

**A Comparative Analysis of Inquiry- Based Tasks in Science textbooks in  
Saudi Arabia and Lebanon**

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## **Abstract**

Studies nowadays are concerned by the reforming of science education according to the standards of science mainly the American National Science Education Standards that give an importance to inquiry experience in the classroom highlighting the 5 features of inquiry. For this reason, the aim of this study was to evaluate elementary science textbooks of two Arab countries (Lebanon and Saudi Arabia) and compare the inclusion of inquiry within the textbook teaching materials between the two countries based on 2 models of inquiry; the five features model and Herron's scale of inquiry. The whole elementary textbooks of both countries were evaluated from cover to cover taking into consideration all exercises, experiments, tasks, questions... and the results were analyzed accordingly for every grade level and then the whole elementary level. The results and comparison of inquiry inclusion revealed that Saudi Arabian elementary textbooks encouraged inquiry-based experience more than the Lebanese textbooks with different percentages for each feature. However, in both countries this inclusion was less than 50% and requires publishers to include more inquiry-based tasks within the textbooks especially when the textbooks serve as a primary resource in learning and teaching. Meanwhile, Saudi Arabian textbooks had teaching materials that are more student-centered than the Lebanese textbooks. They had a great number of activities within the 4<sup>th</sup> level of Herron's scale while the Lebanese textbooks had more activities within the 1<sup>st</sup> level. Further research should be conducted in more textbooks within more countries to better understand the inclusion of inquiry in textbooks and its quality between different textbooks.

## **Introduction**

### **Research Area**

As my last semester was going and due to my interest in teaching science, I was influenced by the inquiry-based method lecture in my PCK Science course. How it makes instructions consistent with NOS and focuses on the process rather than product to reflect science construction. This made me wonder, during the elementary level science teachers focus highly on books to introduce the topic; then, how much inquiry-based learning is provided through this resource in Lebanon? The research was consistent mainly with science subject within the elementary level because science is part of our daily life and it is important to have students explore science to understand it more rather than having students develop facts stated by the teacher. Moreover, science through inquiry starts at the beginning of the elementary level where students are more into exploring and have the courage to know more not to mention that at this stage students tend to use previous knowledge and experiences to communicate new experiences which is an important part of science inquiry.

### **Research problem**

This a concern that would be a good starting point when dealing with reforming science education according to the standards. My primary goal is to explore the inclusion of inquiry experience in the Lebanese and Saudi Arabian national elementary science textbooks and compare it.

### **Purpose**

- To explore inquiry-based experience in a series of 5 elementary science textbooks of 2 Arab countries (Lebanon and Saudi Arabia).
- To compare the inquiry levels in sets of books of both countries.

### **Research Question**

"How do Lebanese and Saudi Arabian elementary science textbooks compare in terms of providing inquiry-based experiences for learners?"

### **Rationale**

Dunne et al, (2013) and Ghaderi, (2010) are research conducted to explore the different ways to support science learning in the classroom; dealing with NOS, curriculum focus and instruction. These studies focused more on the high school level in their exploration of the inclusion of inquiry in science textbooks. Other study by park et al, (2009) focused more on reforming science teaching/ learning by exploring the standards and their aligning with the curriculum along with inquiry and this study was made within the high school level too. This shows that more research should be conducted on inquiry inclusion within the elementary level science textbooks.

However, Aldahmash et al., (2016) did explore the elementary level, where they analyzed the inquiry experience in Saudi Arabia's elementary science textbooks. But the point is that these researchers analyzed the adopted MC-GRAW HILL American version of science textbooks rather than the Saudi Arabian national ones. This raises the question; to what extent is inquiry-based experience included in the national Saudi Arabian textbooks?

On the other hand, inquiry inclusion in textbooks was compared between the US and Korea (Park et al., 2009) and Iran and America (Ghaderi, 2010) exploring random elementary textbooks, but no study compared the Lebanese national textbooks to Saudi Arabian textbooks taking into consideration that Lebanon is one of the poorest Arab countries and Saudi Arabia is considered one of the most richest countries in the Arab world which makes this fact an eye of interest to compare the education in both countries in general and inquiry experience in textbooks in specific.

