Impact of Literal Translation on Arabic Science Textbook Comprehension: A Linguistic Content Analysis

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Abstract

This study investigates the linguistic quality of translated science textbooks in Arabic-medium education, focusing on the Saudi secondary biology textbook adapted from the American McGraw-Hill series. Translated textbooks in the Arab world often retain the linguistic imprint of the source language, potentially hindering student comprehension. To address this, a 25-indicator content analysis framework was developed based on Gardner's theory of linguistic intelligence, encompassing five dimensions: vocabulary diversity, structural clarity, rhetorical strategies, interactive activities, and logical sequencing. All nine chapters (268 pages) were systematically analyzed, with inter-rater reliability reaching kappa = 0.87. Results revealed a moderate overall score of 59% (44/75), with logical sequencing performing well (80%), but rhetorical strategies and interactive activities critically low (47% each). Three indicators consistently scored zero: etymological linking of terminology, locally relevant examples, and scientific linguistic games. A total of 387 linguistic problems were identified, dominated by literal translation effects (132 cases, 34.1%). Recurring issues included unnatural prepositional constructions ("biwasitatiha" >200 times), excessively long sentences (>40 words), and the absence of cultural references to Saudi, Arab, or Islamic contexts. Teacher interviews (n=6) and student focus groups (n=32) fully corroborated the content analysis, confirming systemic rather than incidental problems. The validated framework offers a replicable diagnostic tool for evaluating translated science textbooks in Arabic-medium settings. Findings highlight the urgent need for culturally contextualized translation practices to enhance science literacy. Limitations include the focus on a single textbook and subject area; future research should extend to cross-national comparisons and explore AI-assisted translation for improved linguistic adaptation. This study contributes to translation studies and science education by demonstrating how linguistic intelligence-based evaluation can inform textbook development in non-Anglophone contexts.

Keywords: Content Analysis; Literal Translation; Science Textbook; Linguistic Intelligence; Arabic Language

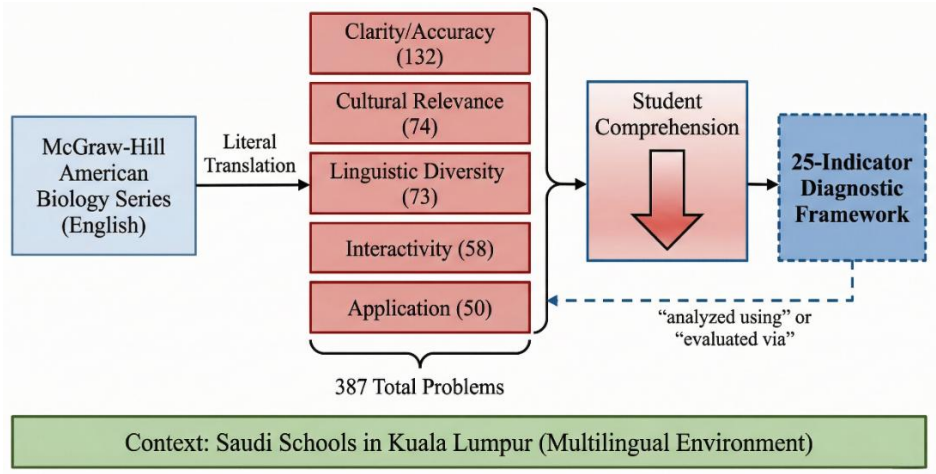
INTRODUCTION

Textbooks are the main instrument used by science teachers when planning and carrying out lessons and setting homework (Düsing, 2025), which influences not only the knowledge students acquire, but also their view of science itself (Sideri & Skoumios, 2021). In the Saudi Arabian educational system, science textbooks at the secondary level

are translations of the American McGraw-Hill series, which are adopted by the Ministry of Education as a basis for curricula in physics, chemistry and biology. While this adoption guarantees access to internationally recognized scientific material, the translation process presents linguistic variables that could impact comprehension. As Khayyal (2022) noted, the scientific translation is not simply applying techniques; the meaning of a word in a scientific context is unlike its meaning in other contexts and the mistake in terminology can discredit the entire text.\Of particular consequence is the linguistic quality of translated textbooks as language is the only medium through which scientific concepts reach the learner. Science subjects are known to be more difficult than other subjects because their language is more complex, technical, and knotty making it difficult for students to easily understand and comprehend (OSO, 2024). When the source and target languages have different structural systems, as English and Arabic do, literal translation often results in syntactic constructions that are permissible under the rules of the target language, but that are unnatural in some other way. Baker (2011) documented the problems of such literal rendering in terms of creating style unfamiliarity, loss of textual coherence and ignoring idiomatic conventions of the target language. In the Arabic context in particular, Al-Dossari (2011) reported that 67% of secondary students complained of difficulty in understanding the scientific texts in science textbooks in Saudi Arabia, and the reasons for this difficulty were seen to be mainly due to the effects of literal translation.

