

The Inclusion Of Science Textbook Quality Assurance Standards

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Abstract

This study investigates the degree of inclusion of quality assurance (QA) standards for 6th grade science textbooks in Jordan according to the domains of basic concepts, balance and appropriateness, relation between the environment and society, and activities. The validity and reliability of the analysis were checked, the degree of agreement between raters for coding and analysis. The study reveals that the books met 21.8% of the basic concept requirements, 48.2% of those of balance and appropriateness, and that the degree of relevance of the educational content to the environment and Jordanian society was 13.6%. The level of inclusion of the textbooks for the activities of 6th graders was 16.4%. There were notable differences in the extent of inclusion of the textbooks in the criteria of basic concepts and balance and appropriateness from the cut point, at 32% and 30% respectively. On the other hand, there were only slight differences in the degrees of inclusion of the relation with the environment and with activities, at 18% and 20% respectively. This could be due to the process of planning and implementing the science textbooks, which are subject to the opinions of educators and developers. The researchers recommend the need to develop the content of the 6th grade textbooks in light of the QA standards.

Key Words: QA, Science Textbooks. Content Analysis and Inclusion.

Introduction

Our modern era has witnessed various challenges in many fields of life due to the significant scientific and technological progress made. Therefore, it is necessary to establish an education infrastructure, to develop education, and to build a distinct educational system, which will allow us to keep pace with the challenges and face the transition from a world that consumes knowledge to one that produces and develops it.

Considering the role of the educational system in preparing generations of students and developing society, attention should be directed

towards the sources of knowledge in the scholastic curriculum, which should be located at the top of the educational system hierarchy.

School science curricula in different countries all over the world depend on textbooks, so their content must be presented to students with an explicit strategy.

The study and analysis of science textbooks is considered important in relation to teaching methods, due to their importance in presenting various forms of scientific knowledge and their role in determining the skills, attitudes, and scientific tendencies that students hope to

acquire. They also play a role in developing the scientific culture of students (Khataybeh, 2012).

Many standards that aim to develop and refine educational science textbooks have emerged, the most important being the QA standards in education, which were defined by Al-Fatlawi (2007) as "an integrated system of a set of standards, procedures, activities and instructions developed by the educational institution itself to overcome challenges in organizing its work and providing its services effectively to their beneficiaries. "

Al-Qahtani (2018) maintains that textbook developers focus on quality, thus ensuring that the books are a powerful and effective tool in the educational system, designed to develop students' mental and skill potentials and abilities.

Several studies have indicated the importance of the QA standards in relation to science textbooks, including those of Khalifa and Shibliq (2007), Diab (2006) and Al-Qahtani (2018).

A related literature review showed that various studies related to this research have been conducted, such as that of Ibn Yassin (2008), who highlights that QA standards must be met in the content of science courses in the first intermediate grade in Saudi Arabia and assessing its availability in this content. Ibn Yassin recommends increasing the availability of QA standards in such content and suggests more comprehensive studies in the various elements of the curriculum at different stages of education should be conducted. Asilan (2011) conducted a study on the extent to which science textbooks developed for the first intermediate grade achieved QA standards in the basic aspects of textbook output, objectives, scientific content, and evaluation methods. Asilan recommends that aspects of the scientific content of science textbooks should be reviewed.

In addition, Muslim (2013) evaluated secondary level physics textbooks with reference to QA standards using an instrument with six domains. It was shown that books for 6th graders did not achieve the necessary standards.

Salha and Allulu (2015) outlined the quality level of biology subjects included in science textbooks for the basic education level of 1st to 9th graders in relation to international standards, with a descriptive and analytical approach using

content analysis being used. They concluded that there was a low level of quality in the degree of availability of international standards regarding biology and science topics in the basic education stage in Palestine. They recommend that international standards for biology in science textbooks for the basic education stage should be adopted.

