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EVALUATION OF BIOLOGY CURRICULUM CONTENT IN LIGHT OF AAAS EVALUATION STANDARDS

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Abstract
The aim of the research was to evaluate the content of the biology curriculum in light of the AAAS evaluation standards. The research used the descriptive analytical approach, and the research sample consisted of the biology book for the third intermediate grade prescribed for the academic year 1446 AH / 2024 AD by the Ministry of Education in the Republic of Iraq, the research tools and materials were represented in the content evaluation list in light of the AAAS evaluation standards. The research results yielded a number of results, the most important of which are: The issue construction standard occupied the highest percentage of the total AAAS evaluation standards available in the biology curriculum for the third intermediate grade in the Republic of Iraq, The meta-scientific criterion came in first place, followed by the coherence of ideas criterion in third place, then the consistency of main ideas with content criterion in fourth place, and finally the accuracy criterion in last place, The study also recommended the inclusion of AAAS assessment criteria in all curricula and at all educational levels.
Keywords: Biology curriculum content evaluation, AAAS assessment standards.

FIRST: INTRODUCTION

The Republic of Iraq is witnessing tremendous progress in all fields and sectors, in light of the modern vision called for by the state, and this vision has resulted in supporting and developing the education sector in all its elements, represented in building and developing curricula, developing teaching methods, and distancing the student psychologically, socially and culturally in a way that suits the developments of the times, and developing theteacher and developing his teaching skills within the classroom In line with modern curricula, in order to build an effective, supportive and stimulating learning environment.
In order to ensure the quality of the school curricula and keep pace with the technological and scientific developments taking place in the Iraqi society, it is necessary to carry out continuous evaluation processes for these curricula, as the issue of curriculum evaluation and development is one of the most important issues in the educational field, and therefore the educational curricula have enjoyed a large share of evaluation studies during recent years, which led to the development of curricula in its various disciplines and educational stages.
The biology curriculum is one of the important and necessary curricula in the life of the middle school student, through which the student gets to know himself and the parts of his body as a living being. Through this curriculum, the student's awareness of his body and behavior increases so that he can interpret and analyze the phenomena that take place in his reality, and then he becomes aware of their causes and deals with them. (Dfar, 79, 2024)
It is also necessary to pay attention to the evaluation of biology curricula and the standards contained in these curricula in light of the deterioration of learning and teaching systems in educational institutions and the change of curricula in close periods of time, and it is also necessary that the subject of biology should occupy an important position among experts, specialists, educators, those in charge of curriculum development and planning, and the focus of attention of teachers and students, as local and international educational systems emphasize that the development of the educational process is in fact the responsibility of the school curricula Therefore, these curricula must be evaluated continuously. (Abdul-Amir Wadfar, 643, 2024)
As an extension of the continuous curriculum evaluation processes, the American Society system has started implementing the (2061) project, where this project is built on scientific culture as content. This project aimed to develop and support the processes of scientific culture among students, and to provide them with extensive scientific knowledge in various science curricula. (Al-Qishi and discourse, 2020).
The American Association for the Advancement of Science (AAAS) has defined through the project (2061) a set of evaluation criteria on which science curricula in general and the biology curriculum in particular should be based, so this research comes as an attempt to evaluate the content of the biology curriculum for the third intermediate grade in the Republic of Iraq in light of the AAAS evaluation standards.

Second: The Research Problem

The current research problem was based on the critical synthesis of a number of studies in the field of science education in general and biology education in particular, which have repeatedly indicated the need to analyze, evaluate, and design biology curricula. They are the works by Beljon (2024), Masir (2023), Al-Harbi and Ghanih (2022), Al-Essi (2018), Al-Wahr and Abu Al-Saman (2017), and Lang and Cobern (2013).

Moreover, a significant amount of research articles has indicated the significance of embracing the assessment standards of the American Association of the Advancement of Science (AAAS) in curriculum evaluation as illustrated in the works of Abdul-Amir Wadfar (2024), Dfar (2024), Al-Muzaini (2021), Al-Shahrani and Mahfouz (2020), Al-Shehri (2020), Smesim (2019), Al-Sadiq (2018), and Haidar (2019). Also, some of them emphasized the necessity to pay attention to secondary-level students by improving their knowledge of science and manipulating their perception of this field, especially the articles by Al-Hindi (2022), Al-Muzaini (2021), and Al-Shehri (2020).

It is therefore deemed important to review the content of the prescribed curriculum on biology in the third intermediate in the Republic of Iraq of course following the AAAS evaluation criteria and to find out the level to which it conforms to the modern global views that must guide the curricula of biology in the secondary schools. This kind of alignment is necessary in order to have meaningful education reform and in order to create curriculum as guided by contemporary methods that consider curriculum development, the learner and the teacher.

Besides, the discussion of the educational reality and the fact the researcher observed in the number of curricular gaps, along with the lack of Arab literature that explores the issue of integrating the AAAS evaluation standards in the biology curriculum to the third intermediate grade in Iraq, further support the current study. Based on the above, the research problem can be stated as the assessment of the content of the biology curriculum in the third intermediate grade in the Republic of Iraq based on the evaluation standards of American Association to Advance Science (AAAS).

Third: Research Questions

1- What are the AAAS evaluation criteria that should be included in the biology textbook for the third intermediate grade in the Republic of Iraq?

2- To what extent does the content of the biology textbook for the third intermediate grade in the Republic of Iraq comply with the standards of the American Association for the Advancement of Science (AAAS) assessment?

Fourth: Research Objectives

1- Identify the AAAS evaluation criteria that should be included in the biology textbook for the third intermediate grade in the Republic of Iraq?

2- To identify the extent to which the content of the biology textbook for the third intermediate grade in the Republic of Iraq is compatible with the standards of the American Association for the Advancement of Science (AAAS) assessment?

