Iranian Journal of Educational Sociology

Journal Website

Article history:
Received 07 April 2026
Revised 08 September 2026
Accepted 16 September 2026
Initial Publication 23 September 2026
Final Publication 30 September 2026

Iranian Journal of Educational Sociology

Volume 9, Issue 5, pp 1-13

Quarterly Iranian Journal of Educational Sociology

E-ISSN: 2645-3460

Evaluating the Content of Iraqi Secondary-School Physics Textbooks Based on Total Quality Criteria: A Content Analysis and Teachers' Perspectives

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A r t i c l e I n f o

Article type:
Original Research

How to cite this article:
Qasim Mohammad, S., Zahed, A., Taghavi, H., & Khaleghkhah, A. (2026). Evaluating the Content of Iraqi Secondary-School Physics Textbooks Based on Total Quality Criteria: A Content Analysis and Teachers' Perspectives. *Iranian Journal of Educational Sociology*, *9*(5), 1-13.
https://doi.org/10.61838/kman.ijes.1576

A B S T R A C T

Purpose: This study aimed to identify the total quality criteria required for Iraqi secondary-school physics textbooks, assess the extent to which these criteria are fulfilled, examine physics teachers' evaluations, and determine whether their perspectives differ according to gender and years of teaching experience.

Methods and Materials: This descriptive-analytical study combined quantitative content analysis with a questionnaire survey. The content-analysis population comprised all six physics textbooks approved by the Iraqi Ministry of Education for the 2025–2026 academic year, totaling 999 pages, all of which were examined through census sampling. The analysis instrument consisted of 10 main criteria and 100 sub-indicators developed based on Crosby and Baldrige quality frameworks and validated by an expert panel with an 80% agreement ratio. In the survey phase, 63 physics teachers, including 35 men and 28 women, were selected through simple random sampling from a population of 90 secondary-school physics teachers in Al-Muthanna Province. Data were collected using a researcher-developed questionnaire and analyzed using independent-samples t-tests and one-way analysis of variance.

Findings: The overall conformity of the textbooks with Ministry of Education quality criteria was 74%, exceeding the 70% benchmark established by the expert panel. Educational and experimental activities showed the lowest level of criterion fulfillment at 61.3%. Teachers rated educational objectives highest, with a mean score of 3.96 out of 5, whereas scientific content received a mean score of 3.58. Gender differences were statistically significant only for educational activities, with male teachers reporting higher evaluations. Significant differences were also observed according to teaching experience, with teachers having more than 10 years of experience providing more critical evaluations than their less-experienced counterparts.

Conclusion: The findings indicate that Iraqi secondary-school physics textbooks generally satisfy established total quality criteria; however, instructional and experimental activities represent a notable area of weakness. The convergence between content-analysis results and teachers' assessments highlights the need for systematic revision of textbook content and

structure, particularly through strengthening laboratory work, practical exercises, inquiry-oriented tasks, and experiential learning opportunities.
Keywords: *Physics Textbooks; Total Quality; Content Analysis; Educational Content Evaluation; Secondary Education; Iraq*

1. Introduction

Textbooks remain among the most influential components of formal education because they structure the sequence of subject matter, define the scope of expected learning, and mediate the relationship between curriculum objectives, classroom instruction, and assessment. In school science education, textbooks assume an even more central role because they do not merely transmit declarative knowledge; they also shape the ways in which students encounter scientific concepts, experimental reasoning, problem solving, and the practices through which scientific knowledge is produced and validated. The quality of a textbook therefore cannot be reduced to the correctness of its factual content alone. A high-quality science textbook should demonstrate coherence among objectives, concepts, activities, illustrations, experiments, assessment tasks, and organizational structure, while also supporting active engagement, conceptual progression, and meaningful application of scientific knowledge. These requirements become particularly important in physics, where many topics are abstract, mathematically structured, and highly dependent on the integration of conceptual explanation with observation, experimentation, and model-based reasoning. Accordingly, the systematic evaluation of physics textbooks constitutes an important component of curriculum quality assurance and educational improvement.

Within this context, the concept of total quality provides a useful framework for evaluating textbooks as integrated educational products. Total Quality Management emphasizes continuous improvement, responsiveness to stakeholder needs, systematic evaluation, process consistency, and the alignment of outputs with clearly defined standards. In educational settings, the logic of total quality has increasingly been applied to curriculum development, instructional planning, school management, and program evaluation. Al Hashami examined the application of Total Quality Management in curriculum development and evaluation within the Ministry of Education and emphasized that quality-oriented curriculum systems require clearly articulated standards, continuous review mechanisms, stakeholder participation, and systematic use of evidence in revising educational materials (Al Hashami, 2022). From this perspective, textbook evaluation should not be confined to isolated characteristics but should assess the extent to which the whole instructional package satisfies interrelated criteria concerning educational objectives, scientific accuracy, teaching and learning activities, assessment procedures, usability, and organization. A total quality perspective is therefore particularly suitable for textbook evaluation because it moves beyond fragmentary review and instead treats curriculum materials as multidimensional systems whose components should function coherently.

