of Science Education*, 5(1), 127–140.
- Mansour, N., & Al-Shamrani, S. (2015). *Science education in the Arab Gulf states: Visions, sociocultural contexts and challenges*. Springer.
- Michelsen, G., & Wells, P. J. (2017). *A Decade of progress on education for sustainable development: Reflections from the UNESCO Chairs Programme*. UNESCO Publishing.
- Miroud, S. (2021). *An evaluation of the reading texts in The English text book for the 3rd year of secondary education*. 10(2), 69–92.
- Miskiyah, N. (2021). *Analyzing Lexical Density and Readability of Reading Texts in English Textbook Stop Bullying Now* by Mahrukh Bashir.

- Mohammed, L., Aljaberi, M. A., Anmary, A., & Abdulkhaleq, M. (2022). *Analysing English for Science and Technology Reading Texts Using Flesch Reading Ease Online Formula: The Preparation for Academic Reading* (No. 2516–2314). EasyChair.
- Moumni, A., & Almoumni, M. (2011). *Readability level of Arabic language textbooks of fourth-year primary schools in Jordan*. 27(4), 558–588.
- Nunoo, F. K. N., Anane-Antwi, E., Mensah, D. P., Nunoo, I. E., & Brew-Hammond, A. (2021). Readability Analyses of Integrated Science Textbooks for Junior High Schools in Ghana. *African Journal of Educational Studies in Mathematics and Sciences*, 17(2), 61–72.
- Nwafor, C. E., Abonyi, O. S., Onyema, E. M., Oka, O. O., & Igba, E. C. (2022). *Content Coverage and Readability of Science Textbooks in Use in Nigerian Secondary Schools*.
- Odo, D. M. (2018). A comparison of readability and understandability in second language acquisition textbooks for pre-service EFL teachers. *Journal of Asia TEFL*, 15(3), 750.
- Öksüz, H. İ., & Keskin, H. K. (2022). A Study on the Impact of Readability on Comprehensibility. *International Journal of Progressive Education*, 18(1), 322–335.
- Omar, R., El-Makky, N., & Torki, M. (2020). *A Character Aware Gated Convolution Model for Cloze-style Medical Machine Comprehension*. 1–7.
- Omebe, C. A. (2015). Using close procedure in assessing the readability of approved chemistry textbooks in Ebonyi state secondary schools in Nigeria. *BEST International Journal of Humanities, Arts, Medicine and Sciences*, 3(10), 97–104.
- Omer, I. A. M., & Al-Khaza'leh, B. A. (2021). Readability and Readability Formulas: English as a Foreign Language Tertiary Education Teachers' Awareness in Shaqra University, Saudi Arabia. *Journal of Education in Black Sea Region*, 7(1), 166–180.
- Phani, S., Lahiri, S., & Biswas, A. (2019). Readability Analysis of Bengali Literary Texts. *Journal of Quantitative Linguistics*, 26(4), 287–305.
- Puspitarini, Y. D., & Hanif, M. (2019). Using Learning Media to Increase Learning Motivation in Elementary School. *Anatolian Journal of Education*, 4(2), 53–60.
- Rusilowatil, A., & Marwoto, P. (2021). *Development of integrated teaching materials vibration, wave and sound with ethnoscience of bundengan for optimization of students' scientific literacy*. 1918(5), 052057.
- Sari, R. K. (2020). The Assessment of The Readability of English Junior high School Textbooks by Implementing Cloze Procedure. *Journal of English Language Teaching*, 4(2), 101–105.
- Sherafati, S., & Ghafournia, N. (2019). The Relationship Among L2 Motivational Self-System, Reading Comprehension Ability, and Gender: A Study of EFL Learners in Iran. *Journal of Applied Linguistics and Applied Literature: Dynamics and Advances*, 7(2), 29-45.

