An Analysis of the Environmental Issues and Environmental Literacy Components

Presented by the Lebanese National Elementary Science Textbooks

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Abstract

This study aimed to determine the environmental issues and environmental literacy components presented by the Lebanese national elementary science textbooks. For this purpose, the Lebanese national science textbooks (grades 1 through 6) were analyzed through content analysis and a mixed approach of qualitative and quantitative research methods. The analysis used two frameworks from previous literature to determine the environmental issues and the inclusion level of environmental literacy components (knowledge, affect, cognitive skill, and behavior) presented by these textbooks. The results of the study showed that the environmental issues presented by the Lebanese national elementary science textbooks are marine pollution, solid waste disposal, hazardous chemicals, biodiversity reduction, habitat destruction, land use, ozone depletion, acid rain, extinction, population growth, human health, air pollution, and soil erosion with the marine pollution and ozone depletion being the most and least issues covered respectively. In addition to that, the results showed that not all components of environmental literacy receive the same attention in the Lebanese national elementary science textbooks. It was shown that the environmental knowledge component is the most highlighted one among the other environmental literacy components (affect, cognitive skill, and behavior). Moreover, the most highlighted environmental literacy components in the environmental issue topics were knowledge and behavior.

Therefore, the study's recommendation is to work on updating the Lebanese science curriculum and textbooks to include more current environmental issues and to give all components of environmental literacy equal attention.

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1. Introduction

In recent decades, human activities have exacerbated major environmental issues. Air pollution, poor waste management, increasing water scarcity, falling ground water tables, water pollution, waste disposal, desertification, endangered species, forest preservation and quality, biodiversity loss, land/soil degradation, global climate change, global warming, the greenhouse effect, acidification, ozone depletion, and other local, regional, and global issues are the present environmental issues that put us at risk (Pant et al., 2020).

1.1. Research area

Lebanon has a number of environmental issues. These issues include air and water pollution, climate change dangers, and the consequences of the 2006 Israeli Lebanese war (SOER Report, 2020). In addition, as a result of the Syrian Civil War in 2011, Lebanon has had significant environmental consequences, including significant strains on the country's water, energy, sanitation, and solid waste management systems, to name a few, which resulted in a serious hazard to water bodies, ecosystems, and land (SOER Report, 2020). The article also discusses the August 4th, 2020, Beirut Port Explosion, which was purportedly linked to harmful environmental and health consequences. Furthermore, Lebanon faced an economic and financial collapse in 2020, as well as a health crisis caused by the COVID-19 outbreak. Both crises have substantial environmental consequences that are not yet completely understood (SOER Report, 2020).

Some of these environmental issues are found in textbooks. Textbooks are books that students will read every day, and any messages, no matter how minor or major, are accessible for interpretation by a young, susceptible mind (O'Keeffe, 2013). These textbooks teach ideological and epistemological principles both explicitly and implicitly, and they feature a diversity of open and hidden signals in the text as well as in the visuals (Caravita et al., 2008; Caravita & Valente, 2013; Clément & Hovart, 2000; Jacob, 1988).

Environmental literacy is very important to understand environmental issues (Goulgouti et al., 2019). Roth (1992) defines environmental literacy as a person's overall quantity of information about the environment and level of awareness of environmental issues. Roth (1992) suggests that environmental literacy consists of four components: knowledge, affective tendency, cognitive skill, and behavior.

1.2. Research problem

Environmental education is a critical strategy for addressing environmental issues and conserving the environment (Petkou et al., 2021). Today, education about environmental issues plays a crucial role in achieving sustainability and preparing future generations for a green society (Boca & Saraçlı, 2019). Erhabor and Don (2016) believe that environmental education would provide some remedies to the deteriorating relationship between man and the natural world. However, although environmental issues were added to the Lebanese curriculum in 1997 and are interwoven into science and social studies textbooks, they are not effectively implemented (Makki, Khalick, & Boujaoude, 2003). If environmental issues are not effectively implemented in the Lebanese curriculum and textbooks, students' behaviors may be negatively impacted. (Dragos & Mih, 2015; Karatekin, 2012) discuss the importance of education and textbooks in the development of

pro-environmental behaviors. Subsequently, there is a need to determine the environmental issues and the inclusion level of environmental literacy components presented by the Lebanese national elementary science textbooks.

1.3. Purpose

The aim of this study is to determine what environmental issues are presented by the Lebanese national elementary science textbooks, and to determine the inclusion level of the environmental literacy components (knowledge, affect, cognitive skill, and behavior) in the Lebanese national elementary science textbooks (Grades 1 through 6).

1.4. Research questions

Consequently, the following research questions should be addressed:

1. What environmental issues are presented by the Lebanese national elementary science textbooks?

2. What are the environmental literacy components included in the Lebanese national elementary science textbooks?

1.5. Rationale

Different research has identified and analyzed environmental issues found in textbooks (Boujemaa et al., 2009; Oguz et al., 2004). And some research (Keskin & Aksakal, 2020; Petkou et al., 2021; Yurttas & Sulun, 2010) studied the environmental issues and problems from students' perspectives and from educators' views. Boujemaa et al. (2009) analyzed four environmental topics in Italy and Morocco, which are the ecosystems and cycles, pollution, use of resources, and biodiversity, with the aim of checking conceptions about ecology and environmental education topics. However, the

current study will determine all the environmental issues presented by the Lebanese national elementary science textbooks. On the other hand, Oguz et al. (2004) examined the average scores of environmental issues included in middle school, high school, and environmental science textbooks. The main difference between the study and the current study is that Oguz et al. (2004) studied the environmental issues in textbooks at three different levels, whereas the current study will study the environmental issues in the six science textbooks at the elementary level. On the contrary, Keskin and Aksakal (2020) coded the environmental issues that 7th grade students consider important. Yurttas and Sulun (2010) studied the perceptions of 8th grade students on the most important environmental issues in Turkey, their city, and Petkou et al. (2021) studied the educators' views on the importance level of eight challenging environmental issues. These three studies analyzed environmental issues from students' and educators' perspectives, but the current study will analyze environmental issues that are presented in the Lebanese national elementary science textbooks.