Fifth: The Importance of Research

1- Drawing the attention of specialists and educators towards the criteria of the American Federation for the Advancement of Science Evaluation that must be included in the biology textbook for the third intermediate grade.

2- Taking steady and precise steps in the development of biology curricula in the Republic of Iraq.

3- Opening the way for researchers to conduct other studies and researches on the criteria of the American Association for the Advancement of Science Assessment.

4- Assisting curriculum developers in general and biology curriculum developers in particular with the results of the current research to benefit from it.

5- The possibility of benefiting from the content evaluation list through the evaluation standards of the American Union for the Advancement of Science, in the development of biology curricula in the Republic of Iraq.

6- Urging biology teachers to benefit from the evaluation standards of the American Association for the Advancement of Science in developing their teaching abilities.

7- The possibility of benefiting from the list of criteria of the American Association for the Advancement of Science (AAAS) in other researches.

8- In response to the call of international educational conferences and reports on the need to follow the standards of the American Association for the Advancement of Science (AAAS) in the development of educational curricula.

9- The scarcity of researches and studies that dealt with the evaluation of curricula in general and biology in particular, following the evaluation standards of the American Union for the Advancement of Science.

Sixth: Limits of the Research

The limits of the biology curriculum variable in the biology textbook (Human and His Health) are prescribed for the third intermediate grade by the Ministry of Education in the Republic of Iraq for the academic year 1446 AH/2024 AD. The objective limits of the American Union for the Advancement of Science Evaluation Criteria variable were represented in the following criteria: (Compatibility between the main ideas and the content, Beyond Scientific Culture, Accuracy, Building a Case, Coherence

between Ideas), and the Biology (Human and His Health) textbook for the third intermediate grade was selected in line with the developments made by the Ministry of Education in the Republic of Iraq, and in view of the importance of this stage and the need to include their curricula in the standards of the American Federation for the Advancement of Science Assessment.

Seventh: Materials and Tools of the Research

The research tool was to prepare a list to evaluate the content in light of the American Association for the Advancement of Science (AAAS) evaluation criteria.

Eighth: Terminology of the Research

1- Evaluation of the content of the biology curriculum

Evaluation is defined as: an integrated process that results in the issuance of special judgments, and based on that, the processes and mechanisms of development are produced as the evaluation of something is only in order to bring about fundamental changes in it for the better. (Al-Taie, 2016, 18)

The evaluation of the content of the biology curriculum procedurally is defined as: coming up with some provisions that indicate the compatibility of the content of the biology course (Human and His Health) for the third intermediate grade by the Ministry of Education of the Republic of Iraq to the evaluation standards of the American Association for the Advancement of Science.

2. AAAS Evaluation Standards

The American Association for the Advancement of Science (AAAS) is an organization attributed to the U.S. state that aims to carry out comprehensive reforms in all scientific sciences, and was based on the construction of Project 2061, which seeks to draw the main features of scientific cultures for various science subjects, at all educational levels. (Zaytoun, 2010, 77)

The AAAS Assessment Standards are defined as: a set of standards developed by the American Federation Organization, with the aim of supporting and developing the process of learning science, which must be taken into account when building the school curriculum. They include two sets of standards, the first: standards that are related to the content of the curriculum, and the second: standards that are related to the development and support of the curriculum content to develop the teaching process, where the goals and knowledge that must be developed in students are determined in order to be able to understand information and acquire innovative scientific ways of thinking. (Al-Issa, 2018, 7).

The AAAS Assessment Standards are procedurally defined as: a set of biology assessment criteria approved by the American Association for the Advancement of Science, against which the content of the *Human and Health* unit in the biology curriculum prescribed for the third intermediate grade by the Ministry of Education of the Republic of Iraq is evaluated.

THEORETICAL FRAMEWORK

First: Evaluation of the Curriculum of Biology

The interest in the educational process starts from the interest in the curriculum and how to build it. The process of curriculum evaluation represents the boundary between what the curricula are in reality and what the curricula should be in the future, hence the importance of curriculum evaluation processes.

The importance of the evaluation is also to reassure educational institutions that they are moving in the right direction, to increase the student's confidence in the knowledge and experience they acquire through these curricula, and to reassure state institutions that they have highly qualified individuals through the study of these curricula. (Al-Fatli, 2020).

The importance of evaluation lies in its ability to achieve the educational goals that the educational system seeks to achieve, as the construction of modern curricula is based on continuous evaluation processes. The evaluation is based on supporting and developing the constructive process among students and developing it in a way that suits the requirements of the age, and the objectives of the evaluation lie in that it is a measurement tool to ensure the extent to which educational goals are achieved. (Al-Harbi and Ghaniyya, 271, 2022)

The evaluation processes of the curriculum are based on a set of sequential and organized procedural steps, and these steps depend on the success of the evaluation process and the achievement of its desired goals, and (Al-Duhaimi & Al-Hafaji, 2014) mentions these steps as follows:

1. Identify the aspects to be evaluated.
2. Determine the materials and tools that will be used in the evaluation.
3- Collecting information and data that facilitate the evaluation process.
4- Selecting qualified people to carry out the evaluation process.
4. Analyzing the data to obtain its images of the reality to be evaluated.
5- Analyzing and interpreting the results in the light of what the evaluation is built for.
6. They issued the corrective judgments for the situation that was corrected.
7. Making the necessary decisions for the events of changing or developing what has been evaluated.

The process of evaluating the biology curricula in the middle school for the purpose of developing it is a necessary and urgent process due to the objectives and nature of the topics of the biology subject. This subject represents the basic environment for acquiring and supporting scientific and life knowledge and

experiences, as well as seeking to develop and develop the cultural, social and scientific abilities and skills of students according to their various abilities, needs and tendencies.