Al-Shehri (2018) acknowledges the international standards for science textbooks in the first intermediate grade in the Kingdom of Saudi Arabia and proposes a perception of the science curriculum content for this grade in light of such standards for science education. To this end, a descriptive curriculum was used. The study tool consisted of a list of the science curriculum standards used. Al-Shehri concluded that there were deficiencies in understanding the standards in the science and technology domains and recommended that the developers of the science curriculum and international standards should pay attention to the inclusion of the field of technology.

Problem Statement

In light of the significance of school science textbooks and their role in building and improving generations, societies, and civilizations, attention should be paid to their content, and their quality should be assured through continuous evaluation and analysis processes to develop them and indicate their strengths and weaknesses. Due to the importance of such textbooks in imparting knowledge and scientific facts, and their vital role in the development of scientific literacy, this study analyzes their content with reference to specific global standards, with the aim of improving them and keeping pace with learners' needs and global trends.

Study Question

The study aims to answer the following question: "What is the extent of the inclusion of QA standards in science textbooks for 6th graders in terms of basic concepts, balance and appropriateness of the educational content, the relation between environment and society, and activities?"

Purpose and Significance of the Study

The study aims to determine the inclusion of QA standards that should be met in the content of science textbooks for 6th graders. The significance of the study is twofold:

Theoretical: regarding disclosure of the most important QA standards for 6th grade basic science textbooks in Jordanian schools, which can be developed and used in the evaluation of science textbooks at any other school stage.

Practical: the significance of the study could help curriculum developers with regard to their commitment to and inclusion of QA standards in improving the quality of science textbooks.

Operational Definitions (Terms of the Study):

Content analysis: A method used by researchers in various fields to describe the apparent and explicit content of the material to be analyzed in response to the research needs formulated in the research questions and hypotheses. It is a structured technique that can be repeated to reduce many textual words into categories of particular content, based on clear coding rules (Khataybeh, 2012). Holsti (1969) defines it as a technique for making inferences by objectively and structurally determining the specific characteristics of messages. For the purposes of this study, it is defined procedurally as the process of classifying the analysis into four categories, namely basic concepts, balance and appropriateness, correlation between the environment and Jordanian society, and activities.

Science textbook: the science textbooks for 6th graders, approved by the Ministry of Education in 2020/2021.

QA standards: Muslim (2013) defines these as the specifications and conditions that should be met in the educational system, thus leading to output quality that meets beneficiaries' needs. In this study, they are a set of scientifically-controlled standard specifications that must be met in the educational content for 6th graders, in terms of science textbooks which enable students

to benefit from them in learning the subject matter, enriching their information, meeting their needs, and developing their skills.

Educational content: Aida (2002) defines this as the part of the curriculum that consists of the cognitive, skill-based, and emotional experiences that courses provide in the form of textbooks prepared by educational institutions. In this study, it is defined as the educational material and the knowledge, concepts, skills, ideas, values and trends included in the science textbook scheduled for 6th graders in Jordan.

Methodology

A descriptive, analytical approach was used in the content analysis of the science textbook for 6th graders in Jordan and the extent to which QA standards were achieved. In addition, the frequency of QA standard themes and indicators in the textbook was determined.

Population and Study Sample

The study population consisted of 6th grade science textbooks approved in Jordan for the academic year 2020/2021, consisting of six units (Electricity in Our Life, Elements and Compounds, The Human Body and its Health, Light Behavior, Forms of Energy and their Sources, and Water in our Lives). The sample consisted of all the topics and units of the textbook, with all its six units, and a total number of pages of 256.

Study Tool

The content analysis form for the QA standards consisted of four domains, which were designed after reviewing previous related studies, such as those of Asilan (2011) and Ibn Yasin (2008); the tool initially consisted of the four domains, with 23 indicators.

Validity of the Analysis Form

The instrument was presented to a panel of judges who were experts in science education for them to perform content and face validity of the content analysis form. They agreed on 12 indicators that were suitable for the QA standards content analysis, as shown in Table 1:

Table 1: Content analysis form for the 6th grade science textbook.