Howard Gardner's (1983) theory of multiple intelligences is a theoretically grounded framework for examining the quality of the language in textbooks. Linguistic intelligence, which Gardner considered as the most widely shared human intelligence, includes sensitivity to the sounds, rhythms and meanings of words, and the ability to use language for different communicative purposes (Morgan, 2021; Gardner & Moran, 2006). Crystal (2010) further specified four components as phonological competence, syntactic competence, semantic competence, and pragmatic competence. These components can be operationalized in evaluation criteria for textbook content, which provide a more nuanced diagnostic than do traditional readability formulas. Manouchehri zadeh (2025) used this approach in an Iranian chemistry text book and found that there is a significant imbalance and textbooks overemphasize linguistic, logical-mathematical and spatial intelligences and ignore other intelligence types.

Figure 1. Conceptual Framework: Literal Translation To Comprehension Barriers



Research on translated Arabic science textbooks has shown recurring problems but has not been able to systematically link these problems to a comprehensive theoretical framework. Al-Omari (2017) found that 73% of the translated scientific texts have been suffering from literal translation and 45% from loss of meaning clarity. Al-Jubouri (2019) showed that students learning from natively authored Arabic textbooks outperformed students learning from translations by 23% with translated materials requiring 35% more reading time. Ben Said (2022) confirmed there is a strong inverse relationship between translation literalness and comprehension with communicative translation enhancing comprehension by 41%. Corpus-based approaches have also contributed to the field: Khojasteh and Mukundan (2025) stated that corpus linguistics offers research investigators with strong research tools for analyzing large data sets, that assist in finding the gap in between textbook language and communication. However, these studies have usually focused on the separate linguistic features instead of using multidimensional evaluative framework.

Evaluating and assessing textbooks plays an important role in ensuring whether they meet the requirements of students, teachers, administrators, and curriculum developers (Gholampour & Mehrabi, 2023). Yet no one study has previously created a comprehensive and linguistically grounded content analysis instrument specifically aimed at assessing translated Arabic science textbooks against indicators of linguistic intelligence. A few researchers have focused on Arabic textbook evaluation using multiple intelligences theory, however, these have focused on Arabic language textbooks as opposed to science (Al-Zahrani, 2018; Al-Mashit, 2020), and none of these have provided detailed chapter-level analysis with documented examples of translation problems. Therefore, this research aims to develop and validate a 25-indicator content analysis framework based on the linguistic intelligence theory, apply it to the biology textbook in Saudi Arabia, covering all the nine chapters, categorize and document the specific translation problems along with concrete textual examples, and support it with teacher and student opinions. The objectives are to find out the textbook's correspondence with linguistic intelligence indicators, to characterize the nature and distribution of problems related to translation in the field of linguistics, and to assess the consistency of these patterns from chapter to chapter.

METHOD

This study used descriptive-analytical content analysis design and qualitative confirmation of teachers and students. The primary data source was the Saudi Biology 3-1 textbook (Secondary Pathway System, 2025 edition, translated from the McGraw-Hill American series). The secondary data sources comprised semi-structured interviews with biology teachers (n = 6) and focus group discussions with students (n = 32 in 4 groups) from Saudi schools in Kuala Lumpur, Malaysia. The qualitative data had a corroborative rather than primary function and triangulated the content analysis findings with stakeholder experiences.

The content analysis sample included all the nine chapters (268 pages) of the textbook, analyzed comprehensively at the page level. Content in the textbook ranges from plant biology, genetics, evolution, and classification. For the qualitative corroboration, six biology teachers (all having a minimum of five years of teaching experience) and 32 secondary students from Saudi schools affiliated with the Saudi Cultural Attache in Malaysia took part. The students were purposively selected to

represent different levels of proficiency and comprised students from both the experimental and control groups of the larger study.

