A CRITICAL EVALUATION
OF AN ELEVENTH GRADE
BIOLOGY TEXTBOOK

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TABLE OF CONTENTS

LIST OF TABLES .................................................................................. iv

ABSTRACT .......................................................................................... v

CHAPTER

1. INTRODUCTION TO THE STUDY .................................................... 1

   Introduction ..................................................................................... 1
   Educational Change in Saudi Arabia ................................................. 2
   Curriculum Process in Saudi Arabia ............................................... 4
   Statement of the Problem ............................................................... 5
   Purpose of the Study .................................................................... 5
   Organization of the Study .............................................................. 5
   Limitations of the Study ................................................................. 6
   Definition of Terms ...................................................................... 7

2. REVIEW OF THE LITERATURE ....................................................... 8

   Introduction ..................................................................................... 8
   Educational System of Saudi Arabia .............................................. 8
   Introduction of Practical Experiments in Saudi Education .......... 9
   Textbook Selection Process ......................................................... 11
   Reform Efforts in Saudi Arabia .................................................... 13
   Role of Textbooks in Education .................................................. 15
   Criteria of Good Textbooks ......................................................... 16
   Instruments for Evaluating Textbooks ....................................... 22

3. METHODOLOGY ........................................................................... 25

   Introduction ..................................................................................... 25
   Target Textbook Under Review .................................................. 26
LIST OF TABLES

PAGE

1. Evaluation Results ........................................................................................................... 41

A1. Evaluation Tool............................................................................................................. 51
ABSTRACT

The study evaluates the effectiveness of a biology textbook for 11th grade students in Saudi Arabia. The main objective of the study was to evaluate the adequacy of biology textbook resources used in schools, and how they facilitate learning. An evaluation criterion recommended by the National Center for Science Education was used to evaluate the textbook’s effectiveness. Another evaluation approach used is a comparison of the Saudi Arabian textbook with a biology textbook published in the United States. The criteria adopted in checking for coherence includes: simplicity, grammar and vocabulary, illustrations/visual, relevance, scientific facts, comprehensiveness of content, reliability of the content, consistency with goals of Islam, and potential interest to students. Based on the findings, the biology textbook meets the criteria recommended approximately 85% of the time. Recommendations are provided on how to improve the quality of the textbook to make it more effective for learners.
CHAPTER 1

INTRODUCTION TO THE STUDY

Introduction

The basis for modern education and for new innovation is still in development in Saudi Arabia, with more encouraged training for teachers. The study focuses on evaluating the effectiveness of biology textbook in teaching and learning. The textbook is expected to match the religious values and cultural sensitivity of Saudi Arabians. At the same time, many types of science curriculum follow the Aims, Content, Method, and Evaluation (ACME) model, which is explained in the following:

1. The aims of the science curriculum are to provide students with science-related learning experience to develop their scientific knowledge and be able to participate effectively in their rapid change-based society.

2. The content of any curriculum is referred to as a set of definitions, concepts, relationships, facts, laws, theories, skills, values, and trends that constitute the learning material in student’s textbook at any academic stage. The content is, usually selected and organized according to specific scientific criteria that achieve the curriculum aims.

3. Teaching methods are the modern concept of teaching methods indicates the inclusion of all means, procedures, activities and assessment tools that the teacher prepares to achieve the educational aims inside and outside the classroom.

4. Evaluation is described as a two-dimensional process. The first dimension is limited and targets judging the curriculum structure represented in its scientific and educational content only. It tries to determine the quality and consistency of this content, its ability to achieve the goals and then to modify its weakness points.
5. Dimension is more comprehensive and tries to diagnose and treat all curriculum aspects and elements starting from the plan towards objectives, content, teaching methods, educational activities and evaluation through the implementation process. (Alhomairi, 2018, p. 71)

Educational Change in Saudi Arabia

It is stated that globalization in itself has provided influence on the Saudi Arabian educational system (Alyami, 2014), but this is only up to a certain level. Even with growing diversity and with more innovations being introduced to teaching as time goes by, the culture of Saudi Arabia is still respected within all classrooms, along with the beliefs of Islam. History classes must adhere to the beliefs of Islam and the context of the Saudi identity, and it is implied strongly that the area of science must be approached this way as well (Rabaah, Doaa, & Asma, 2016). The religious views of the country also support the belief of having exclusion in campuses. Males and females, especially in secondary school, are put into separate campuses and are not in the same class. It does not follow the same co-educational model as many other cultures do. As mandated by the Ministry of Education, the levels of learning are as follows: “[children] are required to attend 6 years of primary, 3 years of intermediate and 3 years of secondary schooling in order to complete their education” (Alyami, 2014, p. 1516).

As of late, the Saudi Arabian government has wanted to introduce new advancement and more courses in technology for its students; according to Rabaah, Doaa, and Asma (2016), “It also makes attempts to change teaching methods, introduce modern technology, reduce rote [repetitive] learning, and encourage analytical thinking” (p. 3). These kinds of concepts can be applicable to providing
more lessons and projects in a secondary biology classroom. Even recently, the Saudi Arabian government has a national campaign called Vision for 2030, wanting to continually improve on science curriculum and providing more opportunities, which can help students transition from school to workplace when it comes to learning more about technology (Alhomairi, 2018). As outlined by the Ministry of Education concerning this new vision, the following goals have been given:

1. Provide education opportunities for all in appropriate learning atmospheres.
2. Enhance the quality of education outcomes.
3. Increase the effectiveness of the scientific research.
4. Encourage creativity and innovation.
5. Develop partnership with the community.
6. Improve the capabilities and skills of education personnel.
7. Bridge the gap between the outcomes of higher education and the requirements of the labor market.
8. Develop public education and guide students towards the appropriate professional options.
9. Provide students with rehabilitation opportunities and flexibility in mobility between different educational tracks. (Alhomairi, 2018, p. 69-70)

As seen in these goals, creativity, innovation, modern teaching along with more globalization influence have become important to education. However, when it comes to making new science curriculum, specifically in biology, educators must keep in mind in that there must be cultural sensitivity still towards the religious values and views of Saudi Arabian society.
Curriculum Process in Saudi Arabia

The focus of this study has to do with teaching biology in a Saudi Arabian class, but in order to understand the research, knowledge of the Saudi Arabian school system must be known. While there are private schools that have tuition and meant for expatriates in the country among other students, the public-school system is the top system, and is free for all Saudi Arabian citizens. The Ministry of Education oversees both the private and public-school systems in all of the country. Private schools do offer some customized education and have many English-speaking teachers, but is still overseen by the Ministry of Education. Therefore, all curriculums taught to students must be approved by the government.

