Analyzing the content of the two science books for intermediateStageaccording to NGSS standards

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Abstract: The aim of the research aims to analyze the content of the two science books for the intermediateStage according to NGSS standards, and the two researchers relied in their answers to the research question on the descriptive analytical method, as the research community and its sample are partly from the content of the science books for the intermediate grade (first and second grade), in both parts, the two researchers prepared the research tool in its initial form represented by the list of dimensions of NGSS standards (scientific and engineering practices, comprehensive concepts, core ideas) after translating it into Arabic, which they obtained from the National Research Council (NRC) website, to ensure the validity of the research tool, it was presented to (24) of the arbitrators specialized in curricula, teaching methods, measurement and evaluation fields, psychology and life sciences, to know its suitability to the nature of the research. Among the most important findings of the researchers is that the interest of the two science textbooks for the intermediate Stage with science standards for the next generation was average compared to the spoken percentage to include the standards adopted by the researchers based on previous studies and the opinions of the referees.

Key words: content analysis, textbook, intermediateStage, NGSS standards

1. **Chapter one / definition of the research**

Research problem:

The textbook is an essential element of the educational process and one of the main means that the student, teacher and supervisor depend on in the teaching and learning process and the main source of information that the student receives in many educational systems and because it performs a vital function in the teaching process, so it is necessary to choose its content in accordance with the clear and specific global standards expressing the aims of the grade for which it was prepared, the intermediateStage in Iraq witnessed many curricula that were changed, including the two science books for the first and second intermediate grades, after the unification of physics, chemistry and biology books in one book, which began in the academic year (2016-2017), to the best of their knowledge, the two researchers noted that there are very few studies in the field of analyzing two science books, which do not exceed one study since the change took place, which is the study (Al-Taie 2020), which carried out the analysis according to (STEM) standards, and given the importance of the NGSS standards, the two researchers decided to conduct a study to reveal the extent of its availability in the two science books for the first and second intermediate grades, the two researchers directed an exploratory questionnaire to a number of science teachers in intermediate and secondary Stage affiliated to the General Directorate of Education in Baghdad, Rusafa (first) who have teaching experience and by (30) male and female teachers after they provided a comprehensive definition of science standards for the next generation and their dimensions, and by sorting Their answers show the following:

• 90% of science teachers have no knowledge of NGSS.

• There is a divergence of opinions in the answers of male and female teachers about the inclusion of NGSS standards in the content of the two science books (first and second) for the intermediate grade.

Therefore, the study problem is determined in the following question: What is the percentage of availability of NGSS standards in the content of science books for the intermediate Stage (first and second grades) for the academic year (2020-2021)?

Research importance

that the age in which we live is characterized by the speed of change and one of the most important manifestations of this change is what is known as the cognitive explosion and one of its most important manifestations is the creation of new classifications in science, which is a natural reaction to the accumulation of knowledge and this flowing knowledge must be classified on new foundations and the development of new definitions and methods in science. (Salama, 2008, 23-24) that the continuous change that is taking place now in societies leads to changes in all social, economic, cultural and political fields, it leads teachers and those responsible for the educational process in the different educational grade to think about the content of the teaching curricula that must be used, and this requires defining the concepts of teaching and learning and their relationship

to the processes of designing, implementing and evaluating the curriculum and their relevance to the development procedures to accommodate the new developments in the educational process. (Tamam, 97,2000). That rapid changes in the world - including technological advancements, scientific innovation, increased globalization, and the demands of the changing workforce - all of these changes redefine the broad skill sets that students need to be adequately prepared to participate in and contribute to society today, (NSTA) recognizes the need for twenty-first century skills and their importance in the context of science education and calls on the community to support twenty-first century skills consistent with best practices across the science education system for pre-kindergarten to age (16) and these skills include learning and innovation skills, information skills Media and technology, life and job skills, communication skills and problem solving (NSTA, 2011,1), the educational arena has witnessed a series of successive programs and projects to reform science education at the global level and at the level of specialized local institutions and bodies, in the period from 1950-1977 a great movement appeared to reform and develop science curricula, where enormous sums were spent on developing science curricula, qualifying and training teachers, and this is why this period was called (the golden age) for science education and scientific education. (Zeitoun, 159,2010). In 2013 the NGSS standards were developed using the latest research in science education and NGSS was divided into three dimensions (A) Common Core Ideas (DCIs) which are content (B) Comprehensive concepts (CCCs) which are the links between scholarly topics, and (C) Scientific and Engineering Practices (SEPs) which are the processes used in the practice of science. (1,2014, Fulcher)

The two researchers abstracted the importance of the research as follows:

1- Explain the importance of content analysis to diagnose strengths and weaknesses

2- It may meet the needs of science students and researchers in the field of science curriculum analysis according to NGSS standards

3- It may benefit educational supervisors and specialists in developing textbooks by providing them with a list of NGSS standards for their observance in the books.