One of the most important reasons for evaluating the biology curricula in the middle stage is what was mentioned by the experts of the Center for the Development of Curriculum and Educational Materials, 2012 as follows:

1- The huge amount of scientific knowledge: its cumulative nature and rapid and successive scientific discoveries, which calls for a continuous evaluation of the development of biology curricula in the light of these modern scientific discoveries.

2- The nature of changing science: Biology is one of the sciences that is characterized by a dynamic and changing nature rather than static, so the curriculum must be evaluated to keep pace with this nature and to be up to date with the latest developments.

3- Changing Labor Market Requirements: Curricula are subject to constant change, as the change in the requirements of the labor market occurs, so it is necessary to evaluate and develop the curricula of the middle stage in general and the biology curricula in particular to suit these changes.

4- Keeping pace with contemporary global changes, modern global trends and the ICT revolution, as they have a strong impact on various areas of life.

5- The biology curriculum seeks to meet the needs, interests and tendencies of students, and due to the continuous change in the needs, interests and tendencies of students, this curriculum must be developed to suit the new needs, interests and tendencies.

6- In response to the recommendations of modern scientific research and studies that called for the need to develop the biology curriculum in the light of contemporary scientific discoveries and modern trends.

Through the above, the researcher believes that the process of evaluating the biology curriculum for the third intermediate grade in Iraq in the light of the evaluation standards of the American Association for the Advancement of Science (AAAS) is an effective process in developing the curriculum according to the requirements of the times. This is done by focusing on the strengths, supporting and developing them, monitoring and treating the weaknesses, as well as directing the curriculum planners to build and design the curriculum in a way that suits the needs and tendencies of the students, and in a way that helps to develop their skills, support their abilities and develop their potential.

Second: AAAS Evaluation Standards.

At the beginning of the 1980s, a reform movement called the American Association for the Advancement of Science (AAAS) was established and sought to educate the American society and its members scientifically, and to develop science curricula and teaching methods, and to clarify what the student must understand and know about science, mathematics, and modern technology methods, in order to provide students with scientific culture various and multiple. (Mlheisen & Aaiton, 2016)

The American Association for the Advancement of Science (ASS) system consists of two bodies: the National Science Foundation (NSF) and the National Association of Science Teachers (NSTA). (Al-Wahr & Abu Al-Samman, 2017). The American Association's (2061) project, which it advocates, aims to increase the public's understanding of science and support and develop teaching and learning processes, as the (2061) project shows a number of habits of mind that science seeks to develop and support in students, which are defined in: (comprehensiveness and integration, diligence and perseverance, research and curiosity, inquiry and openness to all different things). New, knowledge-based skepticism and scientific evidence, critical thinking skills, creativity and imagination. (Al-Qishi & Khattabiya, 2020)

The American Association for the Advancement of Science (AAAS) has defined a set of standards for the advancement of science through the (2061) project. These standards have continued to be developed and updated, so the American Association for the Advancement of Science has identified the basic features of science culture, and support and development continued until the national standards for science education in the United States of America were defined. (Al-Wahr & Abu Al-Samman, 2017)

The benefits and advantages of the AAAS standards are numerous and varied, whether in curriculum development, in supporting students' skills, abilities, and potentials, or in supporting the education process as a whole. These benefits can be summarized as presented by (Al-Qishi & Khattabiya, 2020) and (Al-Wahr & Abu Al-Samman, 2017) as follows:

1. The standards set by the American Association for the Advancement of Science help students gain the skills they need in practice, such as higher mental habits and divergent thinking skills.

2- The standards set by the American Association for the Advancement of Science work to comprehend the student's information and enable him to deal with it, as it is a pattern of positive behaviors that motivate the student to build knowledge and discover information, not just memorize and recall it.

3- Raising life issues and questions related to aspects of students' lives to increase students' exposure to creative processes and increase the opportunity to generate ideas.

4. The standards set by the American Association for the Advancement of Science (AAAS) call for mental strategies to be followed before making decisions, and to investigate the facts raised by higher mental processes.

5- One of the important and basic criteria called for by the American Association for the Advancement of Science is to include habits of mind in the content of science curricula, and to make common

comparisons between science, mathematics and modern technology through the adoption of scientific culture.

6- These norms aid students to be preoccupied with profundity of comprehension, which enhances their knowledge, broadens their perceptions, and widens their skills, potentials, and capabilities. They also allow students to employ thinking tools and implement contemporary processes and strategies to overcome global predicaments and obstacles.

With the above in mind, the necessity of the standards established by the American Association to the Advancement of Science can be observed, along with their aptitude to provide an improvement in the achievement and comprehension and learning of science programs in general and biology curriculum, in particular. These standards also play a role in developing, maintaining, and enhancing the teaching and learning processes besides developing skills, abilities, and potentials in the students.

Consequently, the current research uses the AAAS assessment standards, i.e. the correspondence between major concepts and information, the nature of science literacy, accuracy, constructing an argument, and coherence of ideas, to assess the content of the biology textbook Human and Health, which is taught in the third intermediate level in the Republic of Iraq, against the standards.

Accordingly, the present study adopts the AAAS assessment standards—namely, the alignment between key ideas and content, the nature of science literacy, accuracy, constructing an argument, and coherence among ideas—to evaluate the content of the biology textbook *Human and Health* prescribed for the third intermediate grade in the Republic of Iraq in light of these standards.

Previous Studies on Effective Teaching Practices

1- Studies on the evaluation of the biology curriculum

Research that was concerned with the assessment of the biology curriculum. Abd Al-Amir and Dofar (2024) conducted a study which was designed to examine the content of Life Sciences courses through the prism of the sustainability development concepts. A descriptive-analytical methodology was used in the study, and the sample was comprised of the contents of 36 Life Sciences courses. The scientific instruments consisted of a list of the concepts of sustainable development and their dimensions.

