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ANALYSIS OF CYCLE 2 SCIENCE TEXTBOOKS REPRESENTATION OF SCIENTIFIC LITERACY AND READABILITY LEVEL

Aisha Abdulla Salem Al Qaydi

This thesis is submitted in partial fulfillment of the requirements for the degree of Master of Education (Curriculum and Instruction)

Under the Supervision of Dr. Hassan Hamad Tairab

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Declaration of Original Work

I, Aisha Abdulla Salem Al Qaydi, the undersigned, a graduate student at the United Arab Emirates University (UAEU), and the author of this thesis entitled *"Analysis of Cycle 2 Science Textbooks Representation of Scientific Literacy and Readability Level"*, hereby, solemnly declare that this thesis is an original research work that has been done and prepared by me under the supervision of Dr. Hassan Hamad Tairab, in the College of Education at UAEU. This work has not been previously formed as the basis for the award of any academic degree, diploma or a similar title at this or any other university. The materials borrowed from other sources and included in my thesis have been properly cited and acknowledged.

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Abstract

For over half a century, textbooks have played a decisive role in teaching and learning activities. In today's classrooms, textbooks serve as primary teaching instruments and greatly influence how knowledge is delivered and communicated. With the development of the society, a majority of teachers use textbooks to guide their instruction. On the other hand, readability of textbooks is an important construct for both educators and textbook authors. Finding the right fit between the students' reading ability and the text difficulty is an important and challenging task for teachers.

This study is about how scientific content is presented and represented in Cycle 2 science textbooks of Abu Dhabi Education Council (ADEC) schools. The purposes of this study are therefore to identify the aspects of Scientific Literacy (themes) that are emphasized by the science textbooks used in Grades (6 - 9) and to identify the readability level of these science textbooks.

Two types of samples and sampling procedures were involved in the present study. The first sample was that the textbooks of Science *Focus for the United Arab Emirates* (Student version), 2nd edition by Whalley, Phillips, Monckton, Roberson, Mayers, Brown, and Naville (2009) were the focus textbooks of this study to be analyzed and the second sample pertains to 200 students drawn purposely from two of Al-Ain Cycle 2 government schools covering grades 6, 7, 8, and 9 during the 2013/ 2014 academic year. The textbooks were selected for their content and readability analyses whereas the students were selected to identify their actual reading ability.

The framework used to examine the aspects of the Scientific Literacy presents science as (a) a body of knowledge, (b) a way of investigating, (c) a way of thinking, and (d) an interaction with technology and society (STS). The readability of the science textbooks was determined by using two instruments namely the Flesch-Kincaid Grade Level Readability Formula and the Fry Graph. The actual reading ability of the involved student was determined by the Cloze Test.

The findings showed that while high percentages of content coverage were based on a theme of science as a body of knowledge across all grades, there was a tendency of less representation of this theme as we move up the grades (from grade 6 to grade 9). However, the overall results suggested that the representation of the themes were not really balanced. Science as a way of knowing, as investigative activities, and as interaction with science, technology was all neglected in these textbooks. Findings related to the readability analyses suggested that there was a mismatch between textbooks intended reading levels and the student actual reading levels, indicating that all the textbooks are somewhat complex and far above the reading ability levels of the intended readers. Grades 6, 7, and 8 textbooks showed the highest mismatch as high as two grades level above the actual intended reading level. The findings also indicated that Grade 9 textbook was slightly difficult for the students by one age level higher.

These findings were discussed in the context of science education research with particular emphasis on how science teachers may use textbooks to lessen their impact in regard to views about Scientific Literacy and readability characteristics.

Specific recommendations were that authors and teachers had the responsibility to balance the content in terms of the themes describing the Scientific

Literacy and improve the level of readability of science textbooks. Furthermore, science teachers can play a major role in improving students' reading abilities by using different teaching strategies.

Based on the findings that emerged from the present study, specific suggestions for future research were presented. Studies related to how science teachers conceptualize Scientific Literacy might produce findings that may encounter the imbalance representation of Scientific Literacy themes in these textbooks. Studies on how teachers can explicitly highlight the nexus among science, technology and society would lead to, a realization that science is more than simply the scientific knowledge. Furthermore, investigate the influence of textual difficulty in science textbooks on the students of different levels of reading achievement. Examine the differences of reading ability with regard to students' gender across the same topics of the science textbooks.