Research aims: The research aims at the following: Analyzing the content of science writers for intermediate school according to NGSS standards.

Research limits: Two intermediate Stage science books issued by the Iraqi Ministry of Education / General Directorate of Curricula for the academic year 2019-2020

Define terms

Content Analysis: The method used by the researchers in dividing and deconstructing the content of the two intermediateStage science books (first and second grade and their parts) according to NGSS standards by adopting the paragraph for analysis in order to arrive at a quantitative, objective and structured description of the content of the scientific material.

NGSS Standards: A set of standards used as criteria for judging what should be included in the two intermediateStage science books (first and second) in Iraq for the three interrelated dimensions (scientific and engineering practices, comprehensive concepts and core ideas).

2. Chapter two / theoretical background and previous studies

The first axis - theoretical background

NGSS Standards: These are standards or objectives that reflect what the student should know and be able to do, NGSS does not specify the methods through which standards are taught, NGSS has been written as performance expectations that envision what students should do to demonstrate their competence in the sciences, the NGSS method is designed to provide information to teachers and curriculum developers (NGSS Lead States, 2013), which are coherent and enriching educational standards that cover various topics and academic grade, they provide all students with a decent level of education, and were approved in the United States of America in 2013.These standards were built by the National Research Center in the United States (NRC) in partnership with institutions and bodies such as the (Achieve) organization, the National Science Teachers Association (NSTA) and the National Academy of Sciences (NAS) , the National Research Center has developed a conceptual framework for standards from kindergarten to high school and this framework has been built on a strong foundation from previous research and studies that describe and define the core ideas of science education, (NRC, 2013,1) NGSS standards differ from previous science standards in three main ways:

- Performance: The NGSS standards document should include performance expectations that students should be able to fulfill in order to achieve these standards 2- Inclusion: Performance expectations must be integrated between the three dimensions of the standards 3- Cohesion: Each group of performance expectations must be in

the content of science and engineering Connected and interconnected with the standards of scientific culture and the general state standards, including language and mathematics skills (NGSS, 2012, p1)

NGSS is based on a framework for science education from kindergarten to grade 12 that was developed by the National Research Council (NRC) and consists of three dimensions, namely:

First: Science and Engineering Practices: Practices describe the behaviors that scientists engage in while they investigate and build models and theories about the natural world and the main set of engineering practices that engineers use during their design and construction of models and systems, even though engineering design is similar to scientific research, however, there are major differences, for example, scientific research includes formulating a question that can be answered through investigation, while engineering design includes formulating a problem that can be solved through design. It includes eight practices:
1- Asking Questions & Defining Problems
2- Developing & using model
3- Planning & Carrying Out Investigation
4- Analyzing & Interpreting data
5- Using Mathematics & Computational Thinking
6- Construction explanations & designing Solution
7. Engaging in Argument from Evidence
8- Obtaining & evaluating & communicating information (NGSS, 2013, 4-15)

Second: Comprehensive Concepts: Comprehensive concepts are applied in all fields of science, as it is a way of linking various fields of science, and it includes:
1-Patterns, 2- Cause and Effect, 3- Scale, Proportion, and Quantity, 4- Systems and System Model, 5- Energy and Matter, 6- Structure and Function, 7-Stability and Change (NGSS, 2013, G: 1-17)

Third / Core Ideas: The core ideas are characterized by the ability to focus on science curricula and assessments from kindergarten to the twelfth grade, they are grouped into four main areas: (Life Science, Physical Science, Earth & Space Science, Earth & Space Science). Engineering, Technology & the Application of Science) (NGSS, 2013, E1-8)

3.   **The NGSS standards are drawn up in the form of a table consisting of three parts:**

1- The Performance Expectations Box: It describes the performance expectation of students and what they are capable of doing and integrates the practices, core ideas and overarching concepts.
2- The Core Box: The core box contains the learning objectives that students must achieve and it includes three parts, which are scientific and engineering practices, core ideas and comprehensive concepts, all of which are derived from the framework of science education from kindergarten to the twelfth grade.
3- Correlation Box: This fund includes the correlation of each group of performance expectations with other ideas within the disciplines of science and engineering and their link to common standards in mathematics and the English language. (NGSS, 2013,1-5)