The findings showed that the courses failed to cover some of the issues and concepts of sustainable development; that is, the Life Sciences courses failed to cover enough number of issues of development, and some of these issues were covered in few courses, and insignificantly. In the work by Dofar (2024), the authors decided to examine the first intermediate grade textbook on Biology based on the elements of scientific knowledge. It used descriptive-analytical approach with sample taken as textbook content. A list of scientific knowledge components was used as the study tools. These findings revealed that the textbook covered the elements of scientific knowledge of different degrees, and conceptual skills were the most frequent, then generalization skills, and factual skills which were above other skills.

The purpose of the research conducted by Al-Muzaini (2021) was to examine the content of high school biology textbooks in Saudi Arabia in the three grades in the context of the standards of the knowledge economy. The research was conducted in a descriptive approach to the study based on the use of content analysis. All three high school biology textbooks were used as the sample. The research instruments were a content analysis card according to the knowledge economy standards. Findings revealed 57 befitting knowledge economy standards that will be integrated into the textbooks, which are dispersed into 6 broad categories, which include readiness to learning and development, information and communication technology, development of research and thinking, life skills, development of creativity and innovation and activities and assessment.

The purpose of the research conducted by Al-Shahrani and Mahfouz (2020) was to assess the contents of middle school science curricula based on 21 st century skills. The research employed a descriptive method, and the sample of the research involved six units of the science textbooks of the middle school. The tools of the study were an analysis list founded on 21 st century skills. The findings showed that learning and creativity skills moderately existed in the curricula, digital literacy skills were not evident in the first and the second intermediate grades, and the life and career skills were not mentioned in the science curricula in the middle schools.

The article by Al-Shahri (2020) sought to assess the text content of high school biology textbooks in Saudi Arabia with regard to scientific miracle of the Quran and Sunnah. It was done descriptively-analytically, the sample being high school text books on biology. The tools of the study consisted of the list of the domains of scientific miracles in the Quran and the Sunnah and a content analysis card. The findings demonstrated the existence of all areas of scientific miracles at low levels within the high school biology curriculum. In their study, Samisam (2019) intended to study the content of fifth- and sixth-preparation grade biology textbook (science branch) in accordance with the dimensions of sustainable development. The research was done in the descriptive-analytical approach and the sample was the textbooks content, which was 417 pages.

The tools used in the research featured a list of dimensions of sustainable development that should be featured in the textbooks. The findings revealed that health, environmental, and technical/social impact dimensions were included in the fifth-grade textbook and the health, technical/social impact, and environmental dimensions were included in the sixth-grade textbook. Al-Sadiq (2018) study was

intended to assess the scientific material of the tenth-grade biology curriculum based on the global quality standards. The research was based on descriptive-analytical study and the population was the 10th grade biology textbook in Qatar.

These tools consisted of a content analysis tool and a list of world standards of quality. The findings revealed that the textbook was more focused on heredity and reproduction, whereas processes standards were few, and the study suggested the need to revise the textbook to incorporate processes standards. Al-Shammari (2012) attempted to determine the level of inclusion of biological innovations in middle school biology textbooks. The approach was descriptive-analytical and the sample was a set of textbooks in biology in middle school. The questionnaires consisted of a list of biological innovations.

The findings revealed that the textbooks lacked this aspect with the third intermediate grade text book Human and Health having the highest level of attention followed by the first and the second grade text books. The aim of the study by Haidar (2009) was to test the content of the secondary biology curriculum in Yemen comprising of life, earth and space sciences against the proposed standards based on the global standards. The research was based on a descriptive-analytic methodology, and the study sample was secondary school science textbooks. The research instruments contained a list of the international standards which ought to be featured in the biology curriculum. The findings revealed that the suggested standards existed in the existing curriculum at 71.56 percent and on this basis, the research suggested a new biology curriculum framework. .

2- Studies on the Evaluation Standards of the American Association for the Advancement of Science (AAAS).

Beljun (2024) undertook the study to investigate the level to which the second intermediate level Grade Science textbook in Saudi Arabia is based on the assessments standards of the American Association to Advance Science (AAAS), in addition to the suggestion of a system of integrating the standards into the textbook. The research also used a descriptive-analytical methodology and the sample used was: the second semester science textbook, Unit Six, thermal energy and waves.

The paper by Maseer (2023) was intended to assess the physics textbooks given during the preparatory level based on the American Association of Advancements in Science (AAAS) standards. The research methodology was the descriptive-analytical one. The sample of the study included physics textbooks to prepare stage such as the fourth scientific grade, the fifth scientific grade (applied branch) and the sixth scientific grade (applied branch). The research tools consisted of a content evaluation checklist containing the standards of AAAS. The finding was that the criterion of alignment between main ideas, objectives and content was the first followed by the accuracy criterion, then the criterion of building a scientific case, and the criterion of scientific literacy beyond culture and lastly the criterion of coherence among ideas. The research suggested that the adoption of AAAS standards was needed when assessing physics curriculum content.

The Al-Harbi and Ghunayyah (2022) study sought to assess the Physics 1 textbook of the first secondary grade in Saudi Arabia with regards to AAAS assessment standards. The method used in the study was the descriptive-analytical method. The sample of the study encompassed all the contents of the Physics (1) first grade textbook in the Kingdom of Saudi Arabia. The research tool was a content evaluation checklist according to the AAAS standards. It was found that the Physics 1 curriculum incorporated the criterion of alignment of main ideas (objectives) and content to a high extent, then the criterion of constructing a scientific case, then the criterion of scientific literacy beyond culture, and finally the criterion of coherence among ideas.