Recent studies have also applied total quality principles more directly to curriculum and textbook evaluation. Stephanie evaluated the "English for Iraq" curriculum based on total quality standards and highlighted the value of comprehensive evaluation frameworks for identifying strengths and deficiencies across different curriculum components (Stephanie, 2024). Although language curricula differ substantially from science curricula, this type of quality-based evaluation demonstrates the broader applicability of total quality criteria in educational materials. In science education, the need for such comprehensive assessment may be even greater because textbooks must simultaneously satisfy scientific, pedagogical, cognitive, and practical expectations. Physics textbooks, for instance, should not only present accurate content but also promote inquiry, encourage hypothesis formation, integrate real-world applications, provide suitable experimental tasks, and organize material in a manner that facilitates cumulative conceptual development. Thus, applying total quality criteria can provide a structured basis for judging whether physics textbooks meet the diverse expectations associated with contemporary science education.

The importance of textbook quality is particularly evident when considering the relationship between curriculum content and student development. Educational materials should be designed in ways that correspond with learners' developmental characteristics and support meaningful interaction with their physical and social environments. Adolph and Berger showed that physical and motor development is deeply interconnected with perception, action, exploration, and learning, indicating that educational experiences are strengthened when learners are given opportunities to engage actively with their environment rather than functioning solely as passive recipients of

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E-ISSN: 2645-3460

information (Adolph & Berger, 2018). Although their work focuses on physical and motor development, its educational implications are relevant to science learning, where direct manipulation, observation, experimentation, and hands-on investigation can make abstract concepts more accessible. Physics education is particularly dependent on such engagement because many scientific principles become more understandable when students can observe, measure, test, and interpret physical phenomena. Consequently, textbook quality should be evaluated partly in terms of whether it provides sufficient opportunities for experiential and activity-based learning.

This issue also connects to the broader need for educational materials to reflect learner diversity. Yousefi and Asghari, in their conceptualization of physical mobility in textbooks for elementary students with intellectual disabilities, demonstrated the importance of examining whether textbook content reflects the actual needs, capacities, and experiences of learners rather than merely presenting standardized content in a uniform manner (Yousefi & Asghari, 2024). Their study underscores a broader principle in textbook design: quality educational materials should be responsive to the characteristics of their intended users. In secondary-school physics education, this implies that textbook content should be developmentally appropriate, clearly structured, sufficiently contextualized, and capable of addressing variation in learners' backgrounds and learning needs. When physics textbooks are evaluated according to total quality criteria, therefore, attention should be paid not only to disciplinary accuracy but also to accessibility, usability, relevance, and instructional adaptability.

Another fundamental dimension of textbook quality concerns the coherence of scientific content across subjects and grade levels. Scientific knowledge is inherently interconnected, and learners often encounter related concepts in physics, chemistry, biology, mathematics, and technology. Weak horizontal or vertical coordination between textbooks may lead to repetition, conceptual inconsistency, sequencing problems, or fragmentation of knowledge. Karimi Bioki analyzed secondary-school biology textbooks from the perspective of horizontal connections with chemistry and physics and emphasized the importance of interdisciplinary coherence in curriculum design (Karimi Bioki, 2023). This finding is especially relevant to the evaluation of physics textbooks because concepts such as energy, matter, force, electricity, heat, pressure, and waves overlap with other science subjects. A high-quality physics textbook should therefore not present knowledge in isolation but should connect scientific concepts in ways that support integrated understanding and prevent contradictions or unnecessary duplication across the curriculum.

Content organization has long been regarded as a central criterion in textbook evaluation. Zargani and colleagues examined the content status of textbooks in the second cycle of physical education vocational schools in Iran and showed that systematic content analysis can identify imbalances in the distribution, organization, and representation of instructional content (Zargani et al., 2018). Such studies demonstrate that textbook quality can be investigated empirically by examining the relative presence of intended criteria rather than relying only on general impressions. In physics education, content analysis can reveal whether sufficient emphasis is given to conceptual understanding, experimentation, scientific reasoning, assessment, and real-world application. It can also identify areas that are overrepresented or underrepresented relative to educational standards. This makes content analysis a valuable method for determining whether curriculum intentions are actually embodied in published instructional materials.

The methodological value of content analysis has been demonstrated in a range of educational research contexts. Nonaka and colleagues used content analysis to examine how primary- and secondary-school textbooks addressed malaria control across multiple countries, showing that textbook content can be systematically coded and compared against predetermined educational criteria (Nonaka et al., 2012). Their study illustrated the usefulness of textbook content analysis for assessing both the presence and adequacy of specific instructional themes. Similarly, Seddighi and colleagues described qualitative content analysis as a research method for investigating hazard-related information in school textbooks and demonstrated how systematic coding can uncover the strengths, limitations, and omissions of educational materials (Seddighi et al., 2021). Together, these studies indicate that content analysis offers a rigorous methodological basis for textbook evaluation because it transforms textual and visual features into analyzable units that can be compared with explicit standards. When applied quantitatively, this approach can also provide frequencies and percentages that indicate the relative degree to which predefined quality criteria are fulfilled.