There has been a concern about disorganized teaching and lack of modern teaching methods on the part of teachers. For example, this may mean that a traditional method—such as only memorizing vocabulary but not applying to real-life—was used instead of using more innovative methods and projects. Because of this, there has been some reform wanted in the Saudi Arabian educational system. Starting in 2011, the Ministry of Education made a criterion that would strictly look at the performance of teachers. As stated by Alnahdi (2014), “The new strategy that will put 80% of the weight of evaluating teachers’ performance on their students’ performance on standardized tests. The results from this process of evaluating teachers will determine who deserves incentives for their outstanding performance. This evaluation of performance has put a lot of pressure on teachers to enhance their teaching skills” (p. 3).
Statement of the Problem

Textbooks play an important role in the learning of students. For countries such as Saudi Arabia, finding a textbook that is appropriate for students is a challenge because of issue of quality of resources. This study will review a textbook used for second-grade (second year) high school students. The study will look at the criteria for a high-quality textbook for teenage students in Saudi Arabia. It will then analyze the textbook approved by the Ministry of Education to see if it meets these guidelines.

Purpose of the Study

The thesis will explore at two important questions: What are the characteristics of biology textbooks in the context of Saudi Arabian society in comparison to the United States’ National Science Education Standards? To what degree does the biology textbook meet this criterion? The first question is explored in the beginning chapters. The second question is the focus of the investigation. The two questions go hand-in-hand and will be defined and discussed further in the study.

Organization of the Study

The second chapter of this study will look at the criteria that are taken into consideration for a book to be considered a textbook in Saudi Arabia. The next chapter will report the procedures used to analyze the textbook. The fourth chapter will discuss the results of the analysis of the textbook based on the criteria from the previous chapter. The final chapter will conclude the research with possible recommendations on improving the criteria.
Limitations of the Study

There are a few limitations of this study. Firstly, there is a cultural limitation that can affect the research. Many articles that have to do with biology and higher education lean towards more of the United States educational system, which has differences from the Saudi Arabian educational system. While the area of science is wide and international science education has many concepts in common, the cultural views of science may be different due to history and religion of the area.

Secondly, as stated above, there is a great deal of research, including recent studies, about biology education in the United States, but far less for biology-related education in Saudi Arabia. Because of this, it is difficult to find literature that relates to Saudi Arabia alone, especially when it comes to science and the content of textbooks. There is some research and literature, however, in countries where there may some political or cultural similarities to Saudi Arabia, but only relevant parts of research are taken.

There are also no clear criteria for biology textbooks, and while there are some criteria that have basic parts in common, there is no set standard, especially internationally, so the research is not as narrow (Akçay, 2016). Because of this, some literature is older than five years old and was developed several years ago. However, because of the basic information, it is still relevant today. Thus, there is a constraint on the research due to lack of information and literature.
Definition of Terms

Ministry of Education: department of the Saudi Arabian government that oversees both private and public schools, especially public schools where education is free for students of all levels. Provides goals, planning, criteria, and specific curriculum.

Intermediate School: middle school in Saudi Arabia, which is for three years and is usually from ages 13-16.

Secondary School: high school in Saudi Arabia, which is for three years and is usually from ages 17-19.
CHAPTER 2

REVIEW OF THE LITERATURE

Introduction

The purpose of this literature review is to look at secondary research that explores the topic in-depth. Before proceeding into the general definition of an educational textbook, the context of the Saudi Arabian educational system must be understood. This paper will start with a thorough discussion of the educational system of Saudi Arabia and what reform efforts have been taken recently. Then, the various criteria of good textbooks will be discussed, which can be useful for selecting books for the classrooms. Some of the identified criteria are, illustrations, scientific facts, ease of understanding, et cetera.

Educational System of Saudi Arabia

While there are private schools that have tuition and meant for expatriates in the country among other students, the public-school system is the largest system, and is free for all Saudi Arabian citizens. The Ministry of Education oversees both the private and public-school systems in all of the country. Private schools do offer some customized education and have many English-speaking teachers, but is still overseen by the Ministry of Education. Therefore, curriculum as given to students must still be approved of by the government. The education system in Saudi Arabia is highly structured. However, some of its methods and modules are outdated and need reform activities.
It is expressed that globalization had a significant effect on the Saudi Arabian instructive framework (Alyami, 2014). Indeed, even with the modern development of inclusiveness and with more advancements being acquainted with educating as time passes by, there is a noteworthy accentuation that the ways of life of Saudi Arabia are alien in the classroom. History classes must hold fast to the convictions of Islam and the setting of the Saudi character, and it is suggested unequivocally that the zone of science must be moved toward along these lines, too (Rabaah et al., 2016). The religious perspectives of the nation additionally bolster the conviction of having prohibition in grounds. Males and females, particularly in secondary school, are put into isolated grounds and are not in a similar class. In this sense, the instructive framework does not take after a similar co-curriculum model the same number of different societies do.

Introduction of Practical Experiments in Saudi Education

Hands on experiment sessions are recently being introduced to the classes. The purpose of having of such activities is to help students develop their critical thinking skills. This helps create meaningful learning, which is defined as “directly related to students’ ability to establish and integrate new and relevant existing knowledge” (Akçay, 2016, p. 1841). This definition applies quite well to high school biology, for the knowledge being learned in the higher-grade levels already uses lessons and concepts being taught at earlier grade levels, but combining them with new complex lessons and new projects. When it comes to the experimental content of
biology textbooks, the following criteria for this type of practice has been outlined as such:

- Observing the world around them and formulating a question
- Formulating a hypothesis about what the answer could be
- Gathering information about the incident from textbooks
- Conducting experiments
- Proving or disproving the hypothesis and answering the question

The criteria above imply the teacher leads discussion and before having the students come up with their own views, measuring those views and participation in class. The steps being seen in these criteria can bring on more meaningful learning for high school students. One type of meaningful learning exercise that helps bring on more biology evaluation is the use of analogy. An analogy, in general, is the comparison of one or two objects and/or functions; it does not need to use two comparisons directly from science, and it can borrow ideas from both biology and the outside world. According to Akçay (2016), “Teachers find some specific analogies both efficient and useful. Examples of analogies used by teachers include the car analogy, which explains the importance of a balanced and healthy diet, and the genetic cookbook analogy, which explains DNA” (p. 1841). Analogies help students explore concepts and helps them memorize them within their lessons, for cars and cookbooks are objects that many of them see in their lives. This helps them understand and break down the different parts of their lessons. The discussions can begin with the teacher instructing the analogy and taking it from questions and brainstorming activities as listed in the book, with the students beginning to answer and come up with their own views of the analogy. The analogy then becomes
independent to them; the lesson can finish with students making a cookbook model in order to show a symbol for a DNA lesson, or have them put together other visual models/analogy as relating to lessons in bacteria.