Expected performance		
Shared concepts (The significance of the green color: Phrases derived from the framework of science education that apply to performance)	The main ideas of the specialty (The significance of the violet color: Phrases taken from the framework of science education)	Practices in Science and Engineering (The significance of the blue color: practices in science and engineering, then preparing it to form the above performance)
linked in - Other branches of science that are taught in the same class - Main ideas of the major taught by younger students and older students - The main ideas which taught in Mathematics and English majors		

Figure (1) shows the link between the three dimensions of the standards

The second axis - previous studies
1-Study (Al-Rabeean and Abeer 2017): To identify the extent to which science standards are included for the next generation in science books for the first intermediate grade in the Kingdom of Saudi Arabia, a list of science

standards was prepared and converted into a content analysis card and statistical methods such as percentages, percentage frequencies and Holste equation were used, and the results of the study were the availability of Science standards came in low in science books by 33.1%, and they were as follows: The standard of main specialized ideas was available at a rate of 57% and in a moderate way, while the standard of scientific and engineering practices came in a low rate of 24.3%, followed by the criterion of comprehensive concepts by 18%.

2 - The study (Ahal2019): the extent to which the content of science and life books for the core grade in Palestine included science standards for the next generation. The content analysis card was prepared and statistical means were used such as frequencies, percentages and Holste equation and the results of the study were the availability of the standard of scientific and engineering practices in the science book for the sixth grade by 68 percent. The standard for comprehensive concepts is 22%, the main ideas standard by 10%, the standard for scientific and engineering practices in the seventh-grade science textbook is 62%, and the comprehensive concepts standard is 25%, the standard for main ideas of 13%, the availability of the standard of scientific and engineering practices in the eighth-grade science book by 60% and the standard for comprehensive concepts with a percentage of 26%, and the criterion of main ideas is 14%.

4. Chapter Three / Research methodology and procedures

Research methodology: The two researchers used the content analysis method to arrive at a quantitative and numerical description of the unit of analysis and rely on systematic repetitive monitoring (Mahmoud, 2006, 221-222).

Research Procedures:

1- Research community
: refers to all the elements or units that make up the society, which the two researchers will study. (Al-Taeb, 162,2018) The current research community consists of science books prescribed for students of intermediate (first and second) grades in the Republic of Iraq, which consist of (30) chapters and (488) pages distributed into four books.

2- Research Sample: The research sample consists of a limited number of vocabulary that the researcher will deal with systematically (Tamar, 2007, 24-25), and the current research sample consists of the content of science books for the intermediate grade of grades (first and second) and by four books, (Introduction to books, list of contents, figures, review of lessons, critical thinking, review of concepts, vocabulary and main ideas) contained in books were excluded from the analysis, and the pages subject to analysis were identified with (322) pages, representing 65% of the research community.

Research tool: It represents the main source for obtaining data and information, so the researcher must determine the method that enables him to collect this data, which suits the goal of the research in a sound manner. (Ahmad, 103,2011)

Analysis List: The two researchers prepared a list of NGSS standards for analyzing science books for the intermediate grade after obtaining it through the official website of the National Research Center (NRC) and its translation, in addition to reviewing the studies and literature that dealt with criteria such as the study (Ahal, 2019), and included the following: Three dimensions which are scientific and engineering practices, comprehensive concepts, core ideas and four areas which are biology, physics, earth and space science, engineering Technology and science applications and fifty-three standards.

Validity of the analysis tool: validity meant: measuring the instrument for what it was designed to measure or to measure what it was designed for. (Al-Zuhairi, 218,2017) The validity of the content analysis list was verified through apparent validity through the agreement of the arbitrators that the analysis list measures what it was designed to measure, and the researchers presented the list of standards to a group of referees in the field of curricula and methods of teaching science, measurement and evaluation And the field of life sciences and educational psychology in order to identify their suitability as indicators for content analysis and their relevance to the first and second intermediate grades, and delete and amend paragraphs as they see fit. The two researchers adopted an 80% agreement between the arbitrators to retain, amend or delete the paragraph, and no paragraph was excluded, and thus the tool has the validity of the content.