In physics education specifically, recent studies have increasingly examined textbook quality in relation to

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E-ISSN: 2645-3460

changing curriculum frameworks. Putra and colleagues compared the quality of physics textbooks developed under the 2013 Curriculum and the Independent Curriculum and found that textbook quality varies across curriculum systems, with differences emerging in the treatment of learning objectives, content organization, activities, and other instructional components (Putra et al., 2024). Their work indicates that physics textbook quality should not be taken for granted merely because materials are officially approved. Rather, textbooks should be periodically re-evaluated to determine whether they continue to satisfy current pedagogical standards and curricular expectations. This point is particularly relevant in education systems undergoing curriculum reform, where textbooks may retain structural or pedagogical features that are no longer fully aligned with contemporary approaches to science teaching.

One of the most important quality dimensions in physics textbooks concerns practical and experimental activities. Physics is an empirical science, and meaningful learning is strengthened when students are able to connect theoretical explanations with observable phenomena. However, the effectiveness of textbook-based activities depends strongly on whether schools have access to laboratories, materials, and equipment. Kerekes examined the consequences of insufficient chemistry and physics laboratories in schools and showed that the absence of suitable laboratory facilities can restrict opportunities for practical science learning, reduce student engagement, and weaken the connection between theory and experiment (Kerekes, 2024). Likewise, Mangarin and Macayana reviewed research on why schools lack laboratories and scientific equipment and identified resource limitations as a persistent barrier to effective science education (Mangarin & Macayana, 2024). These findings have direct implications for textbook design. If a textbook prescribes activities that require unavailable or expensive equipment, the formal presence of those activities may not translate into meaningful implementation. Therefore, quality criteria should consider whether experiments and activities can be carried out using locally available, affordable, and realistic resources.

The quality of educational activities is also closely connected to learners' psychological engagement with physics. Students' perceptions of recognition, belonging, and capability can influence whether they develop sustained interest in physics. Li and Singh found that perceived recognition by physics instructors was associated with women's self-efficacy and interest in physics, indicating that students' engagement with the subject is influenced not only by content but also by the instructional environment and the ways in which learning experiences support confidence and participation (Li & Singh, 2023). Although this study focused on instructor recognition rather than textbooks, its implications extend to curriculum materials: textbooks that incorporate inclusive examples, accessible activities, varied forms of participation, and opportunities for successful engagement may contribute indirectly to stronger self-efficacy and interest. Accordingly, evaluating physics textbook quality requires consideration of whether the materials facilitate active participation and support meaningful learner involvement.

Teacher perspectives constitute another indispensable source of evidence in textbook evaluation because teachers are the primary mediators between written curriculum and classroom practice. Their judgments can reveal weaknesses that may not be evident through textual analysis alone, such as impractical activities, insufficient alignment with students' abilities, weak sequencing, or challenges in assessment. Teachers also accumulate professional knowledge through repeated interaction with textbooks, students, and classroom constraints. Research on teacher experience indicates that professional expertise often continues to develop over time rather than reaching an early plateau. Podolsky and Darling-Hammond reconsidered the assumption that the benefits of teacher experience quickly diminish and highlighted evidence that experience can continue to contribute to instructional effectiveness and professional judgment (Podolsky & Darling-Hammond, 2025). This suggests that years of service may influence how teachers evaluate textbook quality, because more experienced teachers may recognize curricular strengths and deficiencies differently from less experienced colleagues.

At the same time, teachers' evaluations may differ according to demographic and professional characteristics, including gender and years of service. Such differences do not necessarily indicate objective differences in textbook quality, but they may reflect variations in classroom experience, instructional practices, professional expectations, access to resources, or interpretations of curriculum requirements. For this reason, examining whether teachers' perceptions vary across demographic groups can provide useful information for curriculum planners. When content-analysis findings and teacher perceptions converge, confidence in the identified strengths and weaknesses of textbooks increases. Conversely, divergence between the two forms of evidence may indicate that formally present textbook features are not functioning

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effectively in classroom practice. A mixed evaluation strategy combining objective textbook analysis with teacher survey data can therefore provide a more comprehensive understanding of quality than either method alone.

The context of Iraqi secondary education makes this multidimensional approach especially important. Physics textbooks in Iraq are expected to serve as core instructional resources across schools that may differ in available laboratories, educational facilities, and teaching conditions. Under such circumstances, textbook quality must be judged not only in relation to abstract curriculum standards but also in relation to practical usability. The evaluation framework should therefore examine whether educational objectives are clear and measurable, whether scientific content is accurate and appropriately sequenced, whether activities are relevant and feasible, whether assessment components support learning, and whether textbook organization facilitates effective teaching. The application of total quality criteria can unify these dimensions within a common evaluative framework and help identify both areas of satisfactory performance and components requiring revision.

Furthermore, existing literature suggests that textbook evaluation benefits from methodological triangulation. Studies based solely on document analysis provide valuable objective evidence but cannot fully capture how textbooks function in classrooms. Survey-based studies, in contrast, provide user perspectives but may be affected by personal experience and subjective interpretation. Combining the two methods allows researchers to compare written curriculum with enacted curriculum. The methodological foundations established by textbook content-analysis research (Nonaka et al., 2012; Seddighi et al., 2021), quality-focused curriculum evaluation (Al Hashami, 2022; Stephanie, 2024), physics textbook assessment (Putra et al., 2024), and studies of laboratory limitations (Kerekes, 2024; Mangarin & Macayana, 2024) collectively support the use of an integrated framework that incorporates both content evidence and teacher judgment.