Keywords: Scientific Literacy, Readability, Student reading level, Readability assessment, UAE Science textbooks, Cycle 2.

Title and Abstract (in Arabic)

تحليل مستوى تمثيل المعرفة العلمية وإنقرائية كتب العلوم للحلقة الثانية

الملخص

لأكثر من نصف قرن، لعبت الكتب الدراسية دورًا حاسماً في أنشطة التعليم والتعلم. كما تعد الأدوات التعليمية الأولية في الفصول الدراسية الحالية، والتي لها تأثيراً كبيراً في كيفية توصيل المعرفة وإبلاغها. ومع تطور المجتمع، فإن غالبية المعلمين يستخدمون الكتب الدراسية لتوجيه العملية التعليمية. ومن ناحية أخرى، مقروئية الكتب له أهمية بنائية لكلٍ من المهتمين في مجال التعليم ومؤلفي الكتب الدراسية. ويعد العثور على صلة مناسبة بين قدرة الطلاب على القراءة وصعوبة النص مهمة صعبة وهامة للمعلمين.

وتتمحور هذه الدراسة حول كيفية تقديم وتمثيل المحتوى العلمي لكتب العلوم للحلقة2في مدارس مجلس أبوظبي للتعليم . وكما تهدف إلى التعرف على جوانب المعرفة العلمية التي أكدت عليها كتب العلوم المستخدمة في الصفوف (9 - 6) وتحديد مستوى مقروئية هذه الكتب العلمية.

وقد شملت الدراسة نوعين من العينات والإجراءات المتبعة لتطبيق العينات. العينة الأولى: هي الكتاب العلوم(Science Focus) المقرر لطلبة الصفوف (9-8-7-6)، (نسخة الطالب)، الطبعة الثانية المؤلف بواسطة Whalley, Phillips, Monckton, Roberson, Mayers, Brown, and Naville (2009). وأما العينة الثانية: تمثل عدد الطلاب المشاركين في الدراسة (200 طالباً) من مدرستين حكوميتين للحلقة الثانية تغطي الصفوف (9 - 6) خلال العام الدراسي 2013 - 2014. وقد تم اختيار الكتب الدراسية لما تتضمنه من محتوى وتحليل مستوى مقروئيتها وتم اختيار الطلاب لتحديد القدرة على القراءة الفعلية.

والإطار المستخدم لفحص جوانب المعرفة العلمية يركز على وصف المعرفة العلمية على أنها (أ) مجموعة من المعارف، (ب) وسيلة للتحقق، (ج) طريقة التفكير، و (د) التفاعل مع التكنولوجيا والمجتمع (STS). وذلك لتحديد مقروئية كتب العلوم باستخدام أداتين هما: اختبار (Flesch-Kincaid Grade Level) Readability Formula لمستوى المقروئية والرسم البياني (Fry Graph). كما أيضاً تحديد القدرة على القراءة الفعلية للطلبة المشاركين في الدراسة من خلال اختبار كلوز (Colze Test).

وأظهرت النتائج أن المحتوى يغطي نسبة عالية متمثلة في "العلوم كمجموعة من المعرفة"لجميع المراحل، ويميل هذا الاتجاه للتناقص كلما انتقلنا لمراحل الصفوف العليا (من الصف 6 إلى الصف 9). ومع ذلك تشير النتائج الإجمالية أن تمثيل الموضوع لم يكن متوازناً. فالعلوم كوسيلة للمعرفة، كوسيلة للتحقيق، والتفاعل مع العلوم والتكنولوجيا قد أهمل في هذه الكتب. وتشير النتائج المتصلة بتحليل مقروئية الكتب أن هناك عدم تطابق بين مستويات القراءة للكتب الدراسية و مستويات القراءة الفعلية للطالب. كما تشير إلى أن جميع الكتب المدرسية معقدة بعض الشيء، وأعلى بكثير من مستويات القدرة على القراءة من قبل الطلبة المستهدفين. وأشارت النتائج أيضا إلى أن الكتب الدراسية للصفوف (8 -7 -6) أظهرت أعلى عدم تطابق يصل إلى مرحلتين دراسيتين فوق مستوى القراءة الفعلية للطلبة. أما كتاب مرحلة الصف 9، تمثل أعلى بفئة عمرية واحدة. ونوقشت هذه النتائج في سياق البحوث التعليمية للعلوم مع التركيز بشكل خاص على كيفية استخدام معلمي العلوم للكتب الدراسية لتقلي لتأثيرها مع مراعاة المعرفة العلمية وخصائصها.