Determining the criterion for comparing the results of the analysis: The two researchers directed an exploratory questionnaire to determine the criterion ratio of the dimensions of the NGSS standards that can be found in the two science books to a group of experts in the field of teaching methods, measurement and evaluation in addition to their reliance on previous studies such as the study (Al-Zubaidi 2020)

1-From 0 to less than 25% is very low

2- From 25% to less than 50%low

3- From 50% to less than 75% average

4- From 75% to less than 100% high

Analysis process:

A- The aim of the analysis: To determine the extent to which the content of science books for the intermediate grade of NGSS standards is included according to the previously prepared tool

B - Unit of analysis: The two researchers relied on the paragraph as a unit of analysis and repetition as a unit of census

Analysis Steps: The researchers followed the following steps in the analysis:

❖   Read the content of the two science books for intermediate school, in first and second parts, a good reading

❖   Determine the unit of analysis represented by the paragraph adopted by the researchers in the analysis

❖   Compare the paragraph with the dimensions of (NGSS standards) to determine its belonging to the main and sub-criteria

❖   Determine the paragraph in the phrases in light of the tool and determine the type of dimension and standard

❖   Dumping the results of the analysis into tables and giving one iteration for each paragraph, for each book and according to the semesters, then converting them into percentages for statistical treatment and interpretation later.

Analysis Validity: the suitability of the measurement method used in measuring the topics that the researcher seeks to measure and the ability of the method to provide the required information. (Al-Falahi, 70,2014) to ensure the validity of the analysis, the two researchers presented a sample of the analyzed material to experts in the field of curricula, teaching methods, measurement and evaluation, and they agreed on the validity of the analysis process, which the researchers considered validity of the analysis process.

Stability of analysis: It means the degree of agreement between analysts or classifiers in their classifications and their analysis of the content elements, or the degree of agreement of the individual's analysis with himself if he re-analyzes himself after a certain period of time. (Mahmoud. 278,2006) The researchers used two types of analysis:

Agreement over time: It means that the researcher arrives at the same results when using the same classification and the same content in different time periods. (Majeed, 382,2013) As the researchers repeated the analysis 30 days after the first analysis, the stability coefficient was calculated using Cooper's equation, and the values of the stability coefficients were as shown in Table (1).

Agreement through analysts: It means that different analysts reach the same results when they use the same classification and the same content and follow the same analysis procedures. (Majeed, 382,2013) The researchers sought the help of external analysts, and a sample was selected from the analyzed material representing (20%) of the content of each book, and to extract the agreement, the researchers used Cooper's equation and the values of the stability coefficients were as shown in Table (1)

Table (1) the values of the stability coefficients for the analysis of the two science books

science books / Analysts	First intermediate class, first part	First intermediate class, second part	Second intermediate class, first part	Second intermediate class, part two
The two researchers through time	0,88	0,92	0,85	0,96
The two researchers and first analyst	0,96	0,88	0,96	0,96
The two researchers and second analyst	0,92	0,96	0,92	0,96
First and second Analyst	0,94	0,92	0,94	0,96

(Abu Samra and Muhammad 2019), citing (Abd al-Hamid 2000), indicates that there is no agreement on the values of stability coefficients that can be decisively accepted educationally, however, he advises the researcher to make his effort to not be less than (0.90) the stability coefficients, in order to be satisfied with the level of his study results, and that the values of the stability coefficients less than (0.60) are unacceptable values. (Abu Samra and Muhammad, 76,2019)

Statistical means: 1- Frequency as a unit of counting and the percentage of counting frequencies

2- Cooper's equation to find the percentages of agreement between the analysts and the researcher himself.

$$\text{Agreement percentage} = \frac{\text{Number of times the agreement}}{\text{Number of times agreed} + \text{Number of times disagreed}} \times 100 \quad \text{(Hussain, 400,2018)}$$

5.   Chapter Four / Results and Discussion

In this chapter, the two researchers presented their findings and discussed them according to the research objective, conclusions, recommendations, and proposals as follows: For the purpose of identifying the extent to which the two science books for the intermediate grade include NGSS standards, the researchers used the content analysis tool in analyzing the two intermediate school science books in the first and second parts to reveal the extent of their inclusion of NGSS standards, the two researchers presented the combined results of the two science literature analysis, as follows:

Table (2) the percentages and frequencies for analyzing the two science books

class / dimension	First (Part One) Iterations	%	First (Part Two) Iterations	%	Second (Part One) Iterations	%	Second (Part One) Iterations	%	Total iterations	%	Number of standards achieved	Number of total standards
Scientific and engineering practices	12	40,70%	96	34,65%	134	20,07%	97	27,40%	539	29,61%	7	8
comprehensive concepts	6	6,90%	31	11,20%	4	0,59%	26	7,35%	97	5,32%	5	7
Core ideas	73	52,40%	150	54,15%	530	79,34%	231	65,25%	184	65,07%	27	38
Total	21	28,62	277	15,21%	668	36,71%	354	19,46%	1820	100%	39	53

Discussing the results: After presenting the results above, the following becomes clear:

1- The two parts of the two science books were collected (1820) iterations, distributed among all the dimensions, and varied in the ratios obtained, so the science book for the second grade (the first part) got the highest percentage (36.71%) by (668) iterations, whereas, the science book for the first grade (first part) ranked second with (28.62%), with (521) iterations, and the science book for the second grade (the second part) ranked third with (19.46%) by (354) iterations, as for the science book for the first grade (Part Two), it came in last place with a rate of (15.21%) by (277), and the researchers believe these results are acceptable because the science book for the second grade (Part One) was more diverse and expanded than other books and more inclusive of standards NGSS due to the nature of its content and commensurate with the nature of the growth of scientific information and knowledge for students.