In recent years, it has been observed that meaningful learning in biology—even with textbooks administered by the Ministry of Education—have not encouraged that much experimental activities. In Saudi Arabia, but as of 2016, this kind of education is shifting towards more discovery in science classrooms. There is even more encouragement for Saudi Arabian science teachers, with the intention to [provide] opportunities for students to practice the scientific ideas and to make those ideas their own” and “to help students to develop the knowledge, skills, and attitude that will enable them to understand what it means to ‘do science’ and participate in a larger scientific community, not only practicing the steps of the fixed ‘scientific method’” (Alabdulkareem, 2016, p. 244). More recent Saudi Arabian biology textbooks appear to be adopting more of this.

Textbook Selection Process

The textbook selection process in Saudi Arabia is gradually improving. Before, the texts used were outdated and gave the students almost no relevant or practical knowledge about the subject. However, more recently, the criteria for good textbooks are being followed. The textbooks need to be able to engage the students as per their age, while being scientifically accurate. Poorly researched textbooks do not find a place in Saudi Arabia’s educational curriculum. This helps in providing the students with the most modern and relevant information.
As stated earlier, it is the Ministry of Education that controls the curriculum of all of Saudi Arabia. Therefore, textbooks that are being taught in the educational system must be approved by the Ministry. The curriculum goes through four committees, including experts, specialists and professors from universities, and that the selection of participants are in accordance with strict controls (Okaz, 2011).

It is not enough for textbooks to be filled with information that is useful for classroom applications and as tools that can be used for “real-life,” such as in looking for careers; all textbooks must align with Saudi Arabian society, culture, and the religion of Islam. One of the original missions that still stands today with the Ministry of Education was posted in 1970:

The purpose of education includes the idea that the Islamic belief is planted and spread from Saudi Arabia, and that students are raised with Muslim values, teachings and ideals. The students are equipped with skills and knowledge which allow them to contribute beneficially to the development of Saudi Arabian society economically, socially and culturally, having been fully prepared to become a useful member in the building of his community.

(BinObaid, 2015, p. 232)

This kind of concept is applied in all areas of education and in all types of subjects, ranging from English as a foreign language and to biology. Therefore, while textbooks have updated facts and photos telling more information and showing more ways for students to learn, it must be still have values as shown in Saudi Arabian culture and religion, and be taught through this type of perspective. It should ultimately teach students to become productive people and to also serve society.

Textbooks that do not respect the nation’s culture, society, and especially religion
would not be allowed in schools. Therefore, a general textbook that is secular and
does not reflect the nation’s values would not be accepted, even if uses the latest
technology and updated facts.

Reform Efforts in Saudi Arabia

It is safe to believe that biology textbooks will change and spread in Saudi
Arabia in the next few years. This is because Saudi Arabia has its own “Vision for
2030” in its development of schools, with all of its schools being led by the Ministry
of Education (Alhomairi, 2018). Changes are to be gradually undertaken by this year,
with goals in place for an overhaul in education, especially science. It is implied that
there will be more openness and more progress in the accepting of scientific
advancements. The Vision for 2030 has clear goals and an approach that wants to
innovate more in education. In this type of framework, it is said that there are three
elements of school science curriculum: “mainly, the scientific facts and concepts (the
content); science nature and processes (the behavior or process); and science
applications in society (the context)” (Alhomairi, 2018, p. 71).

Past research in biology textbooks has shown that in the early 2000s,
“students’ realities or life were not related to the concepts covered in the textbooks or
that students’ background knowledge” were not related to the content, and they were
not even encouraged to do research (Çobanoğlu, Şahin, & Karakayaa, 2009, p. 2505),
but this type of fact no longer applies to what a textbook should be, for a Saudi
Arabian textbook should be applicable to outside life and background knowledge. As
such, these parts of science curriculum must be available in a biology textbook, and
the criteria mentioned above fits into the three parts of the model.
Thus, for being accepted as textbook for school children, being comprehensible and engaging is a main criterion. Being comprehensible can include having understandable language and activities that are appropriate for the grade level, not too advanced (such as college-level) and not too focused on prerequisites (such as elementary-level) (AAAS Project 2061 Textbook Evaluations, 2005). In addition to benchmarks, these were the listed indicators that the criterion is working in the classroom:

1. The material alerts the teacher to specific prerequisite ideas or skills (versus stating only prerequisite topics or terms).
2. The material alerts teachers to specific ideas for which the prerequisites are needed.
3. The material alerts students to prerequisite ideas or experiences that are being assumed.
4. The material adequately addresses (provides instructional support for) prerequisites in the same units or in earlier units (in the same or other grades).
5. The material makes adequate connections (provides instructional support for connections) between ideas treated in a particular unit and their prerequisites (even if the prerequisites are addressed elsewhere). (AAAS Project 2061 Textbook Evaluations, 2005)

There are currently two books per year being used in Saudi Arabian schools, on a basis of one book per semester. The biology textbook is published by King Fahad national Library in 2017. The current book is 266 pages and covers fish and amphibians, reptiles and birds, structural and musculoskeletal system, nervous system, reproduction and growth in humans, human physiology and immune system.

The textbooks that are to be selected for any particular year are evaluated by a few methods like impressionistic, check-list, and in-depth method. A combination of one or more methods can be used for the evaluation of textbooks. However, it is
regularly seen that books usually do not contain a reference to Saudi culture and society.

Role of Textbooks in Education

The role of textbooks does not have one single definition since there are so many subjects, but there is one overall purpose that helps give an idea of the role it plays in education:

In general, the purpose of a textbook is a printed volume, structured in order to assist in a learning process, with the purpose of improving its efficiency. The textbook has the following characteristics: performs different functions associated with learning, serves to achieving some objectives, suggests different types of activities, likely to support the learning process. (Gerard, 2010, as cited in Pop-Păcurar & Ciascai, 2010, p. 1)

The purposes and traits of a biology textbook are more defined. Biology textbooks should have the adequate number of illustrations to explain the matter at hand and grasp the students’ attention, and it should also be appropriate for the purpose of the classroom and project-based study. High quality illustrations are visuals that help students’ picture what the book is teaching, looking at charts, diagrams, photos and layouts; parts of the human body, parts of plants, and parts of animals are examples, along with labels to go along with them.

Scientific experiments are projects that can usually take place in the classroom with the teacher as a guide, and students can work together in order to find out if their hypotheses come true or if the outcome of a physical science project turns out how they thought it would be. Scientific facts are those that the students are to learn and to
remember, taking numbers and statistics from research and showing proven evidence, for science is fact- and evidence-based.