- Shneyderman, M., Davis, R., Snow, G., Dhar, S., & Akst, L. M. (2022). Zenker's Diverticulum: Readability and Quality of Online Written Education Materials. *Dysphagia*, 1–7.
- Sjahrony, A., Lubis, M. A., & Baharudin, H. (2018). The readability of Arabic textbooks among university students in Malaysia based on the cloze test. *Advanced Science Letters*, 24(1), 443–446.
- Smedbøl, T., Saksvik-Lehouillier, I., & Skaug, S. (2017). Overcommitment in students a purely negative trait? An exploratory approach towards a more comprehensive understanding. *College Student Journal*, 50(3), 378–392.
- Songer, N. B., Lee, H., & Kam, R. (2002). Technology-rich inquiry science in urban classrooms: What are the barriers to inquiry pedagogy? *Journal of Research in Science Teaching: The Official Journal of the National Association for Research in Science Teaching*, 39(2), 128–150.
- Sonmez, E. D., & Gokmenoglu, T. (2022). The Impact of Principals' Distributed Leadership Behaviors on Teachers' Attitudes Toward Multiculturalism: Social Justice Leadership as Mediator. *Education and Urban Society*, 00131245221076095.
- Stoffelsma, L., & Spooren, W. (2019). The relationship between English reading proficiency and academic achievement of first-year science and mathematics students in a multilingual context. *International Journal of Science and Mathematics Education*, 17(5), 905–922.
- Sultan, S., Rapi, M., Mayong, M., & Suardi, S. (2020). Textbook discourse readability: Gender, reading interest, and socioeconomic status of students with poor reading ability. *Journal Cakrawala Pendidikan*, 39(3), 583–596.
- Tárraga-Mínguez, R., Tarín-Ibáñez, J., & Lacruz-Pérez, I. (2021). Analysis of word problems in primary education mathematics textbooks in Spain. *Mathematics*, 9(17), 2123.
- Thompson, E. D., Bowling, B. V., & Markle, R. E. (2018). Predicting student success in a major's introductory biology course via logistic regression analysis of scientific reasoning ability and mathematics scores. *Research in Science Education*, 48(1), 151–163.
- Torki, S. (2012). *The Relationship Between Learners' lexical Coverage and The Readability Levels of The Algerian English Textbooks*.
- Torki, S. (2021). Readability of the textbook series Q: Skills for Success in use at Imam Abdulrahman Bin Faisal University. *Middle East Journal of TEFL*, 1(2), 13–25.
- Turkben, T. (2019). Readability Characteristics of Texts in Middle School Turkish Textbooks. *Educational Policy Analysis and Strategic Research*, 14(3), 80–105.
- Udu, T. T., Gyuse, E. Y., Samba, R. M., & Iortim, S. (2017). *Readability Characteristics of Nigerian Science Textbooks as A Factor of Students' science Achievement*. Reading.

van Griethuijsen, R. A. (n.d.). F, Michiel W. van Eijck, Helen Haste, Perry J. den Brok, Nigel C. Skinner, Nasser Mansour, Ayse Savran Gencer, and Saouma BouJaoude. 2015. "Global Patterns in Students' Views of Science and Interest in Science." *Research in Science Education*, 45(4), 581–603.

Vos, M. A., Taconis, R., Jochems, W. M., & Pilot, A. (2010). Teachers implementing context-based teaching materials: A framework for case-analysis in chemistry. *Chemistry Education Research and Practice*, 11(3), 193–206.

Walkington, C., Clinton, V., & Shivraj, P. (2018). How readability factors are differentially associated with performance for students of different backgrounds when solving mathematics word problems. *American Educational Research Journal*, 55(2), 362–414.

Wells, N., Forsdick, C., Bradley, J., Burdett, C., Burns, J., Demossier, M., de Zárata, M. H., Huc-Hepher, S., Jordan, S., & Pitman, T. (2019). Ethnography and modern languages. *Modern Languages Open*, 1, 1–16.

Y Al-Kandari, H. (2016). Students' Familiarity with and Attitudes toward People with Intellectual Disabilities in Kuwait: Educational Level and Gender Invariance. *Journal of the Social Sciences*, 44(2).

Yang, A. C., Chen, I. Y., Flanagan, B., & Ogata, H. (2021). Automatic generation of cloze items for repeated testing to improve reading comprehension. *Educational Technology & Society*, 24(3), 147–158.

Yaseen, M. A., & Rasheed, W. A. (2022). A Comparative Study Of Efl University Students' Written Performance On Cloze And Standardized Test. *Journal of Positive School Psychology*, 6(10), 1282–1289.

Yıldırım, Ö. K., & Özdemir, M. (2022). *A study on the comparative analysis of writing skills activities in Japanese and Turkish textbooks*. 10(4), 410–418.

Yong, B. (2010). Can students read secondary science textbooks comfortably. *Brunei International Journal of Science and Mathematics Education*, 2(1), 59–67.

Zaitoun, A. M. (2007). *Constructivist theory and strategies for teaching science*. Dar Alshrouq for Publishing and Distribution, First (Ed), Amman-Jordan. 66.1, 9.

Zare, S., & Boori, A. A. (2018). Psychometric Evaluation of the Speeded Cloze-Elide Test as a General Test of Proficiency in English as a Foreign Language. *International Journal of Language Testing*, 8(2), 33–43.

Zulkipli, Z. A., Yusof, M. M. M., Ibrahim, N., & Dalim, S. F. (2020). Identifying Scientific Reasoning Skills of Science Education Students. *Asian Journal of University Education*, 16(3), 275–280.