2- The two science books partially dealt with all dimensions of NGSS standards in varying proportions and at an unbalanced level, as it came after (basic ideas) in first place with a percentage (65.07%) by (1184) iterations, followed by (scientific and engineering practices) by a percentage (29) (61%) by (539) iterations, then after (comprehensive concepts) by (5.32%) by (97) iterations, which was the lowest percentage among the other dimensions, figure (23), and these results are consistent with the study (Al Rabeean and Abeer 2017) and disagreed with the study (Ahal 2019) that this discrepancy between the two science books in two parts indicates the lack of coordination and integration between the topics and the lack of the principle of continuity and succession in organizing the content, which made each book not complete what preceded it.

3- The two intermediate school science books achieved (39) standards and neglected (14) standards out of a total of (53) standards distributed over three dimensions.

4- The two science books for the intermediate level achieved a rate of (73.58%), which represents a medium percentage compared to the spoken score adopted by the two researchers, and this means that the science writers did not show much interest in NGSS standards.

Despite the availability of all standards, science books did not achieve a deep understanding of the content due to the imbalance between the dimensions, because one of the characteristics of NGSS standards is the focus on a deeper understanding of the content, and this can only be achieved through the coherence, integration and balance between the three dimensions of the standards.
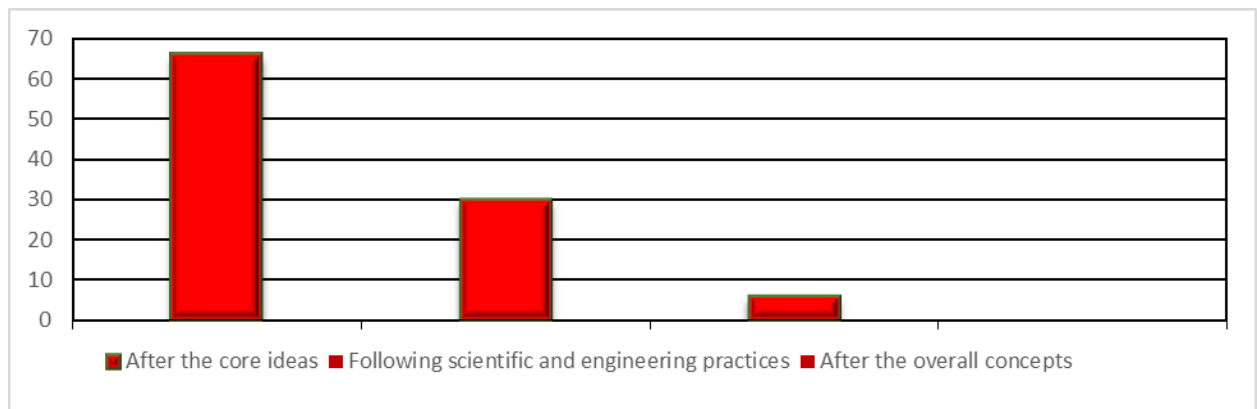

Figure (2) the percentages of science standards for the next generation in the two science books

6.   Conclusions

1- The results indicate that the two science books neglected a number of criteria for each dimension, and this means that there is a weakness in the book's arrangement and topics.

2- The results indicated a difference in the aspect ratios between the two science books for the first and second intermediate grades, and this indicates the weakness of the integration between the two science books for the different grade.

Recommendations

1- The balance in the ratios of inclusion of the NGSS standards dimensions in the two science books for the intermediate grade so that it does not yet overwhelm the rest of the dimensions

2- Paying attention to neglected sub-criteria and working to include them in the two science books for the intermediate level.

The proposals

1- Conducting evaluation studies for the science curriculum and the biology curriculum at the secondary level according to NGSS standards

2- Conducting a similar study to analyze the content of the biology textbook for the third intermediate grade and the biology books for the preparatory grade according to NGSS standards.

3- Conducting a similar study to include other subjects in physics and chemistry, and for different grade of study.

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