Overall, because of the three characteristics listed above, it is important to see the evidence and the discussion behind it as written by other educators and researchers. The past literature will show the underlying theories and methods behind them and show the level of validity, and how it can apply to biology textbooks in today’s world.

Criteria of Good Textbooks

Coherence

According to the 2005 version of the Advancing Science Serving Society (AAAS), Project 2061 of the United States, effective biology textbooks should meet a specific criterion. The AAAS project 2061 presents certain criteria that textbooks should conform to, which provides a basis for evaluating effectiveness of Saudi Arabian biology textbooks.

According to the AAAS Project 2061 Textbook Evaluation, 2005 the purpose of a science textbook is to make sure that it is comprehensible to learners. Another primary purpose of the textbook is that it should be interesting and motivating to learners. Again, students according to AAAS Project 2061, students should be presented with an opportunity to discuss and think about the problem. Also, learners are expected to be conversant and consistent with the stipulated purpose and the ones that are not are deemed or considered as digressions. The benchmarks would enable students to form problem-solving skills and encourage them to think independently.
Scientific Facts

According to Irez (2016), one of the main objectives of science education is to promote scientific literacy, which also means understanding the “nature of scientific knowledge” (NOSK). There must be an important understanding of the difference of scientific knowledge, for it may not be accepted by all societies and all communities. One example would be a group that believes in Creationism while another group believes in Evolution when it comes to the beginning of the earth. Likewise, the framework of scientific knowledge and facts must be applicable to the society and beliefs of Saudi Arabian culture when it comes to having a biology textbook in that area (Alhomairi, 2018). Because of this, it is emphasized that NOSK is what makes a student literate in science, not just the concepts and beliefs of science itself. NOSK includes knowing the process of understanding and how many findings have come to conclusions. Instead of just a focus on facts, the true focus is on finding out how that accepted fact came to be, and what kind of exploration went into it. The process of teaching NOSK, even in a textbook, includes these steps being taught:

1. Scientific knowledge has a basis in empirical evidence.
2. Empirical evidence is collected and interpreted based on current scientific perspectives as well as personal subjectivity due to scientists’ values, knowledge and prior experiences.
3. Scientific knowledge is the product of human imagination and creativity.
4. The direction and products of scientific investigations are influenced by the society and culture in which the science is conducted. (Schwartz & Lederman, 2002, as cited in Irez, 2016, p. 196)

It is important, however, that scientific facts and concepts that are taught in biology textbooks can be applicable not only to the classroom but also in the student’s own life outside of it. For instance, it is stated that too many scientific textbooks focus
more on content and vocabulary than on facts, and what students can do about these facts and knowledge (Calado et al., 2015). According to Calado et al., one way to think about facts within a textbook is to consider how they develop a deeper understanding of the relationship among science, technology, society, and environment (STSE). The authors argue that facts within a written curriculum should fit within the lens of STSE issues to be useful in students’ lives, especially on the emphasis on technology and society. It is believed that getting more knowledge about STSE helps students contribute more to their society and be more active in the workplace (Calado et al., 2015).

Calado et al. (2015) go further, suggesting that scientific facts in biology textbooks are not just seen as trivia to be learned and remembered by students as vocabulary; they should be put into practice. The authors (2015) state,

A STSE curriculum should foster the ability to make decisions about science-related social and environmental issues, according to our view, five aspects may counteract a student’s misunderstanding of the relationship between science and technology in this context: specification of concrete legislation, awareness that decisions differ according to their social context, personification of decision agents, and awareness of the fact that common citizens may influence decisions. This misunderstanding may lead to the misconception that environmental degradation only is caused by science. Therefore, textbooks should also enable students to learn about making choices and participating in political decisions. (p. 267)

Therefore, facts are not just facts to be memorized even though it is encouraged that knowledge within a biology textbook is updated as much as possible (Pop-Păcurar &
Ciascai, 2010). Even if knowledge is updated, it is accepted that science facts can change and evolve over time with new discoveries. For now, science facts are “basic knowledge that everyone accepts” and if theories are scientifically accepted by everyone, they end up becoming laws (Irez, 2016, p. 202), but students must be able to explore them, use them in critical thinking and try to understand them.

Illustrations/Visuals

The illustrations inside of a textbook are very integral for a student’s learning and are just as important as the content listed inside of the book. In Romanian biology textbooks, for instance, Pop-Păcurar & Ciascai (2010) list illustrations as one of the main criteria for a high-quality text; they state the criteria includes that “(1) the presence of an illustration is justified, (2) the illustrations have numbers and captions, and (3) they are clear” (p. 3). This kind of criteria is universal and can apply to any textbook.

In the United States, illustrations in biology textbooks have become increasingly common over time. For example, in the 1950s, 52% American college textbooks did not have any illustrations whatsoever, but in the 1980s, only 22% of American college textbooks had no illustrations as the use of photos tripled (Blystone, 1989).

Illustrations can make books look appealing and attractive to the eyes, but they are so much more than just visuals; illustrations can also be used as a tool for learning. Even before the internet and before people used smartphones, at least 85% of the messages people received were visual (Blystone, 1989). According to Blystone (1989), research has shown that illustrations can be used for cognitive learning.
Student can look at charts, observe diagrams, and other types of visuals that create a deeper understanding of the text.

Illustrations can also be used for modeling. Whether it is done at home as homework or a group project in the classroom, students can create various models by using crafts, learning more about the parts of the biology illustrations as they put the pieces together. This type of learning is beneficial because:

Each step taken by a student in building the model reveals that student’s understanding of the process. The student can be challenged as to why the model was manipulated in the way that it was. Model-building with complex textbook illustrations is an excellent way to pace a student’s learning.

(Blystone, 1989)

Drawing from evaluations of biology textbook, critical evaluation criteria like illustration emerge. Textbook illustrations, for example, can apply to the complexity of cells within the human body. Even if some illustrations are more complex than others, it is still important that they are understandable, are labeled within the textbook, and can be applied to the lessons.

Relevance. A good biology textbook should communicate information relevant to the topic and the level of students. Facts and examples presented should be relevant to the topics and match the interests of the target audience.

Simplicity. The simplicity of a textbook is mostly equated to the language used. The language should match the level of students targeted for to promote clear understanding.
Grammar and Vocabulary. Grammar and vocabulary should be accurate and easy to interpret. Using appropriate grammar makes reading and conceptualization of content much easier for students.

Logical Arrangement in Subjects. Subjects should appear from the simplest to the most complex. Again, topics should be arranged depending on the level of complexity. Simple concepts should be placed at the beginning of the book, and more advanced topics towards the end.