The central instrument was a specially created content analysis card with 25 linguistic intelligence indicators that were distributed across five dimensions, five indicators per dimension. The development of these indicators was based on Gardner's (1983, 1999) theory, Crystal's (2010) four component model of linguistic intelligence, and Wellington and Osborne's (2001) framework for language in science education. Each indicator was rated on a four-point scale, 0 = absent, 1 = low, 2 = moderate, 3 = high. The highest score on one dimension was 15 and the highest possible score was 75. Table 1 presents the complete framework.

Table 2. The 25-Indicator Linguistic Intelligence Content Analysis Framework

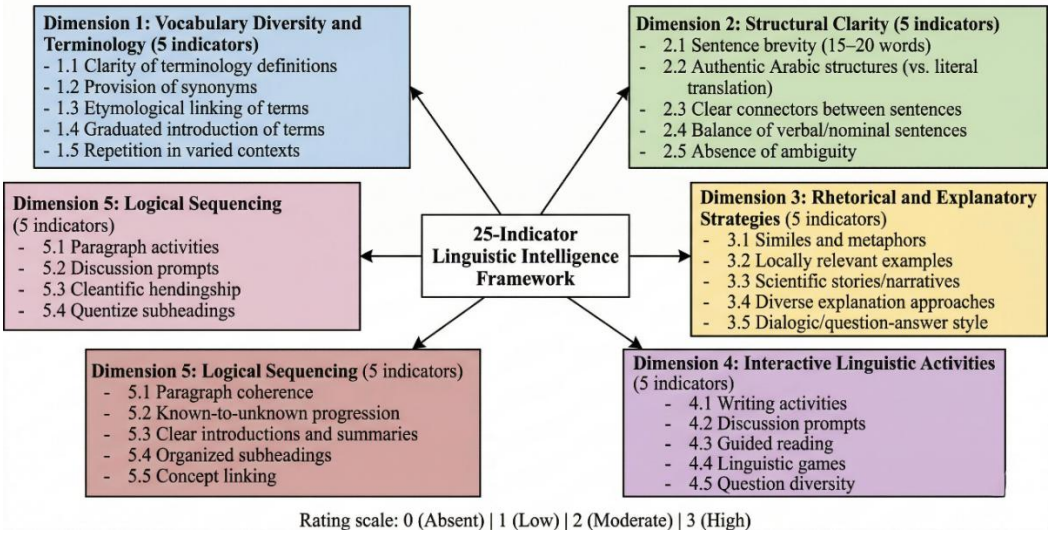
Dim.	#	Indicator	Operational Definition
D1	1.1	Terminology clarity	Clear, simplified definition at first occurrence
D1	1.2	Synonyms provided	Alternative terms or meanings offered
D1	1.3	Etymological linking	Term connected to Arabic or Latin root
D1	1.4	Graduated introduction	Terms progress from simpler to complex
D1	1.5	Contextual repetition	Term repeated across varied contexts
D2	2.1	Sentence brevity	Sentences average 15-20 words
D2	2.2	Authentic Arabic structures	No literal translation calques
D2	2.3	Clear connectors	Logical links between sentences/paragraphs
D2	2.4	Verbal/nominal balance	Mix of verbal and nominal sentences
D2	2.5	Absence of ambiguity	No meaning confusion or opacity
D3	3.1	Similes and metaphors	Explanatory comparisons used
D3	3.2	Local/Arab examples	Examples from Saudi/Arab environment
D3	3.3	Scientific narratives	Short stories explaining concepts
D3	3.4	Explanation diversity	Multiple approaches per concept
D3	3.5	Dialogic style	Question-and-answer approach used
D4	4.1	Writing activities	Tasks requiring scientific writing
D4	4.2	Discussion prompts	Questions stimulating dialogue
D4	4.3	Guided reading	Supplementary texts with comprehension questions
D4	4.4	Linguistic games	Activities combining language and science
D4	4.5	Question variety	Open, closed, and multiple-choice questions
D5	5.1	Paragraph coherence	Logical flow between paragraphs
D5	5.2	Known-to-unknown	Builds on prior knowledge
D5	5.3	Introductions/summaries	Each unit opens and closes clearly
D5	5.4	Organized subheadings	Hierarchical heading structure
D5	5.5	Concept linking	New concepts connected to previous ones

Note. D1 = Vocabulary Diversity; D2 = Structural Clarity; D3 = Rhetorical Strategies; D4 = Interactive Activities; D5 = Logical Sequencing. Scale: 0 = Absent, 1 = Low, 2 = Moderate, 3 = High.