Field	Standards	Indicators
Quality of educational content.	The basic concepts are clear in the textbook.	Basic concepts.
	Ideas and concepts are listed in sequence and are coherent.	
	The content focuses on the application of the concepts and principles and avoids unimportant details.	
	Individuation: the content takes into account individual differences among students in the diversity of their levels through aspects of the content that suit the students' mental, cognitive, and psychological levels.	Balance and appropriateness.
	Development of attitudes: the content promotes positive attitudes towards science subjects.	
	Scientific inquiry: the content motivates students to practice the following steps: observation, description, measurement, and interpretation.	
	The content tackles community issues, health and environmental problems, science and technology, and the interaction between them.	Relation between the environment and society.
	The content presents real-world tasks perceived to be related to the learner.	
	Scientific knowledge and practical skills are applied in community service and solving problems related to the students' lives.	
	Students acquire a variety of skills that are applicable to their needs and interests.	Activities
	Motivation: it raises the motivation to search.	
	Ease of implementation: students can implement it by using materials from the local environment.	

Reliability of the Content Analysis Form

The reliability of the form for coding and analysis was assessed by calculating the inter-rater coefficient of agreement using the Kappa and Holsti equations, as shown below (Holsti, 1969; Stemler, 2001).

$$k = \frac{Pa - Pc}{1 - Pc}$$

k: Kappa coefficient.

PA: coefficient of agreement between rater.

Pc: coefficient of agreement by chance.

The Holsti coefficient was also calculated as follows:

Holsti coefficient reliability=

$$\frac{2F}{R1 + R2}$$

F: Agreement between two raters.

R1: denotes rater 1.

R2: denotes rater 2.

The findings of the Kappa and Holsti coefficients for the three raters are shown in Table 2:

Table 2: Values of Kappa and Holsti coefficients

Holsti coefficient	Kappa coefficient	Raters
0.97	0.83	R1+R2
0.92	0.83	R1+R3
0.98	0.84	R2+R3

R1, R2 and R3 are the raters in the pilot study.

As shown in Table 2, the reliability values of the first, second and third raters, Kappa coefficient were 0.83 or 0.84, indicating the reliability of the analysis by changing people with a high proportion. The Holsti coefficient ranged between 0.92 and 0.98, which is a suitable value for conducting the coding and analysis.

Criteria for Content Analysis

Eight science education experts were asked to suggest criteria for judging the appropriateness of the inclusion of 6th grade QA standards. It was decided that these should be 32%, 30%, 18% and 20% respectively for the basic concepts, balance

and appropriateness, relation between the environment and society, and activities in the textbook.

Results and Discussion

The content of the science textbook for the 6th graders issued by the Jordanian Ministry of Education in 2018 was analyzed in light of the QA standards in order to answer the main study question.

To answer these questions, a content analysis form was prepared according to the standards. This form included four main domains, as shown in Table 3.

Table 3: QA standards domains and number of sub-domains.

Primary domain	Number of subdomains
Basic concepts	3
Balance and appropriateness	3
Correlation between the environment and Jordanian society	3
Activities	3

The content was coded and analyzed, and the frequencies and percentages for each domain

were measured according to the units of the textbooks; see Table 4.

Table 4: Frequencies and percentages of the main domains according to the units within the science textbook.

Unit One: Electricity in our Life				
Sub-domain	Rater (1)		Rater (2)	
	Frequency	Percentage	Frequency	Percentage
Basic concepts	10	15.1%	11	16.6 %
Balance and appropriateness	38	57.5 %	36	54.5 %
Relation between the environment and society	4	6.1 %	5	7.6 %
Activities	14	21.2 %	14	21.2 %
Unit Two: Elements and Compounds				
Sub-domain	Rater (1)		Rater (2)	
	Frequency	Percentage	Frequency	Percentage