Assessment Questions at the End of Each Chapter. Evaluating students understanding of every topic discussed in a textbook helps sharpen the learners’ knowledge and improve their performance. Assessment questions should be made available at the end of every topic.

An Index at the Back of the Book. An index is a directional feature that helps locate specific subjects easily. Indexes make navigation of the within the textbook easier.

A Table of Contents at the Beginning of the Textbook. A table of contents provides a brief summary to the readers about what is covered in the textbook. It helps readers note if all the topics they may be interested in are included. This helps save readers’ time and effort.

Cover the Curriculum Requirement. Every high school textbook should cover all the required topics as par the standards and curriculum requirements. Full and adequate coverage of the curriculum enhances effective learning and teaching in schools.
Content Should be Comprehensive. Every high school textbook should cover the interest and needs of students. Extensive coverage and presentation of detailed information enhance students understanding of complex concepts.

Textbook is Appropriate for the Level of Students Targeted: The appropriateness of a textbook is measured by how much it matches the interests of the target readers.

Accuracy of Content. The question of accuracy answers the question how correct is the content presented? Information in any given textbook should be as complete and accurate as possible.

Currency and Reliability of Content. Textbooks should be as current as possible. This enhances relevance in teaching and makes students be acquainted with recent issues and trends in science.

Students’ Interests: Textbooks should integrate ideologies and questions that most students may most likely be interested in. This enhances students’ interest towards a particular resource that meets their information requirements or needs.

Consistency of the Content with Islam: This is basically providing information that is user centered. The nature and characteristics of the target group for textbook resources should be captured to facilitate usage. A biology textbook meant for Saudi Arabian students should integrate Islam beliefs and customs to make the audience relate more with the content and facilitate learning.

Instruments for Evaluating Textbooks

The previously mentioned AAAS Project 2061 (2005) included additional criteria that are relevant. They provide guidelines not only on what type of content a
biology textbook should have, but also guidelines on how it should build a connection between the teacher and the student. It is even listing that it gives a review of the past curriculum in the past grades for students, building upon the knowledge and lessons they have already learned and using the information to teach them new concepts in their current grade level. This appears to depend also on the classroom, the lessons they learned in classes before, and how the teacher handles the material. How the teacher instructs the students is all up to the teacher and can consist of methods such as explicit teaching and modeling the work, but the textbook must still be used as a tool to do so, not a means to an end. The materials in the above criteria can include the scientific facts and the illustrations as discussed earlier, being used to stimulate students and encourage curiosity beyond learning.

**Modern and Relevant Facts**

The scientific facts stated in the book must be accurate and proven. Additionally, for laboratory experiments and other such procedures, the methodology suggested should be up to date. As the schools have all the modern equipment available, this should be a great learning opportunity for all the students. Also, there should be consistency throughout the book and opposing facts should not be stated.

**Simple Language**

The language level in the books should be simple enough so that even struggling readers can understand it. Essentially, it should be in the reading level of the grade that is supposed to study it. If the students have difficulty in understanding the language itself, they will not be able to take in the knowledge properly. However, it is expected that some high-level language is used for the higher-class textbooks.
Relevancy

Books should use such facts and examples that the students routinely observe in their socio-cultural environment. This way, students would be able to relate more easily with the books and be more engaged in learning. However, if such examples are socially and culturally distance as per the Saudi Arabian society goes, the students will feel distanced and confused as they will not be able to grasp the nuances.
CHAPTER 3

METHODOLOGY

Introduction

The research is aimed at evaluating the effectiveness of the biology curriculum taught in Saudi Arabian high schools by reviewing the textbooks used by students and teachers to facilitate learning. The evaluation was performed based on the National Science Education Standards of textbook requirements in the United States. The reason for using American standards is to gain more efficiency in evaluation given that the education system in the United States is one of the most advanced globally. The main objective is to evaluate: 1) the adequacy of the textbook resources available in Saudi Arabia, 2) how they might facilitate learning and teaching, 3) their usefulness in promoting the application of learned concepts, 4) the reliability of the information given the facts and concepts presented, 5) the consistency and comprehensiveness of the content, and 6) generally the text’s suitability and readability for high school students. In order to test or evaluate biology textbooks used in Saudi Arabia, a comparison was made with a biology textbook used in the United States. A biology textbook by Miller and Levine was used in comparison with Saudi Arabia Textbooks. The ministry of education in Saudi Arabia is a department within the government system that is in charge of monitoring and managing education activities in both private and public schools in the state (Asghar, Hameed, & Farahani, 2014). The ministry provides educational goals, curriculum, and criteria to be followed in teaching and learning in all schools and at all levels.
Target Textbook Under Review

The Biology textbook for 11th grade learners in Saudi Arabia used by teachers and students in high school is the main instrument under review. In order to improve biology instructions provided in high school, it is essential to analyze the role of biology textbooks used in schools. Questions on how the textbook should be designed, selected and used are some of the main concerns of the study. The idea for conducting biology textbook review is to find out the weaknesses and strengths of the book which indicates the strength of biology curriculum in Saudi Arabia.

Miller and Levine Biology Textbook

Miller and Levine biology textbook is used in the United States to teach high school students. It is authored by Miller and Levine who are recognized for creating relevant information content in the field of biology. The book is written for high school students with additional reading support embedded in the book making biology easier for all students with different learning capabilities.

Research Design

A comparative study design was used to assess the quality and effectiveness of the biology textbook used in Saudi Arabian and American high schools. The United States is recognized as one of the nations that has fully evolved and developed education system. Most textbooks published in the United States meant for educational uses in high schools are required conform to various instructional and visual standards of the National Science Education. The percentage of conformance
is measured by evaluating the rate of effectiveness of the resources used in high schools to teach biology in Saudi Arabia.

The level of adherence to the expected national standards for teaching science will help discover if the education system is adequate. Textbooks used in schools reflect the level of learning and teaching in those particular schools. Generally, the level of education discovered or applied in schools indicates the entire learning or education level of the whole country. This is because all education ministries govern learning throughout the whole nation regardless of whether it is a public or private school. The main aim of having this form of governance is to facilitate fairness and giving all students equal learning opportunities. Therefore, carrying out a quantitative analysis of the curriculum covered in high school biology textbooks would help discover the effectiveness of education as far as science is concerned. Quantitative analysis was done or involved checking the rate of conformance of the biology textbook against the National Science Education Standards of the United States to determine level of adherence.