Al-Issa (2018) study was designed to review the textbooks on chemistry recommended in the tenth and eleventh grades in the State of Palestine and to facilitate the teaching process in accordance with the AAAS standards. The research took the descriptive-analytical research method. The sample used in the study was tenth and eleventh grade chemistry textbooks in Palestine. The checklist was an instrument of the study on the basis of the AAAS standards. The findings revealed that the overall ratings of the AAAS standards in the tenth-grade textbook were more than satisfactory and the chemistry textbooks in the eleventh grade were rated moderate.

Al-Wahr and Abu Al-Samen (2017) have conducted a study that studied the content of the chemistry textbook assigned to the ninth grade in Jordan in terms of the standards established by the AAAS. The methodology used was the descriptive-analytical approach to the study. The curriculum of the ninth grade chemistry was the study sample. The research measure was the AAAS criteria of assessment tool. The findings showed that assessment of the ninth-grade chemistry textbook was satisfactory. The strengths revealed in the textbook were compatibility of content with objectives, compatibility of experiences, activities, figures, drawings, and representations with objectives, coherence, and rational arrangement of thoughts, provision of purposeful learning experiences, assessment correspondence with objectives.

In a study by Lang and Cobern (2013), the purpose of the research was to assess the secondary-level life science textbooks in China based on the AAAS standards. The research took the descriptive methodology. The research sample was made of five life science textbooks. The AAAS textbook standards performance tool was used as a study instrument. The findings have indicated a lack of adequate number of standards in the textbooks, limited variety of phenomena of these standards and few controversial scientific issues that are debatable among the students.

Commenting on the Previous Studies

Having considered the previous research that aimed at assessing the biology curriculum, one can say that all the researches were united in their belief in the significance of the curriculum and its influence on shaping the skills, abilities, and potentials of students. Another commonality of most studies was the need to consider the biology curriculum in order to develop it comprehensively, add innovations that would address the modern needs, and predispose it to the scientific culture. Moreover, most of the literature found inadequacies in the curriculum and the need to curb them, which accounts to the need to assess the biology curriculum in order to attain educational goals and the global objectives.

Likewise, having read the studies that paid attention to the assessment standards of the American Association to the Advancement of Science (AAAS), one can say that they all agreed on the importance of the standards and the contribution they make to the improvement and richness of the science curricula, the enhancement of their efficiency and the increase in the skills, abilities, and potentials of the students through the activities they involve. The significance of assessing curricula, in general, and science curricula, in particular, based on AAAS standards to ease their development, was also accepted in most studies. Based on the suggestions and the conclusions of the former research, the present study reveals the necessity to consider the curriculum of biology in terms of AAAS assessment standards.

METHODOLOGY AND PROCEDURES OF THE RESEARCH

First: Methodology of the Research

The researcher used the descriptive-analytical method to answer the research questions, as it is defined as the method that follows the method of accurate and systematic iteration monitoring of the content of the method that was determined for research and study (Al-Assaf, 2006). The researcher chose this method as it suited the nature of the research and its objectives, which requires the use of the content analysis method. To evaluate the content of the biology curriculum in light of the American Association for the Advancement of Science (AAAS) assessment standards, the content evaluation method also refers to the scientific methods that test the objective objective of accurate quantitative and structured description of the content displayed by examining it carefully to classify and determine what it contains. (Fathalla, 2015, 137). The content analysis in this research seeks to identify and extract the apparent components included in the content of the biology curriculum and monitor their frequency ratios.

Second: The Research Community and its Sample

The research population and its sample consist of the biology curriculum decided by the Ministry of Education in the Republic of Iraq, which is represented in the biology textbook (Human and His Health) scheduled for the third intermediate grade, for the academic year 1446 AH / 2024 AD. The following table shows the number of chapters, lessons and pages, and the following percentages show the distribution of the size of chapters, lessons and pages from the total content of the book:

Table (1) shows the distribution of the biology curriculum for the third intermediate grade for the academic year 1446 AH / 2024 AD

Relative Weight	Number of Pages	Curriculum Content	Chapter
12.3%	20	Structural system	**Chapter One**
9.2%	15	Muscular system	**Chapter Two**
9.8%	16	Digestive system	**Chapter Three**
13.5%	22	Rotary device	**Chapter Four**
11.1%	18	Respiratory system	**Chapter Five**
8.6%	14	Directing	**Chapter Six**
8.6%	14	Reproductive system	**Chapter Seven**
6.1%	10	Nervous system	**Chapter Eight**
11.1%	18	Sense organs	**Chapter Nine**
3.7%	6	Release	**Chapter Ten**
5.5%	9	Immunity	**Chapter Eleven**

100%	162	**Total**

Third: Research Materials and Tools

In order to answer the research questions and achieve its objectives, the research tool was designed, and was represented in the content evaluation list in light of the criteria of the American Union for the Advancement of Science (Researcher Preparation). The research tool was prepared according to the following:

1) Define the purpose of the tool:

Evaluate the biology curriculum in light of the American Association for the Advancement of Science Assessment Standards.

2) Determine the criteria for the American Association for the Advancement of Science Calendar that must be included in the content of the biology curriculum.