وجاءت التوصيات محددة لتحمل المؤلفين والمدرسين مسؤولية تحقيق التوازن بين المحتوى من حيث الموضوعات التي تصف المعرفة العلمية وتحسين مستوى القراءة للكتب العلمية. وعلاوة على ذلك، يلعب معلمي العلوم دوراً رئيسياً في رفع قدرات القراءة لدى الطلاب عن طريق استخدام استراتيجيات التدريس المختلفة.

وبناء على نتائج الدراسة الحالية، تم تقديم اقتراحات للبحوث المستقبلية. ومنها دراسة مدى إدراك معلمي العلوم لمفهوم المعرفة العلمية الذي قد يقدم نتائج تمكن من مواجهة الخلل في مواضيع المعرفة العلمية في هذه الكتب. ودراسة كيف يمكن للمعلمين تسليط الضوء بشكل واضح على العلاقة بين العلوم والتكنولوجيا والمجتمع الذي قد يؤدي إلى إدراك أن العلوم هي أكثر من مجرد معرفة علمية. بالإضافة إلى ذلك، التحقيق في مدى تأثير صعوبة نصوص كتب العلوم على الطلاب في مستويات مختلفة لتحقيق القراءة الفعلية.

كلمات البحث المفتاحية: المعرفة العلمية، المقروئية، مستوى القراءة لدى الطالب، قياس المقروئية، مناهج العلوم بدولة الإمارات العربية المتحدة، الحلقة الثانية.

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Dedication

To the spirit of my father, who taught me perseverance and persistence.

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Glossary

Scientific Literacy: is the capacity to use scientific knowledge to identify questions and to draw evidence-based conclusions in order to understand and help make decisions about the natural world and the changes made to it through human activity.

Also, **Scientific Literacy** is the knowledge and understanding of scientific concepts and processes required for personal decision making, participating in civil and cultural affairs and economic productivity.

The essence of **Scientific Literacy** is the ability to use scientific knowledge to make informed personal and societal decisions.

Science as a Way of Thinking: This theme describes how a scientist experiments, shows the historical development of an idea (how science proceeds by inductive and deductive reasoning) gives cause and effect relationship, and brings out how science is a discipline disposed to self-examination.

Science as a Way of Investigating: This theme reflects the active aspect of inquiry and learning which involve the students in the methods and processes of science. It stimulates thinking and doing by asking the students to find out.

Science as a Body of Knowledge: This theme presents and discusses facts, concepts, principles and laws. It presents hypotheses, theories and models and requires the recall of knowledge or information.

Science and Its Interaction with Technology and Society: This theme illustrates the impact of science on society. This aspect of Scientific Literacy pertains to the application of science and how technology helps or hinders humankind. It involves social issues and careers.

Readability: Readability is defined as the relative ease or difficulty of printed material or the quality of reading material that makes it understandable for those for whom it was written. In current study it means that how a student from grade 6 to 9 is capable of reading as well as understanding a context in a scientific textbook.

Student reading level: Student reading level is defined as a measurement of a student's ability to read and comprehend the English language. It is generally stated in terms of grade-level, which is determined from the student's score on the reading section. In this study, it is defined as the analysis of the reading levels of students compared with the level to the reading levels of science textbook using cloze test results.

Cloze Readability Test: Cloze Test a measure of reading levels of students. It is constructed by deleting every fifth word from a passage, the deleted words are replaced by underlined blank spaces of a uniform length, and the tests are mimeographed.

Fry Readability Graph: The 1971 Fry Readability Graph is a graph used to estimate readability levels by plotting sentences per-100 words and syllables per -100 words on a graph. The sentence and syllable counts are based on an average from three 100 word passages randomly selected from the user's material. The Four books used in this study ranged from sixth grade to ninth grade.

Cycle 2: A new grade level system used to describe the preparatory stage level of education system that includes grades 6 – 9 of 12- 14-year old students.