The quantitative approach will mainly help answer the question to what percentage is a biology textbook in Saudi Arabia effective for giving instructions and learning at high school level. The study used a detailed approach to carry out an empirical inquiry systematically to derive sense and obtain reliable information (Katrin, 2015). This design uses an interpretive method to analyze the information presented. This approach is the most effective method for gathering problem-solving information. It provides extensive details relevant for making informed judgments. The hypothesis aimed at being analyzed answers the question if the textbook adheres to the required characteristics of a biology textbook according to the standards of the
National Science Education Standards. The study also attempts to address the certain issues about the textbook like simplicity, grammar and vocabulary, modern realistic facts, and visual effectiveness.

**Target Population**

The study is about the effectiveness of biology textbooks in teaching and learning. Various concepts are taught and covered in every biology book and there are expectations placed on the quality and level of instruction bound in every topic or chapter in biology textbooks. There are various chapters discussed in biology textbooks including cells, nature of life, ecology, genetics, microorganisms, evolution, animals, and human body.

**Sample Population**

In this thesis, the researcher performed a thorough review and critical evaluation of a specific chapter (the sample population), Chapter 6 of the Saudi Arabian textbook with Unit 8 of Miller’s American biology textbook. The researcher selected these chapters to investigate the relevant features and characteristics present in the book. The chapter covers the topic human physiology which is the study of biochemical, physical, mechanical functions that take place in human body. Human physiology forms part of the critical foundation of modern world medicine. The subject provides a framework for learning how the body of humans adapts to diseases, physical activity and stress. The main reason for picking this chapter is that there is a wide coverage of concepts discussed under various subheadings, the images and
illustrations needed to give students a mental picture of the theories taught or communicated by the textbook.

Data Collection Methods

Data collection forms the basis of any research through provision of facts and details that support the study. An elaborate process must be used in order to facilitate efficient and systematic collection of data. Data collection instrument used to gather information for the study is called the Observation Guide.

Data Collection Sequence

This is the sequence that was followed for the collection and tabulation of data:

- Review the sections of the Biology Textbook from Saudi Arabia and the Miller and Levine biology textbook using the criteria in Table 1 (see appendix).
- Identify the issue or problem under evaluation is the first step of data collection. The actual issue under evaluation is the rate of effectiveness of the biology textbook used in Saudi Arabia.
- Select a biology textbook used in the United States. The book chosen is the Miller and Levine biology textbook.
- Observe the features and characteristics of Miller and Levine biology textbook based on the United States National Science Education Standards.
- Compare the features and characteristics of Chapter 6 of Saudi Arabian biology textbook against Unit 8 of Miller’s textbook.
- Analyze the simplicity, modern realistic facts, grammar and vocabulary and visual effectiveness of Chapter 6 and Unit 8 of the two textbooks under review.
• Take note of the critical points observed.

• Use the criteria to write up a comparative evaluation of the two texts.

Observation

Observation of the textual format and content quality of the book was done. An observation guide was used to direct the observation exercise to maintain the researcher’s focus. The observation exercise was carried by analyzing various features and characteristics of the two biology textbooks. The research critically analyzed the textbooks used to teach biology in the United States and Saudi Arabia by looking at the visual effectiveness, language use, vocabulary, simplicity, content organization and modern relevant facts.

Observing the language used in the textbooks, font size and the appearance of the book helps detail the suitability of the book. Illustrations and pictures are significant in any science book, and biology is no exception. They facilitate more profound understanding and capture the attention of high school students. Modern learning methods have to be incorporated in the book and checking its currency would be one way to analyze if up to date concepts are presented in the book.

Data Analysis Procedures

Data analysis is a process of evaluating, arranging and presenting data for decision making. Various activities are featured in this section including, sorting, organizing, focusing and discarding data from the textbook chapter. Data were then combined based on the themes of the research and presented for analysis and interpretation.
Data collected was analyzed based on the criteria selected for this study. The criteria used to evaluate biology textbooks in Saudi Arabian schools were used to assess the features of Biology textbook by Miller and Levine used in the United States. Chapter 6 of the biology textbook was selected that discusses human physiology. The same chapter or topic was analyzed in the selected American textbook to obtain relevant comparison details as far as the coverage of the problem is concerned.
CHAPTER 4

ANALYSIS AND RESULTS

Introduction

To properly discuss the results obtained from the data collected is very important to first analyze the qualities of a good biology textbook for high school students as recommended by the national science education standards. Textbooks are mainly designed for students' understanding and are supposed to cultivate a scientific mentality and attitude within all students (BouJaoude, 2018). A textbook should be as good as the teacher and should be in a position to replace lessons carried out in the classroom. That means students should be presented with textbooks that fit or suit their understanding in order to boost self-directed learning. A science textbook generally should target to promote a clear understanding of theories, enhance open-mindedness and develop a sense of appreciation among students. Qualities of a good biology textbook revolve around the following aspects: organization, content, illustrations, appearance and mechanical makeup, authorship, and content.

Scientific Facts

The content represented in biology textbooks is based on proven facts, theories, and ideologies (Yang & Liu, 2016). The material should be as practical as possible because biology studies are not based on illusions. Content is a broad concept that covers the entire make of the book including texts and images. The language used to convey information should be very simple for high school students. Students tend to be turned off or shun away from materials with complex languages because it takes
them a lot of time and effort to comprehend what the book is talking about or is
discussing. Again, the information presented should be direct to the point and not
ambiguous. The concepts presented in the two textbooks under review are clearly
demonstrated in the images describing how digestion takes place and the parts of
human body involved in digestion. The topics are precise, and the language used is
simple for any high school student to comprehend.

For example, in the Saudi Arabian textbook the topic on blood system is
discussed indicating major points that students should understand. For example,
arteries are said to circulate blood from the ventricles to other parts of the body under
high pressure. Miller’s textbook also discusses the concept of blood system by
making similar remarks. Images of the heart pumping blood in the ventricles to the
arteries give a pictorial representation of what happens in the body making the
information presented applicable and factual.

Grammar and Vocabulary

The vocabulary and grammar used in any textbook should be accurate and
convenient for the target level of students. It would be inappropriate to have students
reading books and referring to dictionaries for words they cannot understand, which
makes learning tedious and complicated for them. Again, chances of remembering
what they have learned would be meager. Similarly, it is impractical to use grammar
and vocabulary at a lower level than the target level of the audience. There are high
chances that the book will be ranked as ineffective or annoying to read. The two
textbooks both the Saudi Arabian and American biology textbook indicate evidence
of appropriate use of grammar and vocabulary through a textual analysis carried out.
Vocabulary and literary styles used in developing a book all rely on the ease of readability for students (Katrin, 2015). The sentences should not be long that students lose focus of the point made in the sentence. The sentences should be as precise and direct to the point as possible. Every single sentence should communicate a single idea. It is also important to use lead paragraphs or sentences. The ideas presented in every sentence should be relevant to the topic discussed. Short precise sentences and topic sentences are used to convey a specific idea in both the books under review. Based on analysis of the two books under review, Miller’s textbook has a complex language, in terms of grammar and vocabulary, compared to the Saudi Arabian book.