Fourteen experts across applied linguistics (5), curriculum and instruction (4), science education (3), and educational measurement (2) validated the instrument. Content validity was established through expert consensus, and construct validity was confirmed by inter-dimension correlations ranging from 0.72 to 0.89 (all $p < 0.01$). Intra-rater

reliability was 0.91 (Cooper's formula, based on re-analysis of 25% of content after three weeks), and inter-rater reliability was κ = 0.87 (Cohen's Kappa, based on independent analysis of 20% of content by a second applied linguistics specialist), comparable to the almost perfect agreement (κ = 0.85) reported by Düsing (2025) in a similar biology textbook analysis.

Figure 2. The 25-Indicator Content Analysis Framework Organized By Five Linguistic Intelligence Dimensions



Analysis proceeded in two phases. In the pilot phase, 20% of content was analyzed to test indicator clarity, resulting in the refinement of three indicator descriptions and the addition of worked examples. In the full analysis phase, every page of all nine chapters was read carefully, the content type was classified (explanatory text, activity, question, summary), all 25 indicators were rated, and qualitative notes on specific linguistic problems were recorded with page references. Discrepancies identified during inter-rater comparison were resolved through discussion. The corroborative qualitative data were collected through individual semi-structured interviews with teachers (30-45 minutes each) and four focus group sessions with students (45-60 minutes each), all audio-recorded with consent and transcribed verbatim.

Data Analysis

Quantitative content analysis data were processed using SPSS v.27 (frequencies, percentages, means, standard deviations, cross-chapter comparisons). Problem instances were classified, counted, and cross-tabulated by chapter and category. Qualitative interview and focus group transcripts were analyzed using Braun and Clarke's (2006) six-phase thematic analysis, with NVivo software supporting coding and theme development. Triangulation was conducted by systematically comparing content analysis findings with qualitative themes.

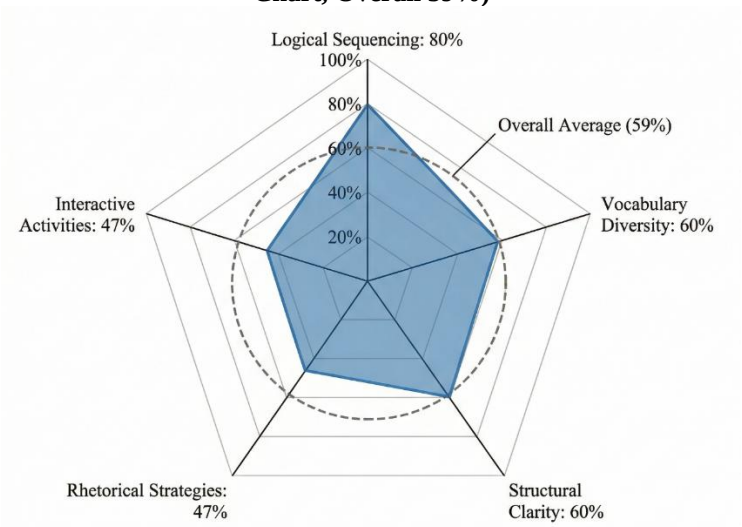
RESULTS AND DISCUSSION

The textbook achieved an overall score of 44 out of 75, corresponding to 59% and classified as moderate on the linguistic intelligence scale. The results of the dimensions are displayed in Table 2.

Table 1. Linguistic Intelligence Dimension Scores Across Nine Chapters (N = 268 pages)

Dimension	Score (/15)	%	Level	Rank
D5: Logical Sequencing	12	80	High	1
D1: Vocabulary Diversity	9	60	Moderate	2
D2: Structural Clarity	9	60	Moderate	2
D3: Rhetorical Strategies	7	47	Low	4
D4: Interactive Activities	7	47	Low	4
Overall	44/75	59	Moderate	

Figure 3. Dimension Level Linguistic Intelligence Profile Of The Saudi Biology Textbook (Radar Chart, Overall 59%)



The best part of the textbook is the logical structure: chapters have a consistent structure with introductions, summaries, and hierarchical sub-headings. This organizational strength probably reflects the McGraw-Hill original, designed for the American classroom with its structured textbook formats to which it is accustomed. The moderate scores in vocabulary diversity and structural clarity suggest partial success: terminology is repeated in different contexts (indicator 1.5 scored 3/3) and connectors are generally present (indicator 2.3 scored 3/3), but fundamental problems in the construction of sentences and the introduction of terminology undermine overall clarity. The extremely low scores for rhetorical strategies and interactive activities (both 47%) indicate the two areas that have been most impacted by the translation process: the cultural framing of content, and the design of interesting linguistic activities.