These criteria were determined by reviewing the researchers' previous researches, studies and literature that were concerned with the criteria of the American Federation for the Advancement of Science in some foreign and Arab countries in general and in the Republic of Iraq in particular. The list included in its initial form (5) main criteria, and (8) sub-criteria were included under them, and the number of indicators indicating each criterion was (31) sub-indicators. Table (2) shows the number of major and sub-criteria of the American Association for the Advancement of Science Calendar and the indicators that indicate each criterion

Indicators	Sub-criteria	Key Criteria
12	3	**Alignment between Key Ideas and Content**
4	1	**Beyond Scientific Culture**
6	1	**Accuracy**
5	2	**Argument Concstruction**
4	1	**Coherence between ideas**
31	8	**Total**

3) Test the validity of the research tool

To verify the authenticity of the research tool, the researcher followed the following:

(a) The main and sub-criteria of the AAAS Assessment have been defined and accurately described for ease of analysis, and the sub-criteria for each major criterion are identified, and the following table illustrates:

Table 3 Explaining the description of the American Association for the Advancement of Science (AAAS) evaluation standards

Description	Sub-Criterion
First: Alignment between Key Ideas and Content	
This criterion refers to the harmony and alignment between the main ideas included in the educational objectives and each of the cognitive content, experiences, activities, skills, figures, illustrations, and modifications.	**1- Alignment of objectives with curriculum knowledge.** **2- Alignment of objectives with experiences, activities, and skills.** **3- Alignment of objectives with figures, illustrations, and modifications.**
Second: Beyond Scientific Literacy	
This criterion refers to the presence of extensive information regarding the lesson content and the educational objectives to be achieved by the end of the lesson, and how to achieve them.	**4- Availability of abundant information about achieving educational goals.**
Third: Accuracy	
This criterion refers to ensuring the scientific correctness of the knowledge and information presented, and not introducing concepts to students without verifying their validity.	**5- Scientific accuracy of the information presented to students.**
Fourth: Argument Construction	
This criterion refers to building opinions on clear evidence and sound logic to establish arguments, which indicates the clarity of ideas, their validity, and arranging them correctly in the students' minds.	**6- Reliance on clear evidence and proof.**

	7- Sequence and integrity of ideas.
Fifth: Coherence between Ideas	
This criterion refers to the clarity of links and connections between all the main and sub-ideas (new) and the previous ideas related to them.	**8- Presentation of the link between the new idea and the old idea related to it.**

B) Presenting the tool—in its initial form—to a number of referees specializing in Curricula and Methods of Teaching Biology. Their number reached (15) referees, in order to gather their opinions and guidance regarding the tool by: ensuring the validity of the tool, the sincerity of its statements, and the clarity of its meanings. Furthermore, ensuring the sound linguistic formulation of the tool's items, in addition to providing any guidance or suggestions the referees deemed necessary to enhance the scientific level of the tool. The arbitration resulted in the approval of the integrity and effectiveness of all the tool's items, as well as the suitability of the criteria for what they were designed to measure.

4. Reliability of the Research Instrument

The reliability of the research instrument which in this case was the content evaluation checklist was tested by the researcher through the evaluation criteria of the association of American Association to the Advancement of Science (AAAS). The curriculum that was available in the Republic of Iraq prescribed by the Ministry of Education on biology in the third intermediate grade was evaluated using this checklist. The issue of reliability was analyzed using a time interval of (35) days to repeat the instrument.

The reliability coefficient was calculated using the Holsti formula (Holsti):

$$\text{Reliability} = \frac{2 \times \text{Number of Agreements}}{\text{First Analysis} + \text{Second Analysis}} \times 100$$

The table below demonstrates the values of the reliability coefficient of the content evaluation checklist against the AAAS evaluation criteria.

Table (4) Reliability Coefficient Values of the Content Evaluation Checklist Based on the AAAS Evaluation Criteria

Practices	First Analysis	Second Analysis	Total of Both Analyses	Number of Repeated Items	Reliability Coefficient
Alignment between main ideas and content	179	175	354	174	98.3%
Beyond scientific literacy	241	240	481	235	97.7%
Accuracy	125	124	249	123	98.7%
Building an argument	281	282	563	280	99.4%
Coherence among ideas	183	181	364	179	98.3%
Overall Total	**1009**	**1002**	**2011**	**991**	**98.5%**

It is evident from the preceding table that the reliability coefficient of the content evaluation checklist based on the American Association for the Advancement of Science (AAAS) evaluation criteria reached **(98.5%)**, indicating a **high level of reliability** of the research instrument.

5) Final Form of the Research Instrument

The final form of the research instrument—represented by the content evaluation checklist based on the AAAS evaluation criteria—consisted of **five main criteria**, namely: alignment between main ideas and content, beyond scientific literacy, accuracy, building an argument, and coherence among ideas. These were subdivided into **eight sub-criteria**, and a total of **(31) indicators** were identified to represent these criteria.

6) Procedures for Evaluating the Content of the Biology Curriculum in Light of the AAAS Evaluation Criteria Using the Research Instrument

The researcher conducted a critical analytical reading of all chapters and topics of the biology curriculum represented in the textbook *Biology (Human and His Health)* prescribed for the third intermediate grade by the Ministry of Education in the Republic of Iraq for the academic year **1446 AH / 2024 AD**. Each chapter, lesson, and page was analyzed separately according to the previously defined indicators, which had been validated by specialized reviewers. Each paragraph was assigned a serial number starting from **(1)**. The total number of paragraphs in the biology textbook *Biology (Human and His Health)* prescribed for the third intermediate grade reached **(1002) paragraphs**.

RESULTS OF THE RESEARCH

Results Related to Answering the First Research Question

The first research question stated: *What are the AAAS evaluation criteria that should be included in the biology textbook for the third intermediate grade in the Republic of Iraq?*

To answer this question, the researcher reviewed relevant literature, research, and previous studies addressing the AAAS evaluation criteria. Based on this review, a list of criteria that should be included in the biology curriculum for the third intermediate grade in the Republic of Iraq was identified in light of the AAAS evaluation criteria. This list consisted of **five main criteria**, **eight sub-criteria**, and **thirty-one indicators** representing these criteria.