Simplicity

The simplicity of content and teaching instructions should be encompassed in the biology textbook. Every biology textbook used at specific levels in high schools should be appropriate for that particular class or level (Morris et al., 2015). The topics covered in the textbook should be the ones that a specific group of students can handle according to given the reading levels and age of students. The examples used in the textbook should be simple or easy to relate with and understand. The language should be in line with the customs and standards of the country. Saudi Arabia uses Arabic and English to teach and learn in schools. The two biology books from both countries are written in simple language for students to learn since it’s a language they are familiar with.

Short notes at the end of each topic are attached to clarify concepts that may be subject to other forms of evaluation. The notes also describe the illustration diagrams used to explain concepts making it simple for students to learn.
Relevance of Content

Relevance of content is very critical in the communication of content in a textbook (Watts et al., 2016). To begin with, there are various subjects that each biology textbook of any particular level should cover. All biology textbooks should adequately contain all the required topics and subheadings depending on the level of audience targeted. A psychological order or sequence should be used to organize subjects or topics. This is because some topics cannot be taught before others because they rely on prior knowledge obtained in the previous subject.

Illustrations/Visuels

Illustrations used in biology textbook are crucial in enhancing learning and more profound understanding (Watts et al., 2016). The textbooks under review from both countries are effectively illustrated using pictures that demonstrate various topics discussed. The photographs are captured in the textbooks, and the diagrams made very attractive to capture the attention of students. The color used in the diagrams has an appealing effect which adds value to teaching and learning. The two biology textbooks analyzed demonstrated creative images of human organs that demonstrate digestion and absorption in Chapter 6 of the Saudi Arabian textbook and Chapter 8 in Miller and Levine’s textbook.

The results fully indicate that the biology textbook in Saudi Arabia fully conforms to the acceptable guidelines for all science resources. The textbook is properly organized in terms of chapters. The chapters are arranged in a logical and systematic order including all heading and subheadings.
The visual appeal of the book is perfectly on point, the font color and size used in writing the book used in Saudi Arabia is fully legible and conformable for the eyes. Illustration and diagrams used based on Chapter 6 of the textbook are sufficient and well labeled facilitating natural interpretation. The grammar and vocabulary used in the textbook are convenient for high school students. Generally speaking, the Saudi Arabian biology textbook meets all expected criteria for science standards. It is reflective of the improvement in educational and learning levels in the nation.

Logical Arrangement in Subjects

Content should appear from the simplest to the most complex. Again, topics should be arranged depending on the level of complexity. Simple concepts should be placed at the beginning of the book, and more advanced topics like human physiology should be placed towards the end like the way the biology textbook of Saudi Arabia treated the subject by placing it in Chapter 6. Some of the topic discussed includes digestion and absorption, the blood system, and defense against infection.

In Miller’s textbook, the subject discussed in Unit 8, the textbook discusses the human body under which topics like digestion and excretion, nervous system, skeletal, integumentary and muscular systems, respiratory and circulation system, reproductive and endocrine system, and finally diseases and the immune system.

The two chapters from the textbooks show some distinctive features in terms of organization of topics discussed in the specific subject of human physiology.
Assessment Questions

Assessment questions should be placed at the end of each topic to exercise the minds of the students. Students should be able to answer questions that help improve their understanding of the subject taught.

In Miller’s textbook, each topic begins with questions that students need to ask themselves when tackling and reading the topic. In Saudi Arabian textbook the questions are placed at the end of the textbook to challenge students to recap what they have learned by answering the questions.

An Index in the Back of the Book

An index is a directional feature that helps students find specific subjects easily. Indexes make navigation of the within the textbook simple. The topics discussed in each chapter are indexed and given a notation that helps in location of both books.

A Table of Contents

A table of contents provides readers with a glimpse of what is covered in the textbook. It helps readers note if all the topics they may be interested in are included. This helps save readers’ time and effort. A logical arrangement of all the chapters and topics discussed in each chapter is presented at the beginning of Miller’s biology textbook and Saudi Arabian textbook.
Cover the Curriculum Requirements

Every high school textbook should cover all the required topics as per the standards and curriculum requirements. Full and adequate coverage of the curriculum enhances effective learning and teaching in schools. Miller’s textbook on Chapter 8 discusses more topics compared to Saudi Arabian textbook on the same subject of human physiology.

Content is Comprehensive

Every high school textbook should cover the interest and needs of students. Extensive coverage and presentation of detailed information enhance students understanding of complex concepts. The books present information logically based on student’s understanding on how the concepts relate to each other. For example, in the Saudi Arabian and Miller’s textbook all topics under human physiology including diseases and infection, blood system, digestion and absorption that pertain to the chapter area all discussed.

Content is Current and Reliable

Biology textbooks should be as up to date as possible. Continuous changes in technology that enable modifications of certain scientific concepts should be incorporated in teaching and learning textbooks. Biology textbooks should also incorporate future trends that are supposed or expected to be incorporated in the field. The two textbooks have not indicated any elements of modern technologies especially in the specific chapter of human physiology being reviewed. The subject discusses
human body and its processes without any incorporation of technology or future trends.

Content is Consistent with Islam

Effective learning requires that the cultures of the target group be indicated or captured in the textbook presentation. This aspect makes information more relatable and interesting for the students and even teachers. One of the ways that culture can be captured in textbooks is by incorporating examples and themes that observe the religion and believes of the audience. The content and pieces of information presented in the two textbooks do not highlight or show any indications of religion or culture integrated in the examples or language used.

Content is Accurate

Accuracy of information is based on how correct the information presented is. The facts, theories and concepts presented should not only be complete but correct. Science textbooks present biological functions happening in animals and plants. The content on Chapter 6 in Saudi Arabian textbook and Unit 8 of Miller’s biology textbook presents similar concepts with similar explanations or meaning. For example, in the blood system topic both books acknowledge that blood flows from the ventricles to the arteries.
Student Interests

To promote and enhance independent learning, students’ questions have to be addressed and conceptualized. Most young people are fascinated by certain issues in life and biology is one of them.

Students are mostly interested in biology because human body and its operation present mystical and unexplainable issues that stimulate their curiosity. For example, students mostly search the internet to try and understand how they could still swallow food with their heads upside down. Students are surprised to find out that gravity forces do not play any role in their bodies. The topic on human digestion on both books explains how food reaches the stomach through contraction of the muscles in the esophagus. An illustration of the digestive system from the mouth to the anus is presented showing how food leaves the mouth all the way to the stomach and out of the body through the anus. The muscles within the gullet are visible in the picture, which allow food to move to the stomach through their contraction and relaxation process. The biology textbook used for 11th grade students seems to capture the interest of the students making it effective.