As for the environmental literacy components, different research has studied the knowledge and attitudes of students and teachers towards environmental issues (Boca & Saraçlı, 2019; Erhabor & Don, 2016; Keskin & Aksakal, 2020; Petkou et al., 2021). Keskin and Aksakal (2020) examined the environmental literacy levels and environmental pollution images of 7th grade students in a public secondary school in the city of Ankara. They examined the environmental literacy of students, whereas the current study will examine environmental literacy in science textbooks. Erhabor and Don (2016) conducted research to assess students' levels of knowledge and attitudes towards the environment in Nigeria. And Boca and Saraçlı's (2019) examined the relationship between perception,

attitude, and environmental behavior of students. Moreover, Petkou et al. (2021) studied the effects of environmental training on the environmental perceptions and attitudes of pre-primary and primary school teachers. A major difference between these studies and the current study is that they focus on the students' or teachers' knowledge, attitudes, behavior, and perception, whereas the current study's focus is on the knowledge, affect, cognitive skill, and behavior domains in the science textbooks. Additionally, other research determined the inclusion level of environmental literacy components (knowledge, affect, cognitive skill, and behavior) in the social studies textbooks for 4th, 5th, 6[th,] and 7th grades in primary school in Turkey (Karatekin, 2012). Its focus is on the social studies textbooks of Turkey, but the current study sheds light on the environmental issues and environmental literacy components presented by the Lebanese national elementary science textbooks.

All that makes this study unique, especially since it will be carried out on Lebanese national science textbooks, in Lebanon.

1.6. Significance

In addition to the uniqueness of this study, it is significant because it tackles the environmental issues addressed in the Lebanese national elementary science textbooks. It also determines the inclusion level of environmental literacy components (knowledge, cognitive skill, affect, and behavior) in these textbooks. This will help textbook developers identify the environmental issues found in the Lebanese national elementary science textbooks to check if they are sufficient or need modifications and updates to achieve the goals behind them. Also, teachers will be able to explore the environmental issues and the level of environmental literacy components so that they can plan their classes more effectively. Thus, students will better understand the environmental issues and improve

their knowledge, cognitive skills, affective tendency, and behavior towards the environment. Besides, curriculum developers can modify the number and kind of environmental issues addressed in the textbooks when they find out if these issues are outdated or require more environmental literacy components. Furthermore, the findings presented in this study will be useful for future research that may explore the environmental issues and inclusion level of environmental literacy in science textbooks in a more in-depth analysis.

1.7. Operational definitions

Environmental literacy: a good understanding, knowledge, character, values, ethics, and skills in preventing environmental issues, as well as the desire to maintain and improve the quality of the environment for current and future generations.

Environmental knowledge: is the fundamental awareness and knowledge of environmental issues.

Environmental affect: is the individual's sensitivity to environmental concerns and consideration of environmental circumstances for the removal of these issues.

Environmental cognitive skills: seeking and obtaining information, comparing, contrasting, evaluating information, applying understanding to systems, and reasoning about the application of knowledge and action in environmental contexts.

Environmental behavior: the opportunities to improve the environment through action and responsible behaviors.

2. Literature review

This section presents a review of the literatures that identify the environmental issues presented in elementary science textbooks in various countries. It also presents different literary works that define the concept of environmental literacy and its components over time. In addition to that, the section reviews literature that analyzes, compares, and contrasts the environmental literacy components presented in elementary science textbooks in different countries. Moreover, this section considers the range of literatures available that interpret elementary students' environmental literacy in some countries of the world.

2.1. Environmental issues in elementary science textbooks

Various studies investigated the environmental issues presented in elementary science textbooks, including those used in specific countries such as Turkey, Australia, Singapore, Ireland, Canada, and Pakistan.

For instance, Hamm and Adams (1989) aimed to examine how global concerns, including population growth, world hunger, air quality and atmosphere, and water resources were addressed in 6th and 7th grade science textbooks. Five raters analyzed ten textbooks to determine the quantity of material offered by different textbooks on global concerns. The results showed that fewer than 2% of the 4,393 pages of content analyzed were devoted to the issues mentioned that are identified as the most severe human concerns. Both textbook levels, sixth and seventh-grade science textbooks, went into greater details about population growth, air quality, and water supplies than they did about world hunger or war technology. Hence, few environmental issues are presented in the 6th and 7th grade science textbooks.

Şimşek (2011) also focused on the quantity of environmental issues presented in elementary science textbooks. His study investigated 6th, 7th, and 8th grade science and technology textbooks to find out how many topics related to environmental issues and values were included. Using document analysis, topics linked to environmental issues in textbooks were explored in terms of content and visual quality. The study showed that out of 556 objectives, only 20 were linked to a set of environmental issues such as nature, plants, and humans. This means that the minimum quantity of environmental themes presented in the 6th, 7th, and 8th grade science and technology textbooks are taught using a nature-centered approach in both the curriculum and textbooks.

Similarly, to compare the quantity of some environmental issues presented in elementary science textbooks, Derman and Gurbuz (2018) compared the objectives of environmental topics in elementary education in different countries including Turkey, Australia, Singapore, Ireland, and Canada. For this comparative research, descriptive and content analysis were used to analyze the data. They found that the "forest" category was not present in any country's curriculum or textbooks. Additionally, they found that only Turkey included objectives about ozone depletion, light pollution, and space pollution, whereas only Canada had objectives about greenhouse, gas emissions and their impacts. It was also concluded that natural disasters and their effects were the main objectives taught in Australia, water problems were the main objectives taught in Singapore, and noise pollution and radiation were the main objectives taught in Turkey.

On the contrary, RafiUllah et al. (2017) focused on the quality, not only the quantity, of environmental issues in elementary science textbooks. They studied the quantity and quality of environmental issues in science textbooks for grades 6 through 10

in Pakistan using an exploratory approach. The findings revealed that although a significant number of environmental issues have been introduced to meet national and worldwide concerns, subject matter coherence is lacking. In addition to that, some textbooks, such as General Science for grades 6 and 10, describe the ecological elements of the environment, but no actions or attitudes that degrade the environment are identified. Moreover, the study found that students' comprehension levels can be enhanced by providing instances from their immediate environment that are lacking in the textbooks. This prevents them from using their critical thinking and analytical skills in the real world.

Therefore, evidence across multiple studies shows that environmental issues are not significantly present in elementary science textbooks, both quantitatively and qualitatively. Quantitatively, the number of objectives related to environmental issues, compared to the total number of objectives in the textbooks, is the minimum. Qualitatively, environmental issues do not focus on actions, attitudes, comprehension, critical thinking, and analytical skills.

2.2. Environmental literacy

Environmental literacy has been viewed from various perspectives for years. Too many definitions of environmental literacy exist. Thus, for the purpose of this study, it is important to examine how environmental literacy has been defined over time and categorize its different definitions in order to appropriately determine the inclusion level of environmental literacy in the Lebanese national elementary science textbooks.