This pattern is in line with the results of Manouchehri zadeh (2025) who noted that science textbooks usually overemphasize some dimensions while ignoring others. It also confirms the observation by Al-Dossari (2011) that the Saudi science curricula have poor linguistic formulations despite the good scientific content. Importantly, Sideri and Skoumios (2021) found a similar imbalance in Greek science textbooks whereby some process skills were more prominent and others especially limited, suggesting that this is a cross-cultural issue in science textbook design that is not unique to translated materials.

Indicator-Level Analysis: Consistent Strengths and Systematic Weaknesses

Three indicators received the highest score (3/3) in each chapter without exception: contextual repetition of terminology (1.5), clear introductions and summaries

(5.3), and organization of subheadings (5.4). On the other hand, three indicators had a score of zero across all chapters - etymological linking of terminology (1.3), locally relevant examples (3.2) and scientific linguistic games (4.4). The zero variance consistency of these scores across all nine chapters (SD = 0) is methodologically significant. It discounts where the weaknesses may be due to individual chapter authors or problems with topics. Instead, it confirms that the problems are rooted in the methodology of translation in itself. Any remediation must therefore be systemic rather than piecemeal.

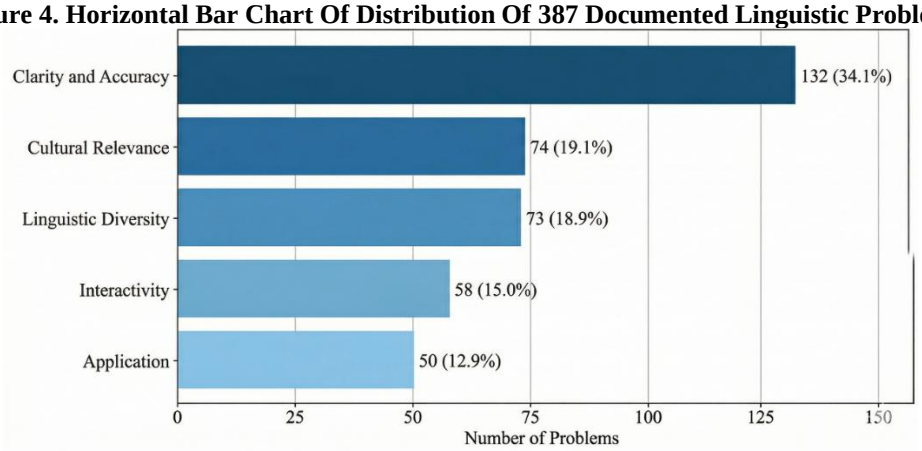
Classification and Distribution of Linguistic Problems

A total of 387 specific linguistic problems were recorded throughout the nine chapters with page level reference to the problems presented in table 3.

Table 2. Classification of 387 Documented Linguistic Problems

Problem Category	Count	%	Illustrative Pattern
Clarity/Accuracy	132	34.1	Literal syntactic calques from English
Cultural Relevance	74	19.1	All examples from North American ecology
Linguistic Diversity	73	18.9	Repetitive expression (e.g., yatakawwanu min x37)
Interactivity	58	15.0	Minimal discussion prompts, no linguistic games
Application	50	12.9	Weak links to daily life or local agriculture
Total	387	100.0	

Figure 4. Horizontal Bar Chart Of Distribution Of 387 Documented Linguistic Problems



The predominance of problems of clarity and accuracy (34.1%) reflects the ramification of the literal translation. Three recurrent syntactic patterns explain the magnitude of this problem. First, the prepositional phrase "biwasitatiha" (بواسطتها), the literal translation of English "by means of," was used more than 200 times in the nine chapters. In the more natural Arabic scientific prose, more simple prepositions (biha, 'abra, min khilal) would be used. Second, the preposition "khilal" (حياته, throughout) was used more than 150 times as a calque of "through" in places where "fi" (في, meaning "in") would be the natural Arabic choice. Third, the construction "laysa ladayha" (ليس لديها, literally "does not have") appeared more than 80 times where the authentic Arabic form "laysa laha" (ليس لها) would be standard. These patterns are individually minor but cumulatively make sustained sense of linguistic unnaturalness which Khayyal (2022) warned degrades text credibility.