Textbook is Appropriate

Based on the analysis conducted in terms of scientific functions, accuracy of content and curriculum coverage clearly shows that the textbook meets the requirements of high school students. The complexity of language in terms of grammar and vocabulary clearly shows that the language suits the level of students.
Table 1

Evaluation Results

<table>
<thead>
<tr>
<th>Factors Considered</th>
<th>Fully Evident</th>
<th>Almost All</th>
<th>Mostly Evident</th>
<th>Partially Evident</th>
<th>No Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simplicity</td>
<td>There are notes that further explain concepts at the end of topics</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grammar and Vocabulary</td>
<td>Language is convenient for the level of student</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Illustrations/visuals</td>
<td>Well-labeled pictures are present</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relevance</td>
<td>Topics available are necessary for 11th grade student</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scientific Facts</td>
<td>Information matches the content communicated in Miller’s textbook</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Content is Comprehensive</td>
<td>Has fewer topics than U.S. textbook (Miller &amp; Levine textbook)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Content is current and reliable</td>
<td>No references mentioned to determine the reliable and up-to-date nature of the text</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Content is consistent with Islam</td>
<td>No indications noted</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Table Continued</td>
<td></td>
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<tr>
<td>-----------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Logical arrangement of content</td>
<td>Properly organized headings and subheadings but slightly different from Miller’s presentation of content</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Table of contents at the beginning of the textbook</td>
<td>Presence of table of contents within the preliminary pages</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Covers curriculum requirement</td>
<td>Fair coverage of the curriculum with fewer topics compared to US textbook (Miller &amp; Levine)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Index</td>
<td>Available in the auxiliary pages</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accuracy</td>
<td>Content is correct in comparison to US textbook</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Textbook is appropriate for the level of students</td>
<td>Language, relevance and curriculum matches requirements for 11th grade students</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student interests</td>
<td>Content is interesting and possible questions of students are answered</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assessment questions at the end of each chapter</td>
<td>Questions available at the end of every chapter</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

Introduction

Biology textbooks used in high schools are meant to teach basic components and enhance the development of scientific minds. Saudi Arabia is working towards incorporating modern innovation and education in their system. Learning in schools is influenced by teaching methods and textbooks used. The research aimed to explore the condition and state of the biology textbooks in high schools.

There have been issues raised about the lack of organized teaching methods and inadequate modern approaches to learning and teaching in Saudi Arabia. This entirely means that traditional teaching and learning approaches were used instead of adoption of current teaching instructions that entail the use of innovative projects and methods. Improved textbooks are part of the effort to improve teaching methods. So, Saudi Arabia has implemented strategies to uplift their level of education by using recommended textbooks and carrying out performance evaluation of teachers based on the content of the textbooks.

The study focused on the effectiveness of biology textbooks used in Saudi Arabia to teach in high schools. A comparison between a textbook used in Saudi Arabia and a biology textbook used in the United States by Miller and Levine was used to carry out the analysis. Qualities of science textbooks according to the National Science education standards was also used to analyze the adherence level of the biology textbooks used in Saudi Arabia.
Comparison and evaluations done during data analysis presented indications that were used to detect the effectiveness and quality of the textbooks. The Saudi Arabian biology textbook was found to be suitable in terms of scientific facts, relevance, simplicity, illustrations/visual efficiency, grammar, and vocabulary. Textbook features like logical arrangement of content, index, table of content, currency of content, comprehensive coverage of content and curriculum are discussed as part of the important features that should be evaluated when selecting an effective science textbook.

The logical arrangement of topics in Saudi Arabian textbook was rather different with the Miller’s textbook. Miller’s textbook presented a wide coverage of the curriculum in comparison to the number of topics discussed in Saudi Arabian textbook. There are no indications that the Saudi Arabian textbook is consistent with Islam. Based on the evidence gathered from the analysis of the criteria and comparison of the biology textbook in Saudi Arabia and Miller’s textbook, it can be concluded that the textbook meets approximately 85% of the requirements.

Recommendations

The development of education standards has been gradual. Continuous review of the textbooks should be done to foster full evolution. This attempt would raise learning levels of the state to be at par with other nations like the United States. All students globally including in Saudi Arabia are given a level learning ground to compete and even integrate with each other.
Developing textbook resources that reflect on the interests and curiosities of students regarding biological functions happening in their lives would help enhance effectiveness of science biology textbooks. Biology is made interesting based on how much is understood and solved in terms of human curiosity of the body activities especially in digestion and reproduction.

Incorporation of modern technologies for learning and teaching science subjects would help enhance self-directed learning and differentiated instructions. Using technologies such as YouTube and videos that demonstrate digestion and respiration on human body would help support clear understanding. It is easier for the memory to remember video presentations watched in class compared to remembering theories taught in class. This makes textbook information presented more effective and realistic to students.

Encouraging students to answer questions at the end of chapters as a group to foster exchange of ideas and widen knowledge basis in biology among students. This enhances deep evaluation of content made available in the textbooks.

Future research should include an observational analysis of the student interaction with the textbooks and a process survey of the students to determine which parts of the textbook are helpful for the student and which parts are confusing. While this textbook seems to be an improvement on the previous versions, it is clear that continuous evaluation of the textbook in real-life classroom settings will be essential to the improvement of science education in Saudi Arabia.
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REFERENCES

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APPENDIX

EVALUATION TOOL

The table presents basic textbook evaluation features that indicate whether the book is suitable for use or not. Areas such as content organization, subject coverage and accuracy of information are assessed. The table is used to check the effectiveness of biology textbooks as per the expectations of science standards.

Table A1

*Evaluation Tool*

<table>
<thead>
<tr>
<th>Features</th>
<th>Fully evident</th>
<th>Almost all evident</th>
<th>Mostly evident</th>
<th>Partially evident</th>
<th>Not evident</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simplicity</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Grammar and vocabulary</td>
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<td>Illustrations/ visual</td>
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<tr>
<td>Relevance</td>
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<tr>
<td>Scientific facts</td>
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<tr>
<td>Content is</td>
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<tr>
<td>comprehensive</td>
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<tr>
<td>Content is current</td>
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<tr>
<td>and reliable</td>
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</tbody>
</table>
Table Continued

| Content is consistent with Islam | Logical arrangement of content |
| Table of contents at the beginning of the textbook | Covers curriculum requirement |
| Index | Accuracy |
| Textbook is appropriate for the level of students | Student Interests |
| Assessment questions at the end of each chapter |