Studies referred to environmental literacy as an individual's knowledge of environmental issues. For instance, Roth (1968), who was the first to introduce environmental literacy into literature, defined the term "environmental literacy" as a

person's overall quantity of information about the environment and level of awareness of environmental concerns.

On the other hand, a series of studies has related environmental literacy to one's skills. For example, McBeth (1997) and NAAEE (2000) defined environmental literacy as a literacy that entails applying skills, including analytical skills, critical thinking skills, problem-solving skills, and good decision-making skills, to learn about the environment's issues and their solutions. This means that such skills are essential for being an environmentally literate individual. Similarly, different research focused on the comprehension and interpretation skills specifically to define environmental literacy as an individual's capacity to comprehend and interpret environmental situations, after which suitable measures to conserve and improve the environment are determined based on the interpretation findings (Erdoğan et al., 2009; Karimzadegan & Meiboudi, 2012; Saltan & Divarci, 2017).

In contrast, Roth (1992) then proposed an expanded definition of environmental literacy, which refers to an individual's ability to translate their knowledge and sensitivity into behavior. Hence, environmental literacy is a concept related to an individual's behavior towards the environment.

Not only that, but environmental literacy can also be related to hygiene habits because Frensly et al. (2020) and Yusuf et al. (2022) argued that environmental literacy is closely linked to personal hygiene, such as wearing clean clothes, washing hands before eating, and eating nutritious foods. This means that environmental literacy is a crucial component in encouraging healthy lifestyle habits.

However, other research viewed environmental literacy from a broader perspective. A perspective that includes knowledge, skills, behavior, and other aspects such as values and ethics. For instance, Reynolds et al. (2010) claimed that environmental literacy is an awareness of the environmental, social, and economic elements of human-environment interactions, as well as the skills and ethics necessary to translate that understanding into personal choices that promote the long-term flourishing of various human groups and natural systems. Moreover, Eliam and Trop (2012) believed that environmental literacy refers to a person's understanding, attitudes, cognitive abilities, skills, and behaviors related to environmental ideas and issues. Additionally, Alkaher and Goldman (2017) believe that if a person has a good understanding of, knowledge of, character, values, ethics, and skills in preventing environmental issues, as well as the desire to maintain and improve the quality of the environment for current and future generations, he/she is considered to have a good mastery of environmental literacy.

2.2.1. *Environmental literacy components*

Roth (1992) was the first to introduce and define the three degrees of environmental literacy, which are: nominal environmental literacy, functional environmental literacy, and operational environmental literacy. Nominal environmental literacy is the lowest degree, which means a person has a fundamental cognitive awareness of his or her surroundings as well as a basic understanding of the natural system (Roth,1992). Functional environmental literacy is the second degree, which means a person has the knowledge and abilities to evaluate, interpret, and analyze environmental information (Roth, 1992). And operational environmental literacy is the highest degree, which

means that a person has the skills and locus of control towards the environment (Roth, 1992).

On the other hand, based on these collaborative definitions of environmental literacy, the North American Association for Environmental Education (NAAEE) was able to define seven key components of environmental literacy, which are: affect, ecological knowledge, socio-political knowledge, knowledge of environmental issues, cognitive skills, environmentally responsible behaviors (ERB) and additional determinants of environmental responsible behaviors (Hollweg et al., 2011).

McBride (2011) defined each of these components. The first component, affect, considers a person's sensitivity to and attitude toward environmental issues. The second component, ecological knowledge, is defined as the ability to convey and apply important ecological principles. From an ecological standpoint, the third component, socio-political knowledge, necessitates an understanding of the economic, social, political, and ecological interconnections in urban and rural regions. An individual's grasp of environmental problems and how they are impacted by political, educational, economic, and governmental institutions is referred to as the fourth component, knowledge of environmental issues. The fifth component, cognitive skills, refers to an individual's capability to interpret and evaluate information regarding environmental issues. And individuals must exhibit persistent active engagement in environmentally responsible activities to be eligible for the sixth component, environmentally responsible behavior. Finally, the seventh

component, additional determinants of environmentally responsible behavior, refers to a person's assumption of self-efficacy and the belief that, as a result of his or her actions, he or she has the power to change.

Different studies proposed that these seven components can be grouped into four categories to make it easier for the public to understand environmental literacy components and easily analyze research findings. These four interrelated dimensions or components of environmental literacy are knowledge, affect, cognitive skills, and environmentally responsible behaviors (ERB) (Hollweg et al., 2012; Hungerford & Volk, 2013; Roth, 1992; Simmons, 1995; Wilke, 1995).

Knowledge is the fundamental awareness and knowledge of environmental issues (Hollweg et al., 2011). Affect or affective disposition is the individual's sensitivity to environmental concerns and consideration of environmental circumstances for the removal of these issues (Chawla, 1998; Dunlap, 1992, 2002; Sward & Marcinkowski, 2001). Cognitive skills mean seeking and obtaining information, comparing, contrasting, evaluating information, applying understanding to systems, and reasoning about the application of knowledge and action in environmental contexts (Hollweg et al., 2011). And the environmentally responsible behaviors (ERB) refer to the opportunities to improve the environment through action and responsible behaviors (Hollweg et al., 2011).

Roth (1992), although being the first to introduce the three environmental literacy degrees, which are nominal environmental literacy,

functional environmental literacy, and operational environmental literacy, his degrees did not tackle the behavioral aspect. On the contrary, NAAEE (2000) defined seven key components of environmental literacy, including environmentally responsible behavior (ERB) and additional determinants of environmental responsible behavior as well. Additionally, NAAEE (2000) divided the knowledge component into three specific components, which are ecological knowledge, socio-political knowledge, and knowledge of environmental issues. However, it may be confusing to both the researcher and the reader to categorize the environmental information presented in the textbooks into one of the seven components. Therefore, different studies (Hollweg et al., 2012; Hungerford & Volk, 2013; Roth, 1992; Simmons, 1995; Wilke, 1995) proposed that these seven components might be organized into four categories to make it easier for the public to grasp environmental literacy components and easily examine research findings. These four components are knowledge, affect, cognitive skills, and environmentally responsible behaviors (ERB).

Based on the evaluation of the different degrees and components of environmental literacy that were developed in various research studies, the current study aims to use the four components (knowledge, affect, cognitive skills, and environmentally responsible behaviors) to determine the inclusion level of the environmental literacy components presented in Lebanese national elementary science textbooks.