Despite the growing literature on textbook analysis and educational quality, relatively limited attention has been devoted to the comprehensive evaluation of Iraqi secondary-school physics textbooks using a total quality framework that simultaneously integrates objective content analysis and teachers' perceptions. Existing studies have addressed individual dimensions such as content organization, interdisciplinary connection, curriculum standards, laboratory availability, or instructional quality, but fewer studies have examined these dimensions together within one integrated evaluative design. Moreover, the inclusion of teacher characteristics such as gender and years of service can offer additional insight into whether perceptions of textbook quality are broadly shared or vary according to professional background. Such evidence can inform curriculum developers, textbook authors, educational administrators, and teacher educators by identifying areas where textbook revision is most needed.

Therefore, the aim of the present study was to evaluate the content of Iraqi secondary-school physics textbooks according to total quality criteria, assess teachers' perceptions of the extent to which these criteria are fulfilled, and examine whether these perceptions differ according to gender and years of teaching experience.

2. Methods and Materials

2.1. Research Design

This study was conducted using a descriptive-analytical approach within a mixed-method design incorporating two complementary methods: quantitative content analysis to objectively evaluate the content of physics textbooks, and a questionnaire survey to assess physics teachers' perceptions regarding the extent to which total quality criteria were fulfilled in these textbooks. The integration of these two methods was intended to provide a more comprehensive picture of the quality status of physics textbooks from both the perspective of objective content characteristics and the experiences of educational users, namely teachers.

2.2. Population and Sample

The present study was based on two complementary statistical populations: a textual population consisting of secondary-school physics textbooks and a human population consisting of physics teachers working at this educational level. The size of each population, sample size, and sampling method for both components are reported below.

a) Population and Sample for Content Analysis. The statistical population for this component consisted of all physics textbooks approved by the Iraqi Ministry of Education for secondary education in the 2025–2026 academic year. Given the limited size of the population, a census method was employed, and all six secondary-school physics textbooks, including the physics sections of the first- and second-grade secondary science textbooks and the physics textbooks for the third through sixth grades of secondary education, comprising a total of 1,100 pages and

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47 chapters, were included in the study. Chapter introductions and tables of contents were excluded from the analysis, whereas all other textbook components, including textual content, images, activities, graphs, explanatory figures, and end-of-chapter questions, were analyzed. Accordingly, a total of 999 pages, equivalent to 91% of all textbook pages, were subjected to content analysis.

b) Population and Sample for the Survey. The statistical population for this component consisted of all 90 physics teachers employed in secondary schools in Al-Muthanna Governorate, Iraq, during the 2025–2026 academic year. From this population, a sample of 63 teachers was selected using simple random sampling, including 35 men (55.6%) and 28 women (44.4%). Participants were categorized into three groups according to years of teaching experience: less than 5 years, 5–10 years, and more than 10 years. The research questionnaire was administered in person to the sampled teachers, and their perceptions regarding the fulfillment of total quality criteria in the domains of educational objectives, scientific content, educational activities, assessment, and the organization and arrangement of physics textbooks were collected. Ultimately, 63 fully completed questionnaires were included in the statistical analyses.

2.3. Research Instrument

Because no standardized instrument was available that fully corresponded with the objectives of the present study, the researcher developed a study-specific measurement instrument. Instrument development proceeded through several stages. First, the literature and previous studies related to educational quality criteria were reviewed, and a preliminary list of criteria was extracted. Second, this list was expanded and structured on the basis of two well-established total quality models, namely Crosby's model and the Baldrige framework. Finally, the developed list was submitted to a panel of specialists in curriculum planning, physics and science teaching methods, educational psychology, and educational measurement and evaluation to establish content and face validity. The criterion for retaining each item was agreement by at least 80% of the expert panel members. The final instrument comprised 10 main total quality criteria, each including 10 sub-indicators, resulting in a total of 100 assessment indicators. The same instrument was used both as the content-analysis checklist and as the basis for developing the teachers' survey questionnaire.

2.4. Procedures for Conducting the Content Analysis

The physics textbooks were analyzed quantitatively according to the following principles: the "idea unit," including both explicit and implicit ideas, was considered the unit of analysis, whereas the frequency of occurrence of each idea was considered the recording unit. The analysis process was conducted in accordance with the evaluation model proposed by Affaneh and Nashwan (2016) and involved the following stages: (a) collecting and preparing the physics textbooks approved by the Iraqi Ministry of Education; (b) conducting a careful and systematic review of all textbook content; (c) identifying statements containing explicit and implicit scientific ideas and coding each as an independent unit of analysis; (d) comparing the identified ideas with the indicators included in the analytical instrument and determining their degree of correspondence; and (e) organizing the results in statistical tables showing the frequency and percentage of fulfillment for each indicator.

To establish the comparison criterion for interpreting the content-analysis results, a 70% threshold was designated as the acceptance benchmark on the basis of expert and evaluator consultation, with 80% of the expert panel agreeing with this threshold.

2.5. Validity and Reliability

Validity. The validity of the analytical instrument was established through two procedures. First, the content and face validity of the instrument were confirmed based on evaluations provided by the expert panel. Second, to ensure the validity of the analysis procedure itself, a randomly selected sample comprising six chapters, one chapter from each of the six physics textbooks and totaling 200 pages, was independently analyzed by two specialists in physics teaching methods who were not involved in the primary analysis conducted by the researcher.