Table (5) Description of the AAAS Evaluation Criteria and Their Indicators
AAAS Evaluation Criteria for Science Advancement (Table Format)

Main Criterion	Sub-Criterion	Indicators
I. Alignment of Key Ideas with Content	1. Alignment of objectives with curriculum knowledge	1. Content includes information linked to all objectives, their classification, and methods for achieving them.2. Logical sequence of information related to objectives.3. Expansion of ideas without repetition.4. Exclusion of unnecessary or redundant ideas.5. Logical progression of knowledge and information.
	2. Alignment of objectives with experiences, activities, and skills	6. Presence of activities, skills, and experiences for each objective.7. Each activity is preceded by an introductory description.8. Allowing students to conduct investigations and similar activities.9. Presentation of questions related to each activity.10. Concluding the topic with enrichment activities.
	3. Alignment of objectives with visuals, diagrams, and representations	11. Inclusion of a sufficient number of visuals, diagrams, and representations.12. Relevance of visuals, diagrams, and representations to the lesson topic and objectives.
II. Beyond Scientific Literacy	4. Availability of ample information to achieve educational objectives	13. Educational content adheres to intended objectives.14. Concepts and terminology are clearly formulated.15. Activities are presented in a familiar and easy manner for students.16. Allowing students to perform various cognitive processes.
III. Accuracy	5. Scientific accuracy of information presented to students	17. Presentation of knowledge accurately and comprehensively with clear visuals and images.18. Correctness of linguistic expressions.19. Clarity of knowledge and information and their relevance to content.20. Correction and treatment of incorrect information.21. Helping students form correct knowledge.22. Curriculum keeps pace with scientific and technological advances in society.
IV. Argument Construction	6. Reliance on clear evidence and proofs	23. Presenting various evidence supporting the idea.24. Presenting real-life examples supporting the idea.
	7. Logical sequence and integrity of ideas	25. Logical organization of ideas.26. Consistency and integrity of scientific arguments.
V. Coherence of Ideas	8. Showing the connection between new ideas and related previous ideas	28. Presenting ideas in a way that shows the interconnection of scientific material.29. Presenting comparisons and tables of similarities and differences.30. Using methods to prevent students' attention from dispersing.31. Linking previous experiences to current experiences to clarify ideas.

Results for Research Question Two, which stated: *To what extent does the content of the 9th-grade Biology textbook in the Republic of Iraq comply with the AAAS Science Advancement Evaluation Criteria?*

To answer this question, the researcher analyzed the content of the 9th-grade Biology textbook in Iraq using the previously prepared research instrument. This analysis aimed to identify the number of AAAS evaluation criteria and their indicators included in the textbook content. The following table illustrates the results:

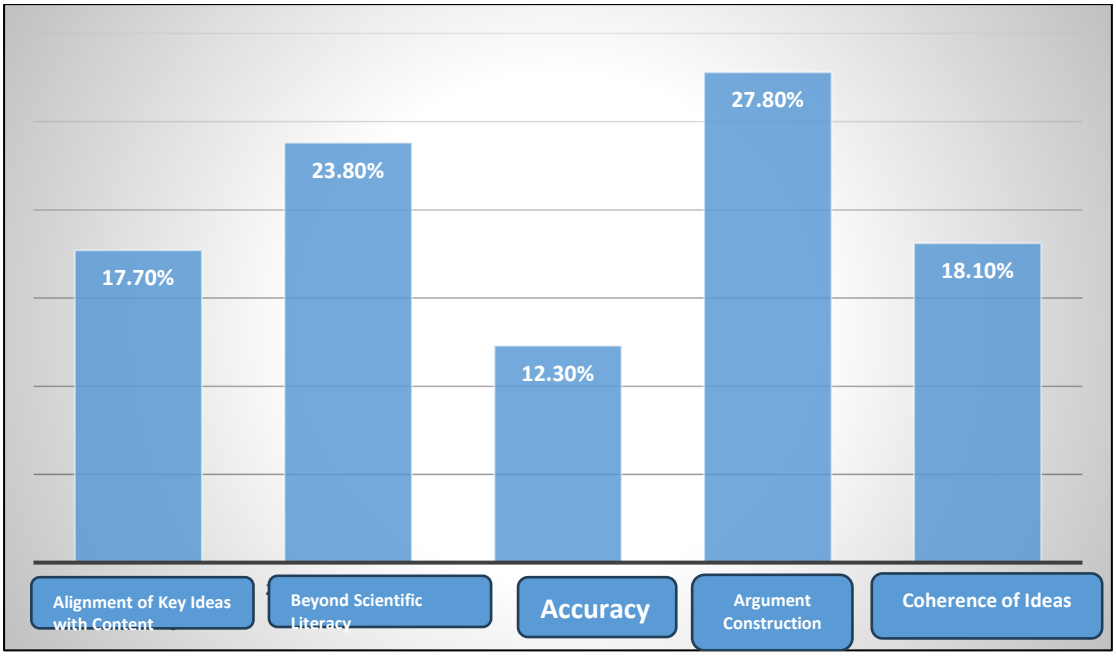
Table (6) Evaluation of the 9th-Grade Biology Textbook Content in the Republic of Iraq in Light of the AAAS Science Advancement Evaluation Criteria