2.2.2. *Environmental literacy in elementary science textbooks*

Components of environmental literacy in elementary science textbooks are analyzed in some research studies. These include elementary science textbooks in Bulgaria, Turkey, Iran, and Macedonia.

Erdogan et al. (2009) analyzed the inclusion level of the basic environmental literacy components of the science objectives in elementary textbooks and how this emphasis varied from Bulgaria to Turkey. To collect data, they used five guidebooks for grades 3rd to 8th that are used in science in elementary schools in both countries. Based on their comparative content analysis of the science objectives, they concluded that most attention was given to knowledge compared to skills, attitudes, and behaviors in both Bulgaria and Turkey. Hence, environmental literacy components in elementary science textbooks in Bulgaria and Turkey do not receive the same attention and are not equally integrated into science textbooks.

Adapting the checklist table of environmental literacy that was used by Erdogan et al. (2009), Karimzadegan and Meiboudi (2012) explored the content of elementary science textbooks in relation to environmental literacy in Iran, in which similar results were obtained. The aim of the study was to determine how well primary science education in Iranian schools fulfills the goal of environmental literacy (EL). For data analysis, a comparative content analysis has been used. According to the findings, not all components of environmental literacy got equal priority in Iran; while environmental knowledge is heavily emphasized, other components are either disregarded completely, such as the

behavior component, or are only partially addressed, such as the affective component.

The similar conclusions of both studies (Erdogan et al., 2009; Karimzadegan & Meiboudi, 2012) seem to indicate that the elementary science textbooks in Bulgaria, Tureky, and Iran extensively focus on the knowledge component of environmental literacy.

Karimzadegan and Meiboudi (2012) assert that environmental knowledge is extensively addressed, whereas other components, are either ignored or partially covered. Srbinovskia et al. (2010) agree when their study revealed similar findings. The study analyzed how much attention was paid to environmental literacy (EL) in the science education curriculum in Turkish and Macedonian schools, and how this focus varies from Turkey to Macedonia. For data collection, nine textbooks of science curricula for 4th to 8th grades were selected for content analysis. It was found that in Turkey, skills were given little consideration, and attitudes and behavior were given much less consideration. However, although the component of behavior is neglected and never considered in Macedonia, the skills and affective sub-components are inadequately integrated.

2.2.3. *Elementary students' environmental literacy*

Some research analyzed, compared, and contrasted the inclusion level of environmental literacy components in elementary science textbooks in different countries. However, other literature focused on students'

environmental literacy in different countries of the world, including Indonesia, Ankara, and China.

Astuti and Aminatun (2020) determined if there were any variations in environmental literacy between Adiwiyata and non-Adiwiyata high school programs in Indonesia in Sleman Regency, Yogyakarta, using a quantitative approach, a survey method, and a sample of 1,568 students from nine schools. Using the environmental scale developed by the North American Association (NAAEE), the findings revealed that the average environmental literacy of students in Adiwiyata and non-Adiwiyata schools was not significantly different, but overall, students at Adiwiyata schools have higher environmental literacy than students in non-Adiwiyata schools in Sleman Regency. According to the findings of this study, efforts to maintain environmental literacy among students in Adiwiyata schools are required as the Adiwiyata program has been shown to play a role in the development of environmental literacy among students in the school environment.

While the previous study was done on students in Yogyakarta high schools, Keskin and Aksakal (2020) conducted a study on students in Ankara primary schools to examine the environmental literacy levels of students depending on a variety of characteristics. The study was conducted with 76 7th grade students from four distinct classes at a public secondary school in Ankara using the environmental literacy scale developed by Sontay, Gökdere, and Usta (2015). The findings of the environmental sensitivity scale, which was used to determine the student' environmental sensitivity, indicated that the students are

concerned about the environment and environmental concerns, are prepared to take responsibility, and engage in environmentally responsible behavior. Additionally, the results of the environmental behavior scale, which was used to determine the students' attitudes toward the environment, showed that the students avoid behaviors that hurt the environment, warn others who do, and demonstrate appropriate behaviors to prevent pollution. Moreover, according to the cognitive skills interview form, the results showed that the students are aware of a variety of environmental issues. The students alluded to a variety of environmental issues and displayed a good level of understanding of these issues. Consequently, effective environmental education may ensure environmental literacy, environmental consciousness, and environmental awareness in students.

The evidence shows that elementary students' environmental literacy components (knowledge, affect, cognitive skill, and behavior) in Indonesia and Ankara schools are significant. Yet, other literature analyzed the students' environmental literacy as a result of participating in summer programs.

For instance, Erdogan (2011) studied elementary school students' environmental knowledge, affect, and behavior as a result of participating in an ecology-based summer nature education program. A total of 64 elementary school students participated in this pre-test post-test study. According to the findings, an ecology-based summer nature education program greatly contributed to the development of environmentally responsible behavior as the post-test scores on the behavior component were considerably greater than the

pre-test scores. On the other hand, the impact of a nature education program on pupils' environmental awareness, knowledge, and affect were found to be insignificant. This means that an ecology-based nature education program played a substantial role in the development of environmentally responsible behavior.

On the other hand, Bexell et al. (2013) analyzed whether elementary students' (8-12-years-old) knowledge of how to protect animals, compassion for animals, propensity for environmental and wildlife stewardship, and compassionate behavior toward animals and nature were positively affected by participation in a conservation education camp. At two zoological organizations in China, camps were held where activities were created to assist children in forming connections with animals and caring enough to change their behavior toward animals and nature in a positive way. Pre-and post-visit surveys, researcher field notes, vignettes, student journals, an end-of-camp questionnaire, and a camper behavior ethogram were the mixed methods used in this study. The findings demonstrated a considerable increase in self-reported knowledge, caring, and predisposition for animal and environmental sustainability. Accordingly, students' environmental literacy components (knowledge, affect, and behavior) were increased.

To conclude, this section reviewed the literature related to the environmental issues presented in the elementary science textbooks in different countries, the definition of environmental literacy over the years, components of environmental literacy, components of environmental literacy in elementary

science textbooks, and the elementary students' environmental literacy in various countries.

Knowledge about environmental issues is critical, but is this enough? Knowledge of the subject matter is vital, yet it is insufficient to suit the demands of some students (Milner, 2013). Knowledge about environmental issues is more effective when skills are acquired. Schwartz and Fischer (2004) claim that cognitive skills help in building a more complete understanding of a particular topic. Knowledge about environmental issues is ineffective without love. "Knowledge without love will not stick. But if love comes first, knowledge is sure to follow" (Sobel, 2013, p. 13). Knowledge about environmental issues is meaningless if it is not followed by action. Funke (2017) believes that action implies a link to some background representation, which is commonly referred to as knowledge. Consequently, it is important to analyze the environmental issues and the inclusion level of environmental literacy components in the national Lebanese elementary science textbooks.