Reliability. The reliability of the content-analysis procedure was assessed using two methods. First, temporal reliability was examined by having the researcher reanalyze the selected sample after a one-month interval, resulting in an agreement coefficient of 98%. Second, inter-rater reliability was examined by comparing the researcher's coding results with those of two independent analysts. The resulting agreement coefficients were 90% between the researcher and the first analyst, 88% between the researcher and the second analyst, and 88% between the first and second analysts. The overall mean agreement coefficient

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was 91%, indicating satisfactory reliability of both the instrument and the analytical procedure.

2.6. Data Analysis

Descriptive statistics, including frequencies and percentages of criterion fulfillment for each indicator and domain, were used to analyze the content-analysis data. For the survey data, arithmetic means and standard deviations were calculated to describe teachers' perceptions in each domain. A three-level interpretive scale was applied to the mean scores: a mean score of 4.00 or higher was classified as "high," a mean score from 3.00 to less than 4.00 was classified as "moderate," and a mean score below 3.00 was classified as "low." An independent-samples t test was used to examine differences in teachers' perceptions according to gender, whereas one-way analysis of variance (ANOVA), followed by a post hoc test, was used to examine differences according to years of teaching experience. The statistical significance level for all analyses was set at $p < .05$.

3. Findings and Results

The results of the content analysis of secondary-school physics textbooks indicated that, overall, the textbooks met 74% of the quality criteria approved by the Iraqi Ministry of Education. This proportion exceeded the 70% benchmark expected by the expert and evaluator panel.

A more detailed examination of the domain of educational and experimental activities, which constituted one of the five principal domains of the analytical instrument, showed that the overall mean fulfillment of the indicators in this domain across the three secondary levels—first, second, and third—was 61.3% (Table 1). Among the indicators within this domain, "use of locally available or readily accessible materials and equipment" showed the lowest level of fulfillment, with an average of 53.7%, whereas "availability of clear guidance and instructions for conducting experiments" showed the highest level of fulfillment, with an average of 70%. The fulfillment rate for the indicator "relationship of activities to everyday life" was 60.3%.

Table 1

Percentage of Fulfillment of Quality Criteria in the Domain of Educational and Experimental Activities in Secondary-School Physics Textbooks

No.	Indicator	First Grade	Second Grade	Third Grade	Overall Mean	Fulfillment Level
1	Types of activities (practical, theoretical, applied)	60%	55%	65%	60.0%	Low
2	Relationship of activities to everyday life	58%	62%	61%	60.3%	Low
3	Availability of instructions and guidance for conducting experiments	68%	70%	72%	70.0%	Moderate
4	Use of locally available or readily accessible materials and equipment	50%	53%	58%	53.7%	Low
5	Support for scientific thinking skills	62%	60%	66%	62.6%	Moderate
	Overall domain mean	59.6%	60.0%	64.4%	61.3%	Low

The survey results for physics teachers in Al-Muthanna Governorate showed that the overall mean evaluation for the domain of "educational objectives" was 3.96 out of 5, which was classified as "high." Within this domain, the item "the objectives are clear and specific" obtained the highest mean score (M = 4.10, SD = 0.65), whereas the item "the objectives are measurable" obtained the lowest mean score (M = 3.80, SD = 0.78).

The overall mean evaluation for the domain of "scientific content" was 3.58, which was classified as "moderate." Within this domain, the item "the textbook content includes accurate concepts" obtained the highest mean score (M = 4.05, SD = 0.60), whereas the item "the textbook content reflects learners' individual needs" obtained the lowest mean score (M = 3.10, SD = 0.90).

Comparison of teachers' overall mean ratings across the five domains examined in the study (Table 2) showed that the domain of "organization and arrangement" received the highest evaluation, with a mean score of 4.10, classified as "high," whereas the domain of "activities" received the lowest evaluation, with a mean score of 3.20, classified as "low." The overall mean across all five domains was 3.66, which was interpreted as "moderate tending toward high."

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Table 2

Overall Mean Scores of Physics Teachers' Perceptions Across the Five Quality Domains

Domain	Arithmetic Mean	Interpretation
Objectives	3.96	High
Content	3.58	Moderate
Activities	3.20	Low
Assessment	3.45	Moderate
Organization and arrangement	4.10	High
Overall mean across all domains	3.66	Moderate tending toward high

Differences According to Gender. The results of the independent-samples *t* test showed that, in the "objectives" domain, the difference between male teachers ($M = 4.01$, $SD = 0.40$, $n = 35$) and female teachers ($M = 3.95$, $SD = 0.42$, $n = 28$) was not statistically significant, $t = 1.12$, $p = .267$. Similarly, in the "content" domain, the difference between male teachers ($M = 3.72$, $SD = 0.45$) and female teachers ($M = 3.60$, $SD = 0.50$) was not statistically significant, $t = 0.98$, $p = .330$.

In contrast, in the domain of "educational activities," the difference between male and female teachers was statistically significant in favor of male teachers, with male teachers reporting a mean score of 3.45 ($SD = 0.48$), $t = 2.19$, $p = .032$. In other words, male teachers rated the degree of fulfillment of quality criteria in the educational activities domain more highly than female teachers (Table 3).