Sub-Criterion	Indicator	Frequency	Percentage
I. Alignment of Key Ideas with Content	**Alignment of objectives with curriculum knowledge**		
	1- Content includes information linked to all objectives, their classification, and how to achieve them.	18	1.7%
	2- Logical sequence of information related to objectives.	20	1.9%
	3- Expansion of ideas without repetition.	15	1.4%
	4- Exclusion of unnecessary or redundant ideas.	11	1%
	5- Logical progression of knowledge and information.	11	1%
Alignment of objectives with experiences, activities, and skills	6- Presence of activities, skills, and experiences for each objective.	12	1.1%
	7- Each activity is preceded by an introductory description.	11	1%
	8- Allowing students to conduct investigations and similar activities.	11	1%
	9- Presentation of questions related to each activity.	17	1.6%
	10- Concluding the topic with enrichment activities.	18	1.7%
Alignment of objectives with visuals, diagrams, and representations	11- Inclusion of a sufficient number of visuals, diagrams, and representations.	15	1.4%
	12- Relevance of visuals, diagrams, and representations to the lesson topic and objectives.	20	1.9%
Total for Alignment of Key Ideas with Content		179	17.7%
II. Beyond Scientific Literacy			
Availability of ample information to achieve educational objectives	13- Educational content adheres to intended objectives.	55	5.4%
	14- Concepts and terminology are easily formulated.	56	5.5%
	15- Activities are presented in a familiar and easy manner for students.	78	7.7%
	16- Allowing students to perform various cognitive processes.	52	5.1%
Total for Beyond Scientific Literacy		241	23.8%
III. Accuracy			
Scientific accuracy of information presented to students			
	17- Presentation of knowledge accurately and comprehensively with clear visuals and images.	20	1.9%
	18- Correctness of linguistic expressions.	15	1.4%
	19- Clarity of knowledge and information and their relevance to content.	30	2.9%
	20- Correction and treatment of incorrect information.	11	1%
	21- Helping students form correct knowledge.	19	1.8%

	22- Curriculum keeps pace with scientific and technological advances in society.		30	2.9%	
Total for Accuracy			125	12.3%	
IV. Argument Construction					
Reliance on clear evidence and proofs					
	23- Presenting various evidence supporting the idea.		70	6.9%	
	24- Presenting real-life examples supporting the idea.		55	5.4%	
Logical sequence and integrity of ideas	25- Presenting ideas in an easy-to-follow sequence.		88	8.7%	
	26- Providing definitions for each new concept.		34	3.3%	
	27- Presenting ideas clearly and simply.		34	3.3%	
Total for Argument Construction			281	27.8%	
V. Coherence of Ideas					
Showing the connection between new ideas and related previous ideas					
	28- Presenting ideas in a way that shows the interconnection of scientific material.		50	4.9%	
	29- Presenting comparisons and tables of similarities and differences.		73	7.2%	
	30- Using methods to prevent students' attention from dispersing.		30	2.9%	
	31- Linking previous experiences to current experiences to clarify ideas.		30	2.9%	
Total for Coherence of Ideas			183	18.1%	
Overall Total for All Criteria			1009	100%	

What stands out in the above table is that the criterion of the Argument Construction is at the top of the percentage of all the AAAS evaluation criteria that exist within the 9 th -grade Biology textbook in the Republic of Iraq and is at the top percentage of 27.8. Beyond Scientific Literacy criterion comes second with 23.8 percent and Coherence of Ideas is positioned at number three with 18.1 percent. The fourth criterion is the Alignment of Key Ideas with Content with a score of 17.7, and lastly the criterion is the Accuracy with 12.3. These findings show that the Argument Construction criterion is the most attended in educational institutions of Iraq because of its critical value and the need to incorporate it into the Biology curriculum. Conversely, the Accuracy criterion is least followed which implies it is not so focused and not given so much coverage in the material in the 9th-grade book of Biology.

Figure (1) Evaluation of the 9th Grade Biology Textbook Content in the Republic of Iraq in Light of the AAAS Science Advancement Evaluation Criteria



These findings are consistent with the past researches that have identified the relevance of incorporating AAAS Science Advancement evaluation criteria in content of science courses in general and science textbooks in particular, as a result of their great importance in enriching, supporting, and developing of curriculum in accordance with the needs of students. Some of these studies are: Baljun (2024), Maseer (2023), Al-Harbi and Ghani (2022), Al-Essi (2018), Al-Wahr and Abu Al-Samman (2017), and Lang and Cobern (2013).

They also coincide with the literature that stresses the necessity of the constant assessment and construction of Biology curricula as it is very important in the life of a student. Such examples are: Abdul Ameer and Dafar (2024), Dafar (2024), Al-Muzaini (2021), Al-Shahrani and Mahfouz (2020), Al-Shahri (2020), Smeism (2019), Al-Sadiq (2018), and Haider (2009).

Research Recommendations:

1. Highlight the importance of AAAS evaluation criteria in the process of enhancing the educational process in general and Biology curricula in particular.
2. Offer enlists the most valuable AAAS evaluation criteria and include them in professional development programs on the Biology teachers.
3. Prepare an activity, skills and science experiment guide according to the evaluation criteria of AAAS.
4. Implement successfully AAAS standards throughout the Biology curriculum.
5. Design curriculum in 9th grade Biology in Iraq using AAAS assessment standards.
6. Improve the awareness of teachers about the necessity to adhere to AAAS standards in the process of the preparation and delivery of Biology lessons.
7. Apply the AAAS requirements in every curriculum and learning level. 8. Pay more attention to 9th grade students in Iraq and make sure that they are taught by the most qualified Biology teachers.

Research Suggestions:

1. Efficacy of AAAS-based classrooms in building laboratory skills of 9th -grade students in Iraq.
2. Knowledge of AAS evaluation criteria by teacher and curriculum planners.
3. Effects of a training program grounded on AAAS criteria on the development of the skills of science teachers.
4. Performance of Biology teachers using AAAS guidelines in cultivating profound knowledge in high school students in Iraq.
5. Addition of AAAS criteria to the enhancement of the performance of the biology teachers in Iraq in their perspective.
6. Scientific analysis of textbooks on science in Iraq based on AAAS standards of evaluation.
7. Assessment of the Biology syllabus in Iraq based on the consideration of the needs of the teachers.

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