3. Methodology

This section presents the research methods used in this study. The aim of this study was to determine the environmental issues and the inclusion level of the environmental literacy components (knowledge, affect, cognitive skill, and behavior) presented by the Lebanese national elementary science textbooks. For this purpose, the research study

explored and analyzed the Lebanese national elementary science textbooks, which are for grades 1-6.

3.1. Method

This research, designed to determine the environmental issues and the inclusion level of the environmental literacy components (knowledge, affect, cognitive skill, and behavior) presented by the Lebanese national elementary science textbooks, used mixed methods of quantitative and qualitative approaches based on primary sources.

For the purpose of answering the two research questions regarding environmental issues and the inclusion level of environmental literacy components, document review, one of the qualitative research methods, was used. However, although qualitative research is flexible and can be conducted on small samples, it cannot be statistically analyzed. Therefore, quantitative research was also used to answer both research questions. Although this type of research requires statistical training and large samples, it can be used to make generalized descriptions of large collections and is used to produce consistent information.

It is also important to mention that data collection used primary sources. Although it is a time-consuming method and requires training in data collection methods, it can be used to collect data that answers the specific research questions.

Accordingly, this study used qualitative and quantitative research methods using primary data, with the aim of producing generalized information about the

environmental issues and the inclusion level of environmental literacy components presented by the Lebanese national elementary science textbooks.

3.2. Sources of data

The Lebanese national elementary science textbooks (grades 1-6) were selected as the source for this data analysis. The latest issues (2020) of the digital copies of the national textbooks, CRDP-Ebooks, issued by the Center of Educational Research and Development (CEDP), were used.

3.3. Data collection

To gain a better insight into the environmental issues and inclusion level of environmental literacy components presented by the Lebanese national elementary science textbooks, existing data from primary sources was used.

To determine what environmental issues are presented by the Lebanese national elementary science textbooks, it is important to mention that, for this purpose, Oguz et al.'s (2004) table was adapted. The table that Oguz et al. (2004) used presented the average scores of environmental issues (EI) included in the middle school textbooks, high school textbooks, and environmental science textbooks.

Keskin and Aksakal (2020) used a table in their study that included 30 different environmental issues, but it was used to represent the environmental problems that students considered important in their country. Whereas the focus of the current study was to determine the environmental issues presented in science textbooks. Furthermore, Petkou et al. (2019) used a table in their study that included

only eight environmental issues. In addition to that, the table was used to represent the importance level of each environmental issue from the students' perspectives. On the other hand, Oguz et al. (2004) used a table that included 23 different and specific environmental issues, and it was used to represent the environmental issues included in different textbooks. The difference between the tables used by Petkou et al. (2019) and Oguz et al. (2004) is that the first includes a smaller number of environmental issues that are not significantly specific. For example, pollution is not categorized into different types. However, the table used by Oguz et al. (2004) includes specific categorized environmental issues. For instance, pollution is categorized into marine pollution and air pollution. Accordingly, because the table used by Oguz et al. (2004) is characterized by having different categorized environmental issues that might be included in textbooks, the current study chose to adopt the same table to represent the average scores of the environmental issues included in the Lebanese national elementary science textbooks.

To determine the environmental literacy components (knowledge, affect, cognitive skill, and behavior) in the Lebanese national elementary science textbooks, the frequency and percentage distribution table of environmental literacy components used by Karatekin (2012) was adopted. The reason for choosing to use this framework among other environmental literacy scales is that it includes the four components of environmental literacy that my study is based on, which are knowledge, affect, cognitive skills, and behavior.

To answer the first research question of the study, related to the environmental issues presented by the Lebanese national elementary science

textbooks, the following steps were taken. First, I created six excel sheets for each grade level, and one excel sheet for the table of environmental issues. Each of the six excel sheets included the level, the 23 environmental issues, lessons/chapters, and page numbers (see Appendix 1). The table included the 23 environmental issues and the average scores of the environmental issues included in each textbook at the six grade levels (see Appendix 2). Second, I read each page of the six textbooks, including the pictures, sentences, questions, exercises, activities, or graphs. Then, following the framework used by Oguz et al. (2004), I marked the environmental issues presented in each grade level, lesson/chapter, and page. For example, if a page included a picture that showed emissions from cars, a mark was put in the "air pollution" cell. After filling out the six excel sheets, the table that presents the average scores of environmental issues in the Lebanese national elementary science textbooks was used to insert the average score of each environmental issue included in each of the six textbooks. The average was computed by dividing the frequency of each environmental issue by the total number of pieces of information that presented environmental issues.

The steps used to collect the data regarding the inclusion level of environmental literacy components (knowledge, affect, cognitive skill, and behavior) were the same steps used for determining the environmental issues presented in the Lebanese national elementary science textbooks. The additional step was identifying the environmental literacy component (knowledge, affect, cognitive skills, and behavior) associated with each piece of information selected following Karatekin's (2012) strategy (see Appendix 3). For instance, if a piece of

information highlights knowledge about environmental issues, it was classified as belonging to the environmental knowledge component. If a piece of information highlights feelings towards the environment or any environmental issue, it was classified as belonging to the environmental affective tendency component. If a piece of information shows cognitive thinking skills, it was classified as belonging to the environmental cognitive skill component. And if a piece of information requires a certain behavior or requests to improve the conditions of the environment, it was classified as belonging to the environmental behavior component. After filling out the six excel sheets, the frequency and distribution table of environmental literacy components was used to insert the amount of information in each category by counting the number of information pieces that fell into the knowledge component category, affective tendency component category, cognitive skill component category, and behavior component category. Then, the percentage of each of the four components was calculated and inserted into the table. Calculating the percentage required dividing the frequency of a specific component by the total number of information selected in each science textbook. For example, if 68 sentences were selected from the 2nd grade science textbook to be categorized into the four components of environmental literacy, and 11 of these sentences fall under the environmental knowledge component category, then the percentage of the environmental knowledge component in the 2nd grade science textbook is $11/68 = 16.18\%$.

The percentage of each of the four components was computed for each of the six textbooks separately, and then it was computed for all six textbooks together.

3.4. Data analysis

The data obtained from document review was interpreted using content analysis in this study. Despite the fact that data content analysis is time-consuming, it is flexible and allows for both qualitative and quantitative research.