Table 3

Results of the Independent-Samples t Test Comparing Male and Female Teachers' Perceptions

Domain	Gender	n	Mean	SD	t	p	Result
Objectives	Male	35	4.01	0.40	1.12	.267	Not significant
Objectives	Female	28	3.95	0.42	—	—	—
Content	Male	35	3.72	0.45	0.98	.330	Not significant
Content	Female	28	3.60	0.50	—	—	—
Educational activities	Male	35	3.45	0.48	2.19	.032	Significant in favor of males

Differences According to Years of Teaching Experience. The results of the one-way ANOVA indicated that, in the "content" domain, differences among teachers with different levels of teaching experience were not statistically significant, $F(2, 60) = 2.89$, $p = .063$. In contrast, a statistically significant difference was found among experience groups in the domain of "educational activities," $F(2, 60) = 4.75$, $p = .012$. The results of the LSD post hoc test indicated that this difference favored teachers with more than 10 years of teaching experience, meaning that this group provided higher evaluations of the degree to which quality criteria were fulfilled in the educational activities domain compared with teachers with fewer years of experience (Table 4).

Table 4

Results of One-Way Analysis of Variance (ANOVA) According to Teachers' Years of Teaching Experience

Domain	Source of Variation	Sum of Squares	df	Mean Square	F	p	Result
Content	Between groups	1.45	2	0.725	2.89	.063	Not significant
Content	Within groups	18.20	60	0.303	—	—	—
Educational activities	Between groups	3.60	2	1.80	4.75	.012	Significant (in favor of >10 years of experience)
Educational activities	Within groups	22.80	60	0.38	—	—	—

Comparison of the findings from the two components of the study showed that the domain of educational and experimental activities was identified as the weakest domain in terms of the fulfillment of total quality criteria both in the objective content analysis of the textbooks, with a mean fulfillment rate of 61.3%, and in teachers' perceptions, with a mean score of 3.20 out of 5, which was the lowest mean among the five domains.

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E-ISSN: 2645-3460

4. Discussion and Conclusion

The present study evaluated Iraqi secondary-school physics textbooks according to total quality criteria through a combination of quantitative content analysis and teachers' perceptions. The findings showed that the textbooks achieved an overall conformity rate of 74% with the quality criteria adopted by the Iraqi Ministry of Education, exceeding the 70% benchmark established by the expert panel. This result suggests that, at the general level, the textbooks possess an acceptable degree of alignment with expected standards of educational quality. However, the overall percentage should not obscure the marked differences observed across specific domains. In particular, educational and experimental activities emerged as the weakest area in both the objective content analysis and teachers' evaluations. The convergence of these two independent sources of evidence strengthens the interpretation that the practical and activity-based dimensions of the textbooks represent a substantive area requiring improvement.

The overall 74% conformity rate indicates that Iraqi secondary-school physics textbooks generally include many of the components expected in a quality-oriented curriculum, including identifiable objectives, scientifically structured content, assessment elements, and acceptable organization. This result is broadly consistent with the argument that educational materials can satisfy formal curriculum requirements while still displaying uneven quality across particular components. Putra et al. found that the quality of physics textbooks differed across curriculum frameworks and that textbook evaluation should consider multiple dimensions rather than relying on a single overall judgment (Putra et al., 2024). Similarly, Al Hashami emphasized that applying Total Quality Management principles to curriculum development and evaluation requires systematic attention to several interconnected components rather than isolated indicators (Al Hashami, 2022). Thus, the present finding of an acceptable overall level accompanied by domain-specific weaknesses is consistent with the multidimensional nature of textbook quality.

The finding that educational and experimental activities achieved an overall fulfillment rate of only 61.3% is particularly important. Among the indicators assessed in this domain, the use of locally available or readily accessible materials and equipment showed the lowest level of fulfillment at 53.7%, while the presence of clear guidance for conducting experiments reached the highest value at 70%. This pattern suggests that the problem is not merely the absence of practical activities but also the feasibility and accessibility of those activities under actual school conditions. Kerekes highlighted that the lack of chemistry and physics laboratories can substantially constrain the implementation of experimental science education and reduce opportunities for students to connect theoretical principles with direct observation (Kerekes, 2024). Likewise, Mangarin and Macayana identified the shortage of laboratory facilities, equipment, and material resources as a persistent obstacle to effective science teaching (Mangarin & Macayana, 2024). The present findings therefore indicate that textbook quality should be assessed not only according to whether activities are included, but also according to whether those activities can realistically be implemented in schools with varying levels of resources.

The relatively low fulfillment of the indicator concerning the relationship of activities to everyday life, which reached 60.3%, also deserves attention. Physics concepts are often perceived as abstract when they are presented mainly through formulas, symbolic representations, and decontextualized examples. Linking activities to everyday phenomena can help learners interpret scientific concepts through familiar experiences and thereby support conceptual understanding. The emphasis placed by Adolph and Berger on active interaction with the physical environment provides a relevant conceptual basis for this interpretation, because learning is strengthened when individuals engage directly with the objects, movements, and events around them (Adolph & Berger, 2018). Although their work addresses physical and motor development more broadly, the same principle is applicable to physics education: students are more likely to understand forces, motion, energy, pressure, light, or electricity when such concepts are connected with observable situations in their daily lives.