Sentence length was another problem of clarity. In Chapter 1, one sentence of 42 words was found that had several embedded clauses that expressed different facts about the composition of cellulose and the storage of starch, in violation of the 15-to-20 word recommendation for secondary level scientific texts. The expression "yatakawwanu min" (يتكون من, "is composed of") was repeated 37 times with no variation, while a synonym, "yata'allafu min" appeared only 3 times. This lexical monotony comes under the category of linguistic diversity, which decreases the reader's engagement and goes against the concept that diverse expression enhances the level of understanding (Khojasteh & Mukundan, 2025).

The category of cultural relevance (74 problems, 19.1%) showed the most striking result: throughout the 268 pages of a textbook studied only by Arab students, there was not a single example taken from the context of Saudi, Arab, or Islamic contexts. All botanical examples were of North American species (Sphagnum, Pacific yew, witch hazel, cocklebur), North American agriculture, and Western ecologies. The lack of date palms (Phoenix dactylifera), desert plants (al-arfaj, al-talh, al-sidr), or mentions of the Arab scientific heritage (Ibn al-Baytar, al-Dinawari) are opportunities missed of considerable proportions. Al-Hassnawi (2016) showed that cultural adaptation enhances comprehension by 42%, leading one to infer that this absence has some measurable educational costs.

Regarding nomenclature, four common names had no etymological explanation even though they appeared several times: chlorophyll (47 occurrences, from Greek chloros + phyllon), mitochondria (35 occurrences, from Greek mitos + chondrion), plastid (28 occurrences, from Greek plastos) and osmosis (52 occurrences, from Greek osmos). Providing the terminological etymology has been shown to deepen terminological retention (Crystal, 2010), the systematic absence of etymology in all the chapters is the further confirmation of the translation-driven nature of the problem.

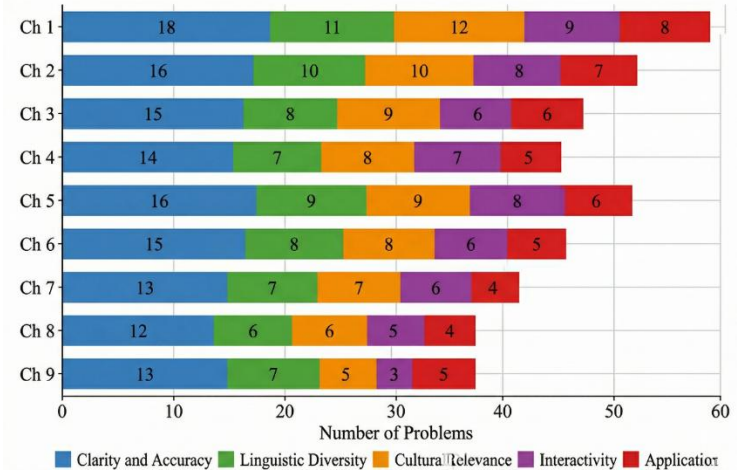
Cross-Chapter Consistency

Table 4 shows the distribution of linguistic problems on a chapter level, which shows that there is a consistent pattern for all the nine chapters.

Table 3. Distribution of Linguistic Problems Across Nine Chapters

Chapter	Clarity	Diversity	Cultural	Interactive	Application	Total
1: Intro to Plants	18	11	12	9	8	58
2: Plant Structure	16	10	10	8	7	51
3: Seed Plants	15	8	9	6	6	44
4: Genetics Basics	14	7	8	7	5	41
5: Heredity/Variation	16	9	9	8	6	48
6: Molecular Genetics	15	8	8	6	5	42
7: Evolution	13	7	7	6	4	37
8: Classification	12	6	6	5	4	33
9: Bacteria/Viruses	13	7	5	3	5	33
Total	132	73	74	58	50	387

Figure 5. Stacked Bar Chart Of Distribution Of Linguistic Problems Between 9 Chapters



The data presented at the chapter level substantiate the systemic nature of the problems. All nine chapters had the same score across all five dimensions (SD = 0 across all five dimensions), and the same three indicators had a score of 3/3 and the same three had a score of 0/3 in all chapters. Problem counts varied from 33 (Chapters 8 and 9) to 58 (Chapter 1) with this variance explained by chapter length rather than by quality differences. This amazing consistency is effective in ruling out the possibility of chapter-specific explanations and points unambiguously to the translation process as the source. Pakdel and Nosratzadeh (2024) came to a similar conclusion when studying the Persian translation of technical textbooks, they found that in both theoretical and statistical analyses, it was emphasized that the quality of translation into Persian is low.