Basic concepts	23	27.4%	17	20.2 %
Balance and appropriateness	40	47.6 %	44	52.4 %
Relation between the environment and society	12	14.3 %	13	15.4 %
Activities	9	10.7 %	10	11.9 %
Unit Three: The Human Body and its Health				
	Rater (1)		Rater (2)	
Sub-domain	Frequency	Percentage	Frequency	Percentage
Basic concepts	35	29.9 %	36	30.7 %
Balance and appropriateness	45	38.4 %	46	39.3 %
Relation between the environment and society	14	12.0 %	12	10.3 %
Activities	23	19.7 %	23	19.7 %
Unit Four: Light Behavior				
	Rater (1)		Rater (2)	
Sub-domain	Frequency	Percentage	Frequency	Percentage
Basic concepts	13	20.3%	15	23.4%
Balance and appropriateness	39	60.9%	37	57.8%
Relation between the environment and society	4	6.3%	4	6.3%
Activities	8	12.5%	8	12.5%
Unit Five: Forms of Energy and their Sources				
	Rater (1)		Rater (2)	
Sub-domain	Frequency	Percentage	Frequency	Percentage
Basic concepts	16	20.3%	15	19.0%
Balance and appropriateness	37	46.8%	40	50.6%
Relation between the environment and society	12	15.2%	10	12.7%
Activities	14	17.7%	14	17.7%
Unit Six: Water in our Life				
	Rater (1)		Rater (2)	
Sub-domain	Frequency	Percentage	Frequency	Percentage
Basic concepts	12	15.0%	12	15.0%
Balance and appropriateness	36	45.0%	35	43.7%
Relation between the environment and society	21	26.3%	22	27.5%
Activities	11	13.7%	11	13.7%

The frequencies and percentages of each domain were calculated, as shown in Table 5.

Table 5: Frequencies and percentages of the main domains for the 6th grade science textbook .

Main domain	Frequency (percentage)		
	Rater (1)	Rater (2)	Mean
Basic concepts	109 (22.2)	106 (21.6)	107 (21.8)
Balance and appropriateness	235 (47.9)	238 (48.6)	236 (48.2)
Relation between the environment and society	67 (13.7)	66 (13.5)	67 (13.6)
Activities	79 (16.1)	80 (16.3)	80 (16.4)
Total	490 (100)	490 (100)	490 (100)

As can be seen in Table 5, the average percentage of the extent of inclusion of the textbook of basic concepts was 21.8%, that of balance and appropriateness 48.2%, while the correlation between the Jordanian environment and society

accounted for 13.6%. The inclusion of activities achieved 16.4%.

The frequencies and percentages for each sub domain and for each rater were calculated, and are presented in Table 6.

Table (6): Frequencies and percentages for each of the sub-domains and for each rater.

Domain	Sub domain	Frequency (Percentage)		
		Rater (1)	Rater (2)	Mean
Basic concept	The basic concepts are clearly visible in the textbook.	30 (27.5)	28 (26.4)	29 (26.9)
	Ideas and concepts are listed in sequence and are coherent.	42 (38.5)	40 (37.7)	41 (37.9)
	The content focuses on applying concepts and principles and avoids unimportant details.	37 (33.9)	38 (35.8)	38 (35.2)
Total		109 (100)	106 (100)	108 (100)
Balance and appropriateness	Individual differences among students regardless of the diversity of their levels through aspects of the content. The content is commensurate with the students' mental, cognitive, and psychological level.	49 (20.9)	51 (21.4)	50 (21)
	Development of attitudes: the content promotes positive attitudes towards science subjects.	92 (39.1)	90 (37.8)	91 (38.4)
	Scientific inquiry: the content motivates students to practise scientific inquiry in all its steps, namely observation, description, measurement, and explanation.	94 (40)	97 (40.8)	96 (40.5)