The findings regarding teachers' perceptions supported this interpretation. The educational objectives domain received a mean score of 3.96 out of 5 and was classified as high, whereas the scientific content domain received a moderate mean of 3.58. Within the objectives domain, teachers rated clarity and specificity relatively highly, suggesting that the textbooks communicate intended learning outcomes effectively. However, the lower evaluation of the measurability of objectives indicates that some objectives may not be formulated in ways that can be readily translated into observable or assessable learning outcomes. From a total quality perspective, this distinction is important because clear objectives alone are insufficient if

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they cannot be operationalized in teaching and assessment. Al Hashami argued that quality-oriented curriculum evaluation depends on coherence between curriculum objectives, instructional processes, and evaluation standards (Al Hashami, 2022). Therefore, the present result suggests that future revisions should place greater emphasis on formulating objectives that are not only explicit but also measurable and directly connected to instructional and assessment practices.

Teachers' evaluation of scientific content as moderate also points to a mixed pattern. The item indicating that textbook content includes accurate concepts received a relatively high mean of 4.05, suggesting confidence in the scientific correctness of the material. In contrast, the item concerning whether the textbook reflects learners' individual needs received a substantially lower mean of 3.10. This difference reveals an important distinction between disciplinary accuracy and learner responsiveness. A textbook may be scientifically correct while still failing to fully accommodate differences in students' abilities, learning needs, prior knowledge, or pace of learning. Yousefi and Asghari emphasized the importance of considering learner characteristics when examining textbook content, particularly in relation to physical mobility and the representation of learner needs (Yousefi & Asghari, 2024). Their work supports the broader principle that quality educational materials should be responsive to learners rather than being designed exclusively around subject content.

The moderate rating of scientific content may also be interpreted in relation to curricular coherence. Karimi Bioki examined horizontal connections between secondary-school biology textbooks and chemistry and physics and demonstrated the importance of interdisciplinary alignment in curriculum design (Karimi Bioki, 2023). Physics concepts are frequently interdependent with chemistry, mathematics, and other sciences, and weak coordination across textbooks can lead to fragmentation or redundancy. Although the present study did not directly measure interdisciplinary coherence, the teachers' moderate evaluation of scientific content may partly reflect issues related to sequencing, integration, or relevance across subjects. Zargani et al. similarly showed that content analysis can identify imbalances in the structure and distribution of textbook content (Zargani et al., 2018). Accordingly, the present findings reinforce the need to evaluate scientific content not only for correctness but also for balance, sequencing, relevance, and integration.

A notable finding was that organization and arrangement received the highest teacher evaluation, with a mean of 4.10. This suggests that the textbooks are generally perceived as well structured in terms of sequencing, presentation, and overall arrangement. This is an important strength because effective organization can reduce cognitive burden and support progressive learning. A coherent textbook structure enables students to move from foundational concepts toward more complex applications while allowing teachers to plan instruction systematically. The relatively high rating of organization can therefore be considered one of the major strengths of the textbooks examined. This result is compatible with the broader literature indicating that systematic organization is a central dimension of textbook quality and curriculum effectiveness (Putra et al., 2024; Zargani et al., 2018).

In contrast, the activities domain received the lowest teacher evaluation, with a mean of 3.20, which mirrored the content-analysis result identifying educational and experimental activities as the weakest area. This agreement between objective and subjective evidence is one of the most important findings of the study. Methodologically, the convergence supports the validity of the conclusion that activity design is a genuine weakness rather than a result of a single measurement approach. Nonaka et al. demonstrated the value of content analysis for systematically determining the presence or absence of targeted educational components in textbooks (Nonaka et al., 2012), while Seddighi et al. showed that content analysis can reveal patterns, omissions, and deficiencies in school textbook information (Seddighi et al., 2021). In the present study, the combination of content analysis and teacher survey data provided a form of methodological triangulation, with both approaches identifying the same problematic domain.

The weakness of educational activities may have important consequences for student engagement in physics. Physics is not learned effectively through passive reading alone; it requires opportunities to test ideas, manipulate materials, interpret evidence, and connect concepts with phenomena. Li and Singh demonstrated that students' engagement with physics is related to self-efficacy, interest, and perceived recognition within the learning environment (Li & Singh, 2023). Although their study focused on instructional recognition, the implications are relevant to textbook design because well-designed activities can create opportunities for participation, success, and active involvement. Poorly developed or difficult-to-implement activities, by contrast, may reinforce the perception of

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physics as an abstract and inaccessible subject. Thus, improving experimental and inquiry-based textbook components may have benefits not only for conceptual learning but also for students' motivation and confidence.

The gender-based findings showed no statistically significant differences in teachers' perceptions of the objectives and content domains, whereas a significant difference was observed in the educational activities domain in favor of male teachers. This suggests that male and female teachers generally held similar views regarding the clarity of objectives and the quality of scientific content, but differed in their evaluation of activity-related criteria. Because the present study was not designed to identify the causes of this difference, it would be inappropriate to attribute it to gender itself. The difference may instead reflect variation in access to laboratory resources, teaching assignments, classroom conditions, professional experiences, or patterns of activity implementation. The main implication is that evaluations of practical components may be more sensitive than evaluations of textual components to teachers' actual instructional context.