To determine the environmental issues and environmental literacy components presented by the Lebanese national elementary science textbooks, I analyzed the Lebanese national elementary science textbooks (grades 1 through 6), excluding the introduction and references. Because the sample consists of only six textbooks, I analyzed all the samples.

The analysis units identified to answer the research questions were the texts, questions, pictures, graphs, exercises, and activities that mentioned or described environmental issues.

To get a more detailed understanding of the first research question regarding environmental issues, I categorized the environmental issues based on Oguz et al.'s (2004) table of the average scores of environmental issues included in textbooks. The environmental issues are divided into 23 categories, which are: armed conflict/war, wildlife management, invasive species, distribution of water resources, marine pollution, mineral resources depletion, solid waste disposal, world hunger/food, hazardous chemicals, biodiversity reduction, habitat destruction, land use, ozone depletion, acid rain, extinction, nuclear stuff, water quality, energy consumption, population growth, human health, GCC, air pollution, and soil erosion. The marine pollution issue has the highest average score, while the ozone depletion issue has the lowest average score among the thirteen

environmental issues presented by the six Lebanese national elementary science textbooks.

To get a more detailed understanding of the second research question regarding environmental issues, I categorized the environmental issues based on Karatekin's (2012) frequency and percentage distribution table of environmental literacy components. The environmental literacy components are divided into four categories, which are knowledge, affective tendency, behavior, and cognitive skill. Environmental knowledge has the highest inclusion level, while environmental affective tendency has the lowest level among the environmental literacy components in the Lebanese national elementary science textbooks.

3.5. Validity and Reliability

To ensure reliability in research, I read the Lebanese national elementary science textbooks (grades 1 through 6) two times to answer the two research questions. Moreover, this study adopted frameworks used in other reliable literature, which is the reason that makes the data analysis reliable. Additionally, because the data collection for this study does not involve collecting data from people, it is worth mentioning that IRB approval was not required.

4. Results

4.1. Environmental issues

The environmental issues presented by the Lebanese national elementary science textbooks (grades 1-6) are presented in Table 1.

Table 1. The average scores of the EI included in the Lebanese national elementary science textbooks.

Issue	% in G1	% in G2	% in G3	% in G4	% in G5	% in G6	Total
Armed conflict/ war	0	0	0	0	0	0	0
Wildlife manage.	0	0	0	0	0	0	0
Invasive sp.	0	0	0	0	0	0	0
Dist. of water res.	0	0	0	0	0	0	0
Marine pollution	0	0	36.9 (31)	23.33 (7)	0	18.18 (6)	23.04 (44)
Mineral res. Depletion	0	0	0	0	0	0	0
Solid waste disp.	21.43 (3)	30 (3)	11.9 (10)	10 (3)	0	6.06 (2)	11.01 (21)
World hunger/ food	0	0	0	0	0	0	0
Haz. Chem.	14.29 (2)	0	19.05 (16)	6.67 (2)	0	9.09 (3)	12.04 (23)
Biodiversity red.	35.71 (5)	60 (6)	16.67 (14)	10 (3)	15 (3)	12.12 (4)	18.32 (35)
Hab. Destruction	0	0	2.38 (2)	10 (3)	5 (1)	9.09 (3)	4.71 (9)
Land use	0	0	2.38 (2)	3.33 (1)	0	0	1.57 (3)
Ozone depletion	0	0	0	0	5 (1)	0	0.52 (1)
Acid rain	0	0	0	0	10 (2)	0	1.05 (2)
Extinction	0	0	2.38 (2)	3.33 (1)	0	0	1.57 (3)
Nuclear stuff	0	0	0	0	0	0	0
Water quality	0	0	0	0	0	0	0
Energy consumption	0	0	0	0	0	0	0
Pop growth	0	0	0	0	0	9.09 (3)	1.57 (3)
Human health	7.14 (1)	10 (1)	0	16.67 (5)	0	0	3.66 (7)
GCC	0	0	0	0	0	0	0
Air pollution	21.43 (3)	0	7.14 (6)	10 (3)	65 (13)	36.37 (12)	19.37 (37)
Soil dest/erosion	0	0	1.2 (1)	6.67 (2)	0	0	1.57 (3)
Total	**100 (14)**	**100 (10)**	**100 (84)**	**100 (30)**	**100 (20)**	**100 (33)**	**100 (191)**

Based on the data presented in Table 1, it is shown that some of the environmental issues are not presented by any of the six Lebanese national elementary science textbooks, which are: armed conflict/war, wildlife management, invasive species, distribution of water resources, mineral resources depletion, world hunger/food, nuclear stuff, water quality, energy consumption, and GCC.

In the 1st grade, five environmental issues are presented, which are solid waste disposal, hazardous chemicals, biodiversity reduction, human health, and air pollution. The issue of biodiversity reduction has the highest average score with 35.71%, while the human health issue has the lowest average score among the five environmental issues presented by the 1st grade Lebanese national science textbook.

In the 2nd grade, only three environmental issues are presented, which are solid waste disposal, biodiversity reduction, and human health, with the issue of biodiversity reduction having the highest average score (60%).

The 3rd grade textbook includes more environmental issues than the 1st and 2nd grade textbooks. Nine environmental issues are presented, with the issue of marine pollution having the highest average score, with 36.9%, among the nine environmental issues.

Ten environmental issues are presented in the 4th grade textbook. The issue of marine pollution has the highest average score with 23.33% among the ten environmental issues presented. Moreover, hazardous chemicals and soil erosion issues have the same average scores with 6.67% each, and land use and extinction

issues have the same average scores with 3.33%, which is the lowest among the ten environmental issues.

In the 5th grade, only five environmental issues are presented, with a significant difference between the highest and lowest average scores. The air pollution issue has the highest average score with 65%, while habitat destruction and ozone depletion issues have the lowest average scores with 5% among the five environmental issues presented by the 5th Lebanese national science textbook.

In the 6th grade, seven environmental issues are presented. The air pollution issue has the highest average score with 36.37%. In addition to that, hazardous chemicals, habitat destruction, and population growth have the same average score (9.09%) among the seven environmental issues presented by the 6th Lebanese national science textbook.

Comparing the six textbooks, the marine pollution issue has the highest average score with 23.04%, while the ozone depletion issue has the lowest, with 0.52%, among the thirteen environmental issues presented by the six Lebanese national elementary science textbooks.

4.2. Environmental literacy components

The environmental literacy components presented by the Lebanese national elementary science textbooks (grades 1-6) are presented in Table 2.