## **Significance**

As schools now are working to reform science education according to standards of science and in a way to prepare social citizens and have students understand the NOS and since teachers in the elementary levels rely heavily on books as primary resource for students to acquire the knowledge it is important to shed the light on the importance of inquiry in experiences and explore its presence in a way that helps in reaching these goals mentioned.

Inquiry based experience results in students engaging in the process of learning, analyzing, thinking, using evidence, arguing based on real experience, asking questions, forming hypothesis, predicting and trying to find answers. This helps students understand what is science and why they are learning science. In the context of practice and teaching, it is important that this source of education (the textbook) teaches students the science as process and assist them to use their higher order thinking skills rather than providing the basic products. Therefore, such study would help teachers understand the difference between textbooks that provide inquiry and those that does not and know how to integrate inquiry in the learning process. On the other hand, comparing different books gives publishers an insight into the different ways/strategies used in developing inquiry experience that they could benefit from when publishing their textbooks from one side and help them take into consideration inquiry experience in the future when publishing these textbooks and base them on older versions.

In the context of research, this would encourage researchers to look further into the education field, how it works and compare it within different countries. It would also open the door for future research to try to study if there is a relation between the development of the country and education or they are not linked.

## **Literature Review**

### **Lit Review**

In elementary classes, textbooks serve as an essential tool for learning (Lewis, 2012). Whether it is hard copy or an E-book it still serves as a primary resource for students and teachers at the same time (Lewis, 2012). For instance, in teaching science, teachers have relied heavily on textbooks - to present concepts- as a source of scientific information (Yacoubian et al., 2011).

Science textbooks provide a variety of instructions, tools, experiment and other content that aid the teacher in lesson planning (Lewis, 2012). However, textbooks are also considered to provide students with the subject outline, applications and borders for experience and evaluations (Aldahmash et al., 2016) which means that they are major requirements to fulfill the learning outcomes since they contribute to teaching and learning. Giving science textbooks this major role in the learning/teaching process emphasizes how important it is to analyze to what extent inquiry – based learning is provided through these textbooks (Schulman & Tamir, 1973).

### **An insight on Inquiry**

Lederman (2004) defines inquiry as a combination of traditional science process along with developing science knowledge by reasoning, analyzing, experimenting, interpreting, predicting, combining data, formulating and answering questions. The forementioned process is the same process scientists go through in investigating new research (Dunne et al., 2013).

According to Anderson (2002) inquiry is used in three terms; (1) scientific inquiry which is what scientists do during their investigations, (2) inquiry learning that is the product of scientific inquiry done in classroom, and (3) inquiry teaching which is the process of acquiring scientific literacy through different inquiry-based tasks and activities. The analysis of inquiry through

science textbooks falls in the 3<sup>rd</sup> dimension that is scientific literacy is acquired through inquiry-based activities that should be presented in the textbooks since as it was said before the textbook plays major role in teaching and learning. To wrap up, it can be said that inquiry in principle is a set of practices applied in order to achieve long term scientific literacy.

The literature compares the traditional textbooks with inquiry-based textbooks in terms of activities, tasks, experiments... Then it moves further to the different models of inquiry; 5 features of inquiry, Herron's scale and the 5E model. In addition to that, it highlights the major functions of inquiry-based experience in a textbook and gives an insight on inquiry in the Lebanese science textbooks.

### **Science textbooks between the traditional and inquiry-based tasks**

Lewis, 2012 claims that traditional textbooks have no content and strategies that enhance inquiry learning. She believes that these textbooks do not go through the construction of science but rather present facts, concepts and descriptive information that do not model inquiry learning.

Meanwhile, Dunne et al., (2013) argues that inquiry tasks support exploring questions, arguing, using evidence, understanding context, applying, experimenting and thinking critically. However, traditional textbooks focused on reading, answering questions, memorizing, getting concepts only and if students were to perform experiments, the textbook guided them through it rather than having them think in developing the suitable procedure (Lewis, 2012). It is clear that, the type and way the textbooks present the experiments, questions, tasks and problems assist the way students grasp the information. For that, these tasks, experiments and questions if did not follow one of the different models of inquiry, textbooks won't be able to address science inquiry through learning. Thus, textbooks are to be analyzed, studied and evaluated based on any of the different models of inquiry in terms of exercises, problems, questions, experiments and tasks.