The analysis by years of teaching experience showed that differences in the content domain were not statistically significant, but differences in educational activities were significant, with teachers who had more than 10 years of experience providing higher evaluations. This finding suggests that professional experience may shape how teachers interpret the feasibility and instructional value of activities. More experienced teachers may have developed greater familiarity with adapting textbook activities to classroom realities, compensating for resource limitations, or implementing experiments using alternative materials. Podolsky and Darling-Hammond emphasized that the benefits of teacher experience may continue to develop over time rather than disappearing after the early years of practice (Podolsky & Darling-Hammond, 2025). Their argument supports the possibility that accumulated experience improves teachers' capacity to interpret and use curriculum materials effectively.

At the same time, the higher evaluations provided by experienced teachers should not necessarily be interpreted as indicating that the textbooks are objectively better for this group. Experienced teachers may simply be more skilled at overcoming weaknesses in the materials. In this sense, their higher ratings may reflect adaptive professional competence rather than superior textbook quality. Less experienced teachers may depend more heavily on explicit instructions, accessible materials, and clearly structured activities because they have had fewer opportunities to develop alternative strategies. This interpretation is consistent with the total quality perspective, which emphasizes that educational materials should be usable by the full range of intended users rather than requiring extensive compensatory expertise from teachers (Stephanie, 2024). Therefore, quality improvement should aim to make activities sufficiently clear, feasible, and well supported that they can be implemented effectively by both novice and experienced teachers.

Overall, the findings indicate that the Iraqi secondary-school physics textbooks possess several notable strengths, particularly in the organization of content, clarity of objectives, and general conformity with established quality criteria. Nevertheless, the results also identify a clear structural weakness in educational and experimental activities. This weakness was confirmed by both textbook content analysis and teachers' perceptions, making it the most consistent finding of the study. The results align with previous research emphasizing the importance of systematic textbook evaluation (Nonaka et al., 2012; Seddighi et al., 2021), total quality principles in curriculum development (Al Hashami, 2022; Stephanie, 2024), science textbook quality (Putra et al., 2024), and the central role of laboratory resources in effective physics education (Kerekes, 2024; Mangarin & Macayana, 2024). Taken together, these findings suggest that future textbook revision should move beyond maintaining scientific accuracy and formal organization and should give substantially greater attention to practical feasibility, learner-centeredness, experiential learning, and the integration of scientific concepts with everyday life.

The present study had several limitations that should be considered when interpreting its findings. First, the content analysis was restricted to the six physics textbooks approved for Iraqi secondary education during the 2025–2026 academic year; therefore, the findings may not be directly generalizable to textbooks used in other educational stages, subjects, provinces, or curriculum periods. Second, the teacher survey was conducted only among physics teachers in Al-Muthanna Governorate, which may limit the representativeness of the findings for all Iraqi physics teachers. Third, teachers' responses were based on self-reported perceptions and may have been influenced by individual experience, school resources, instructional workload, or personal expectations. Fourth, although the content-analysis instrument demonstrated acceptable validity and reliability, the use of a researcher-developed

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E-ISSN: 2645-3460

tool means that the findings remain partly dependent on the conceptual framework adopted in this study. Finally, the study focused primarily on textbook content and teacher perspectives and did not directly assess classroom implementation, student learning outcomes, or the actual availability and quality of laboratory facilities.

Future studies should extend the present investigation to larger and more geographically diverse samples of physics teachers across different Iraqi governorates in order to examine whether the observed patterns are stable across educational contexts. Comparative studies could also assess physics textbooks across different curriculum revisions, educational stages, or neighboring countries to identify common and context-specific quality issues. Further research should incorporate classroom observations, student interviews, and achievement measures to determine how textbook quality translates into actual instructional practice and learning outcomes. It would also be valuable to examine the relationship between school laboratory resources and the implementation of textbook activities, particularly in schools with different levels of material support. Longitudinal studies could assess whether future textbook revisions improve the fulfillment of total quality criteria over time. In addition, future research may develop and validate standardized instruments for evaluating total quality in science textbooks so that findings can be compared more consistently across studies.

Curriculum planners, textbook authors, and educational authorities should prioritize the redesign of educational and experimental activities in Iraqi secondary-school physics textbooks. Activities should be diversified to include practical, inquiry-based, problem-solving, and application-oriented tasks, while greater emphasis should be placed on connecting physics concepts with students' everyday experiences. Experimental activities should be designed so that they can be conducted with affordable, locally available, and safe materials, thereby reducing dependence on sophisticated laboratory equipment. Textbook activities should also include clearer procedural guidance, expected learning outcomes, safety considerations, and alternative implementation options for resource-limited schools. Teacher guides should provide additional strategies for adapting activities to different classroom conditions, particularly for less experienced teachers. Finally, textbook revision committees should systematically incorporate feedback from practicing teachers, science education specialists, curriculum experts, and assessment professionals to ensure that future editions are scientifically accurate, pedagogically effective, practically feasible, and aligned with the principles of comprehensive educational quality.

Authors' Contributions

Authors equally contributed to this article.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

Acknowledgments

We hereby thank all participants for agreeing to record the interview and participate in the research.

Declaration of Interest

The authors report no conflict of interest.

Funding

According to the authors, this article has no financial support.

Ethical Considerations

All procedures performed in studies involving human participants were under the ethical standards of the institutional and, or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

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E-ISSN: 2645-3460