Selected Translation Problem Examples

Table 5 shows representative examples of literal translation problems with their English source constructions and suggested natural Arabic alternatives.

Table 4. Problems with Representative Literal Translation with Proposed Alternatives

English Source	Literal Arabic	Occurrences	Problem	Natural Alternative
by means of	biwasitatiha	200+	Unnatural preposition	biha / 'abra
through the bodies	khilal ajsam	150+	Wrong preposition	fi ajsam
does not have	laysa ladayha	80+	Calque from English	laysa laha
42-word compound	Single sentence	Multiple	Exceeds 20-word limit	Split into 2 sentences
is composed of	yatakawwanu min	37x (no variation)	Lexical monotony	yata'allafu / yashmalu

The examples show that the translation problems are not errors in the ordinary sense but systematic choices to maintain the structures of the source-language. If the syntactic and lexical characteristics of the source and target languages are different, in order to be clear, the sentences in the target language must be thoroughly reformulated (Khayyal, 2022). The cumulative effect of hundreds of such constructions is a text that reads as if it were written in another language and simply transcribed into Arabic

characters, as described by students in the focus groups who reported that the original textbook felt like it was written for students from some other country.

Figure 6. Literal Translation Problems And Suggested Natural Arabic Alternatives

#	English Source	Literal Arabic Translation	Problem	Natural Arabic Alternative
1	by means of	بوساطتها (biwasitatiha)	Unnatural preposition (200+ occurences)	بها / عبر / من خلال
2	through the bodies	خلال أجسام (khilal ajsam)	Wrong prepostion (150+ occ.)	في أجسام (fi ajsam)
3	does not have	ليس لديها (laysa ladayha)	Calque from English (80+ occ.)	ليس لها (laysa laha)
4	42-word sentence	Single sentence with multiple embedded clauses	Exceeds 20-word recommendation	Split into two 20-word sentences
5	is composed of	يتكون من (yatakawwanu min)	Repeaed 37 times without variation	يتألف من / يشمل / يضم

Teacher and Student Corroboration

Thematic analysis of the data from teacher interviews and student focus groups yielded five themes that separately supported the findings of the content analysis. First, in terms of literal translation effects, teachers claimed that it takes 15 to 20 minutes per lesson to explain language before getting to science, with one teacher commenting that literal constructions cause students to ask what does this sentence mean?, instead of the science. Students substantiated this, one of them saying: I would read the paragraph multiple times and not understand.

Second, as to a cultural disconnection, teachers noted that students are asking what are these plants? We have never seen them while students described the content as feeling like a book written for students from another country. Third, with regards to the complexity of the sentences, teachers reported that long sentences confuse students and they need two to three readings. Fourth, with respect to terminology, teachers reported that when using the original textbook they were more language teachers than science teachers. Fifth, there was support from all six teachers and the majority of the students for systematic linguistic revision.

Figure 7. Triangulation Matrix Illustrating Convergence Between Findings Of Content Analysis With Teacher/Student Corroboration

Finding from Content Analysis	Teacher Corroboration	Student Corroboration	Convergence
Literal translation dominant (34.1%)	Students ask: "what does this sentence mean?" (all 3 experimental teachers)	Students reported needing to read paragraphs multiple times to understand	✓ Full
Zero local examples	Students ask: "what are these plants? We've never seen them" (all 3 experimental teachers)	Students described the content as feeling like it was "written for students from another country"	✓ Full
Complex sentence structures	Long sentences confuse students, they need 2-3 readings" (all 3 experimental teachers)	Students reported difficulty with first-read comprehension	✓ Full
Missing etymological links	"I no longer spend 15-20 min explaining language before science" (experimental teacher, describing prior state)	Students reported difficulty remembering terminology	✓ Full
Few interactive activities	"Students are less engaged with the original content" (control teachers)	Lower participation rates reported in control group	✓ Full

The full convergence of the quantitative content analysis and the qualitative stakeholder data around all the five themes represents a strong methodological triangulation, which significantly enhances confidence in the validity of the findings. This convergence is consistent with Gholampour and Mehrabi's (2023) argument that

evaluation of textbooks needs to incorporate multiple stakeholder perspectives so that they can be evaluated comprehensively.