In the 1st grade textbook, environmental behavior has the highest inclusion level, with 37.5% (12), while environmental knowledge has the lowest level, with

9.38% (3), among the environmental literacy components in the 1st grade Lebanese national science textbook.

Examples on environmental literacy components in 1st grade science textbook:

- Sentence: In my environment, there are many kinds of plants. **(Sc1, p. 90- Knowledge)**

- Title: I Care for Plants. **(Sc, p. 115- Affect)**

- Exercise: I circle the wrong actions that hurt the plants. **(Sc1, p. 119- Cognitive skill)**

- Picture: A boy throwing garbage in the trash bin. **(Sc1, p. 43- Behavior)**

Table 2. Frequency and percentage distribution of Environmental Literacy Components in the Lebanese national elementary science textbooks.

Lebanese elementary Science textbooks								
Components of environmental literacy		**Grade 1**	**Grade 2**	**Grade 3**	**Grade 4**	**Grade 5**	**Grade 6**	**Total**
knowledge	**f**	3	11	33	30	24	31	132
	%	9.38	16.18	49.25	46.88	80	55.36	41.64
Affective tendency	**f**	11	10	1	6	1	0	29
	%	34.38	14.71	1.5	9.38	3.33	0	9.15
Behavior	**f**	12	26	13	15	1	2	69
	%	37.5	38.24	19.4	23.44	3.33	3.57	21.77
Cognitive skill	**f**	6	21	20	13	4	23	87
	%	18.8	30.9	29.85	20.3	13.34	41.07	27.44
Total	**f**	32	68	67	64	30	56	317
	%	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Similarly, in the 2ⁿᵈ grade textbook, environmental behavior has the highest inclusion level with 38.24% (26) among the components of environmental literacy. However, environmental affective tendency has the lowest level with 14.71% (10) among the environmental literacy components.

Examples on environmental literacy components in 2ⁿᵈ grade science textbook:

- Sentence: A garden is made up of soil, plants, and some animals. **(Sc2, p. 17-Knowledge)**

- Sentence: Sami's father likes his garden. **(Sc2, p. 22- Affect)**

- Question: Make a plan to help Nour make the garden better. **(Sc2, p. 47- Cognitive skill)**

- Sentence: The teacher asked Fadia to pick up the trash and throw it. **(Sc2, p. 29-Behavior)**

In the 3ʳᵈ grade textbook, environmental affective tendency has a frequency of 1 with a 1.5%, which is the lowest level among the environmental literacy components in the 3ʳᵈ grade Lebanese national science textbook.

Examples on environmental literacy components in 3ʳᵈ grade science textbook:

- Sentence: The place where animals and plants live together is called their environment. **(Sc3, p. 26- Knowledge)**

- Picture: A boy sitting happily in the nature without harming it. **(Sc3, p. 108- Affect)**

- Question: You might want to propose a list of solutions. **(Sc3, p. 52- Cognitive skill)**

- Sentence: In order to protect our environment, we must not cause fires. **(Sc3, p. 33-Behavior)**

In the 4th grade textbook, environmental affective tendency has the lowest level with 9.38% (6) among the environmental literacy components in the 4th grade Lebanese national science textbook.

Examples on environmental literacy components in 4th grade science textbook:

- Sentence: Many wild animals in Lebanon are endangered. **(Sc4, p. 57- Knowledge)**

- Sentence: I commit to myself to protecting freshwater from pollution. **(Sc4, p. 129-Affect)**

- Question: What are some ways you can suggest to help him conserve his soil? **(Sc4, p. 240- Cognitive skill)**

- Sentence: Never pick a wild mushroom or touch it. It might be poisonous. **(Sc4, p. 122- Behavior)**

In the 5th grade textbook, environmental affective tendency and environmental behavior have the same lowest level with 3.33% (1), among the environmental literacy components in the 5th grade Lebanese national science textbook.

Examples on environmental literacy components in 5th grade science textbook:

- Sentence: Deforestation causes a disequilibrium in the proportion of oxygen in the air. **(Sc5, p. 45- Knowledge)**

- Question: Why do you think this man cares about planting those trees? **(Sc5, p. 53-Affect)**

- Question: Write a letter suggesting ways of preserving forests in Lebanon. **(Sc5, p. 45- Cognitive skill)**

- Picture: Firefighters turning off a fire in the forest. **(Sc5, p. 45- Behavior)**

In the 6th grade textbook, environmental affective tendency is not presented at all among the environmental literacy components.

Examples on environmental literacy components in 6th grade science textbook:

- Sentence: There is a continuous increase in the human population on earth. **(Sc6, p. 67- Knowledge)**

- Question: Propose three solutions to reduce the atmospheric pollution in Lebanon. **(Sc6, p. 117- Cognitive skill)**

- Sentence: Adding filters to cars **(Sc6, p. 132- Behavior)**

- There has not been found information about affective tendency component.

Comparing the six science textbooks, it is shown that environmental knowledge has the highest inclusion level with 41.64% (132), while environmental affective tendency has the lowest level with 9.15% (9), among the environmental literacy components in the 1st, 2nd, 3rd, 4th, 5th, and 6th grade Lebanese national science textbooks.

Regarding the inclusion level of each of the environmental literacy components, it is shown that the highest inclusion level of environmental knowledge is 80% in the 5th grade textbook. The highest inclusion level of environmental affective tendency is 34.38% in the 1st grade textbook. In addition to that, it is shown that the highest

inclusion level of environmental cognitive skill is 41.07% in the 6th grade textbook. Moreover, it is shown that the highest inclusion level of environmental behavior is 38.24% in the 2nd grade textbook.

4.3. Environmental literacy components of the environmental issues

The environmental literacy components of the environmental issues presented by the Lebanese national elementary science textbooks are presented in Table 3.

The results show that the environmental knowledge component is the most emphasized component in 9 out of 13 environmental issues presented by the Lebanese national elementary science textbooks which are marine pollution, hazardous chemicals, land use, ozone depletion, acid rain, population growth, human health, air pollution, and soil erosion.

On the other hand, the environmental behavior component is the most emphasized component in 3 out of 13 environmental issues which are solid waste disposal, biodiversity reduction, and habitat destruction.

Both environmental knowledge and environmental behavior components are equally emphasized in the extinction environmental issue in the Lebanese national science elementary textbooks.

However, the environmental affect and environmental cognitive skill are not highly emphasized in any of the environmental issues presented by the Lebanese national elementary science textbooks (grades 10-6).