Total		235 (100)	238 (100)	237 (100)
Correlation between the environment and Jordanian society	The content deals with community, health, and environmental issues and the interaction between them and between science and technology.	19 (28.4)	21 (31.8)	20 (29.9)
	The content presents real-world concrete issues related to the learner.	31 (46.3)	28 (42.4)	30 (44.7)
	The content employs scientific knowledge and practical skills in community service and in solving problems related to the students' lives.	17 (25.3)	17 (25.8)	17 (25.3)
Total		67 (100)	66 (100)	67 (100)
Activities	Students gain a variety of skills that meet their needs and interests.	23 (29.1)	24 (30)	24 (30)
	The motivation encourages students to search for information.	29 (36.7)	31 (38.8)	30 (37.5)
	Ease of implementation: the students can implement the content by using materials from the local environment.	27 (34.2)	25 (31.2)	26 (32.5)
Total		79 (100)	80 (100)	80 (100)

Table 6 shows that the highest percentage of inclusion of the basic concepts in the science textbook related to the indicator of the cohesion of ideas and concepts, at 37.9%. The content indicator concerning the application of concepts and principles and the avoidance of unimportant details was 35.2%. The basic concepts are clearly structured in the textbook and occupied the lowest position, with 26.9%.

The highest percentage in the textbook's achievement of balance and appropriateness was for the Scientific Inquiry Index, at 40.5%, as this motivates students to practise scientific inquiry in all its steps: observation, description, measurement, and explanation. Moreover, in relation to the attitudes development index, the content fostered positive trends towards science subject, with an average percentage of 38.4%.

The lowest percentage of the indicator that takes into account individual differences among students through the diversity of their levels and through content aspects that meet the students' mental, cognitive, and psychological levels was

21.0%. The highest percentage was for the inclusion of concrete tasks related with the learner achieved, at 44.7%. The indicator addresses community issues, health and environmental problems, and the interaction between them and science and technology, with an average percentage of 29.9%. The lowest percentage of 25.3% was for the indicator that employs scientific knowledge and practical skills in community service and solving problems related to the students' lives.

As for the fourth domain, which indicates the degree to which the activities are included in the textbook, this achieved the highest percentage (37.5%) of the motivation index, as it raises the motivation for researching information. The ease of implementation indicator, showing that students could implement it using raw materials from the local environment, was 32.5%. The lowest percentage (30.0%) was for the indicator that shows that students acquire various skills by taking into account their needs and interests. When comparing the results of the study with the

average percentages of the QA standards in educational content that are suggested by 6th grade teachers, supervisors, experts in science

textbook, and graduate students. As indicated in Table 7.

Table 7: Comparison between the percentages of the experts' criteria and the QA standards results.

QA standard	Average percentage	Percentage of the experts' criteria
Basic concepts	21.8 %	32 %
Balance and appropriateness	48.2 %	30 %
Relation between environment and society	13.6 %	18 %
Activities	16.4 %	20 %

Examination of Table 7 shows that regarding the average percentage of the degree of inclusion of the QA standards for the educational content of the 6th grade science textbook in Jordan, the domain of basic concepts is 21.8% and that of balance and appropriateness is 48.2%. The domain of the extent of the relation between the environment and society is 13.6%. As for the extent to which the textbook includes activities, this is 16.4%. Table 7 shows that only the domain of balance and appropriateness exceeded the experts' criteria, while the other three domains were lower. This could be due to the lack of the curriculum developers' knowledge of QA standards and how to tailor a curriculum that includes these.

There is a clear difference in the extent of inclusion of the textbook in the criteria for basic concepts, and balance and appropriateness from the cut point, at 32% and 30% respectively. There were slight differences concerning the degrees of inclusion of the correlation standards between the environment and activities, amounting to 18% and 20% respectively.

The reason behind these differences could be attributed to the inclusion of QA standards for the textbook. The process of preparing and developing science textbooks is subject to the views of educators and the authors due to their experience in science teaching. Besides, there are no clear nor specific criteria for including QA standards in the content of science textbooks.

Recommendations

The study recommends the following:

1- Those responsible for preparing and developing science textbooks should take into consideration the inclusion of QA standards for

6th grade students in line with the educational content and in a balanced way.

2- Further studies should be conducted to examine QA standards in the educational content of science textbooks at all levels of education.

3- Educators and authors should observe all the QA standards when preparing science textbooks.

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