CONCLUSION

This study developed and applied a 25 indicator's content analysis framework based on linguistic intelligence theory to assess the Saudi biology textbook translated from the McGraw-Hill series. The analysis of all nine chapters (268 pages) showed a medium overall linguistic intelligence score (59%), with specific systematic weaknesses in rhetorical strategies and interactive activities (both of which was 47%) juxtaposed by an adequate logical sequencing (80%). The 387 recorded problems, with a predominance of literal translation effects (34.1%), were spread out evenly across all the chapters (SD = 0 for individual dimension scores; total scores approximately 44/75 with SD = 1.2), proving their systemic origin in the translation methodology. Three indicators received a score of zero in every chapter: etymological linking, local examples and linguistic games. Specific patterns included unnatural prepositional calques used more than 200 times, 42-word sentences, lexical monotony, and an utter lack of Saudi or Arab cultural content over the course of 268 entire pages. Teacher and student data independently supported all of the major content analysis findings. The 25-indicator framework itself is a methodological contribution: a validated, reliable (k = 0.87), and replicable diagnostic tool which can be applied to any translated Arabic science textbook. Future research should seek to apply this framework to other science textbooks in Saudi Arabia (physics, chemistry), compare the literal vs. communicative approaches to translation using the same indicators, and examine the link between the indicator scores and measurable outcomes of comprehension using experimental designs.

REFERENCES

Al-Dossari, A. (2011). Linguistic analysis of Saudi science curricula: Strengths, weaknesses, and implications. Saudi Journal of Educational Sciences, 14(2), 45–68.

Al-Hassnawi, A. (2016). Cultural challenges in translating English scientific texts into Arabic. Translation Journal, 20(1), 1–18.

Al-Jubouri, M. (2019). Comparative analysis of student achievement in translated versus natively authored science textbooks. Arab Studies Quarterly, 41(3), 201–222.

Al-Mashit, S. (2020). Content analysis of Arabic language textbooks in light of multiple intelligences theory. Umm Al-Qura University Journal for Educational and Psychological Sciences, 12(1), 78–102.

Al-Omari, H. (2017). Problems of translating scientific texts from English to Arabic. Journal of Translation Studies, 22(3), 45–62.

Al-Zahrani, M. (2018). Analysis of Arabic language textbooks according to multiple intelligences theory. Journal of Educational Sciences, 30(2), 189–215.

Armstrong, T. (2017). Multiple intelligences in the classroom (4th ed.). ASCD.

Baker, M. (2011). In other words: A coursebook on translation (2nd ed.). Routledge.

Ben Said, L. (2022). Translation quality and reading comprehension of scientific texts. Arab World English Journal, 13(1), 45–62.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. Qualitative Research in Psychology, 3(2), 77–101.

Crystal, D. (2010). The Cambridge encyclopedia of language (3rd ed.). Cambridge University Press.

Düsing, K. (2025). A content analysis of how biology textbook tasks address system thinking skills in the context of the carbon cycle. Research in Science Education.

Gardner, H. (1983). Frames of mind: The theory of multiple intelligences. Basic Books.

Gardner, H. (1999). Intelligence reframed: Multiple intelligences for the 21st century. Basic Books.

Gardner, H., & Moran, S. (2006). The science of multiple intelligences theory: A response to Lynn Waterhouse. Educational Psychologist, 41(4), 227–232.

Gholampour, S., & Mehrabi, D. (2023). Literature review of ELT textbook evaluation. MEXTESOL Journal, 47(2).

Khayyal, O. (2022). Teaching and learning scientific translation: Problems, challenges, and solutions. British Journal of Translation, Linguistics and Literature.

Khojasteh, L., & Mukundan, J. (2025). A systematic review of corpus-based methodologies in textbook analyses and evaluation. Language Teaching Research Quarterly.

Manouchehri zadeh, E. (2025). Analysis of the contents of the 10th grade chemistry book based on Gardner's multiple intelligences. Research in Chemistry Education, 7(1), 92–111.

Morgan, H. (2021). Howard Gardner's multiple intelligences theory and his ideas on promoting creativity. KIE Publications.

OSO, M. T. (2024). An assessment of the language of instruction in selected senior secondary two science classrooms in Osun State, Nigeria. Journal of Education and Practice, 15(10), 18–22.

Pakdel, H., & Nosratzadeh, H. (2024). Application of House's translation quality assessment to Persian translation of technical texts. Translation and Interpreting Research, 1(2), 61–77.

Sideri, A., & Skoumios, M. (2021). Science process skills in the Greek primary school science textbooks. Science Education International, 32(3), 231–239.

Wellington, J., & Osborne, J. (2001). Language and literacy in science education. Open University Press.