Table 3. The percentages of environmental literacy components in the environmental issues presented by the Lebanese national elementary science textbooks.

	% Knowledge	% Affect	% Behavior	% Cognitive skill	Total %
Armed conflict/ war	0	0	0	0	0
Wildlife manag.	0	0	0	0	0
Invasive sp.	0	0	0	0	0
Dist. of water res.	0	0	0	0	0
Marine pollution	72.727	2.27	22.73	2.273	100
Mineral res. Depeletion	0	0	0	0	0
Solid waste disp.	38.89	0	61.11	0	100
World hunger/ food	0	0	0	0	
Haz. Chem.	73.9	8.71	17.39	0	100
Biodiversity red.	25.71	0	74.29	0	100
Hab. Destruction	22.22	0	77.78	0	100
Land use	66.67	0	33.33	0	100
Ozone depletion	100	0	0	0	100
Acid rain	100	0	0	0	100
Extinction	50	0	50	0	100
Nuclear stuff	0	0	0	0	0
Water quality	0	0	0	0	0
Energy consumption	0	0	0	0	0
Pop growth	100	0	0	0	100
Human health	57.14	42.86	0	0	100
GCC	0	0	0	0	0
Air pollution	75	11.11	13.89	0	100
Soil dest/erosion	66.67	0	33.33	0	100

This section presented the findings of data collection of the environmental issues and environmental literacy components presented by the Lebanese national elementary science textbooks. The findings will be discussed in the section that follows.

5. Discussion and conclusion

The results of the study indicated that the environmental issues presented by the Lebanese national elementary science textbooks are marine pollution, solid waste disposal, hazardous chemicals, biodiversity reduction, habitat destruction, land use, ozone depletion, acid rain, extinction, population growth, human health, air pollution, and soil erosion. Overall, marine pollution was the most covered topic and ozone depletion was the least covered topic in the Lebanese national elementary science textbooks. This means that global environmental issues are not highly emphasized in these textbooks. Similar results found that little attention was devoted to global issues in elementary science textbooks (Hamm & Adams, 1989). On the contrary, ozone depletion was one of the main environmental issues covered in Turkey (Derman & Gurbuz, 2018).

Additionally, based on the results of the study, it was found that not all components of environmental literacy received the same attention in the Lebanese national elementary science textbooks. While the environmental knowledge component was the most highlighted among the elementary science textbooks, the other environmental literacy components were partially or totally ignored. Similar results were obtained in a study based on comparative content analysis of the science objectives, in which it was found that knowledge received the highest focus in both Bulgaria and Turkey, compared to skills, attitudes, and behaviors (Erdogan et al., 2009). Similarly, Karimzadegan and Meiboudi (2012) used a comparative content analysis method and found that not all components of environmental literacy get equal priority in Iran; while environmental knowledge is heavily emphasized, other components are either disregarded completely or are only partially addressed. The results are also consistent with a study that found that in Macedonia, the

affective component of environmental literacy is inadequately integrated (Srbinovskia et al., 2010).

Moreover, the results of the study showed that the environmental literacy components do not receive the same attention in the environmental issues presented by the Lebanese national elementary science textbooks, in which the knowledge and behavior components are the mostly highlighted while affect and cognitive skill components are either partially included or completely disregarded.

The findings of this study have to be seen in light of a main limitation. The primary limitation to generalizing these results is the absence of a triangulation method. In qualitative research, triangulation refers to the use of various methods or data sources to build a thorough understanding of a topic (Patton, 1999).

These findings have important implications for updating the Lebanese science curriculum. Curriculum developers and analysts can, through this study, be informed about the environmental issues and environmental literacy components presented by the Lebanese national elementary science textbooks. The current study's results showed the most and least covered environmental issues in these textbooks and the highest and lowest inclusion levels of environmental literacy components. As a result, curriculum developers and analysts can use the results of the current study to develop and analyze a more updated science elementary curriculum and textbooks. Furthermore, future research could extend this work to determine the environmental issues and environmental literacy components presented by all Lebanese science textbooks, including elementary, primary, middle, and secondary textbooks.

This study aimed to determine the environmental issues and environmental literacy components presented by the Lebanese national elementary science textbooks. Based on content analysis that allowed for both qualitative and quantitative data collection, it can be concluded that marine pollution, the most covered environmental issue, solid waste disposal, hazardous chemicals, biodiversity reduction, habitat destruction, land use, ozone depletion, the least covered environmental issue, acid rain, extinction, population growth, human health, air pollution, and soil erosion were the environmental issues presented by the Lebanese national elementary science textbooks. Additionally, the most highlighted environmental literacy component in these textbooks was the environmental knowledge compared to the affective, cognitive skill, and behavior components. Moreover, the most highlighted environmental literacy components in the environmental issue topics were knowledge and behavior.

Based on these conclusions and considering that the Lebanese curriculum has not been updated since 1997, practitioners should take into consideration developing and updating the Lebanese science curriculum. This update might be necessary to include more current environmental issues and to give all environmental literacy components (knowledge, affect, cognitive skill, and behavior) the same attention in the Lebanese national elementary science textbooks.

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Appendices

Appendix 1.

1st grade textbooks			
Environmental issues	Lesson/ chapter	Page number	Frequency
Armed conflict/ war			
Wildlife manage.			
Invasive sp.			
Dist. of water res.			
Marine pollution			
Mineral res. Depletion			
Solid waste disp.			
World hunger/ food			
Haz. Chem.			
Biodiversity red.			
Hab. Destruction			
Land use			
Ozone depletion			
Acid rain			
Extinction			
Nuclear stuff			
Water quality			
Energy consumption			
Pop growth			
Human health			
GCC			
Air pollution			
Soil dest/erosion			

Appendix 2.

Issue	% in G1	% in G2	% in G3	% in G4	% in G5	% in G6	**Total**
Armed conflict/ war							
Wildlife manage.							
Invasive sp.							
Dist. of water res.							
Marine pollution							

Mineral res. Depletion						
Solid waste disp.						
World hunger/ food						
Haz. Chem.						
Biodiversity red.						
Hab. Destruction						
Land use						
Ozone depletion						
Acid rain						
Extinction						
Nuclear stuff						
Water quality						
Energy consumption						
Pop growth						
Human health						
GCC						
Air pollution						
Soil dest/erosion						
Total						

Appendix 3.

1st grade textbooks				
Lesson/ chapter	Page number	EL component	Frequency	Percentage %
Knowledge				
Affective tendency				
Behavior				
Cognitive skill				