Research was conducted in various countries including (Ireland, America, Iran, Korea, U.S and Saudi Arabia) to analyze inquiry-based tasks in textbooks using different frameworks. Each study adopted a different model of inquiry and its implementation basing their work on previous studies.

### **Textbook Inquiry Analysis Frameworks**

To evaluate inquiry in textbooks, researchers went into analyzing the content of textbooks in terms of the different materials presented within each textbook (tasks, exercises, experiments, procedures...) (Lewis, 2013). It is a considered a systematic method that helps in evaluating textbook materials and investigating the needed information (Lewis, 2012). Thus, content analysis has the ability to evaluate to what extent the tasks in the textbooks are able to promote inquiry (Yang & Liu, 2016). However, in order to have a valid content analysis, Lewis (2012) and Dunne et al. (2013) claim that it is important to have “objectivity” that is developing the criteria that the content is to be analyzed upon it.

Different studies developed their criteria based on the 3 different models of inquiry; the 5E model, 5features of inquiry and Herron’s scale.

### ***The 5 Features of Inquiry***

The 5 features of inquiry were emphasized in the American National Science Education Standards (NRC, 2000). These features contribute to textbooks helping learners:

1. Engage in scientifically oriented questions,
2. Use evidence as a priority to answer questions
3. Use evidence to formulate explanations
4. Connect scientific knowledge with explanations

5. Communicate this knowledge and explanations with others (Aldahmash et al., 2016).

The 5 features of inquiry were models used in the analysis in both studies investigated by Lewis (2012) and Aldahmash et al. (2016). Although these studies used the same features, each developed their study in their own perspective of inquiry.

Lewis (2012) started by classifying the units in the textbooks into the 3 branches of science: Physics, life and earth science. Similarly, Aldahmash et al. (2016) adopted this classification with an extra “Chemistry” branch. Analyzed tasks in textbooks are the practical activities such as goals, questions, diagrams, experiments, procedures and tables. Following the coding criteria, Aldahmash et al. (2016) first checked if the practical activities addressed one, more or none of the five features by developing a rubric (Scientific inquiry skill analytic rubric-SISAR) and putting a check mark for every feature presented in the activities. In Aldahmash’s et al. (2016) study and since the analyzed textbooks were adopted from the U.S the results revealed 99% inquiry inclusion within the evaluated textbooks which means that the U.S textbooks highly encouraged inquiry-based tasks due to the fact that the 5 features of inquiry were emphasized in the American National Science Education Standards.

### ***Herron’s Scale***

To measure the openness of inquiry in a specific activity/task, researchers use the 1 – 4 scale developed by Herron (1971) known as “Herron’s scale. In the first level, students are provided with the problem, procedure and solution whereas in level 2 inquiry slightly increases by providing students with the problem and procedure only. Moreover, in the 3rd level inquiry openness is higher, giving students only the problem and having them think of the procedure to find solution and level 4 has the highest inquiry openness by which students have the chance to

formulate their own problems and work on procedure and solution in their own way. Herron's scale was adopted by the study of Yang and Liu (2016) as a second category of inquiry analysis in textbooks while Aldahmash et al. (2016) analyzed the whole practical activities based on it by developing a specific rubric having the 4 levels.

However, the major difference in these 2 studies reflecting the 5 features as a main method of analysis is that Aldahmash et al. (2016) admitted the selection of random textbooks in Saudi Arabia and these textbooks were the U.S adopted books and not the national ones. The fact of adopting other countries textbooks to analyze inquiry within a specific country weakens the results of the study. For this, a research analyzing national Saudi Arabian textbooks gives more precise and valid results concerning inquiry in this country.

On the other hand, Lewis's (2012) research was more specific. She based her research on 3rd grade textbooks of 2 years editions (2000 before the reform and 2010 after the reform). She compared them in terms of inquiry relying on the activities defined by the publisher as inquiry. Lewis (2012) provided a framework dividing activities as full and partial inquiries and non-inquiry labeled inquiry (referring to those set by publisher as inquiry exercises but ended up to have none of the 5 features).

### ***5E Model***

The 5E model can carry out the different phases of inquiry process. It was developed based on the idea that IBSE relies on process and not specific activity as claimed by Anderson (2002). The 5E model first aligns with the model developed by Mayer (1999) that relates text to constructivism. This model creates texts that help students relate prior knowledge with the given instruction (Mayer 1999). A step that would contribute in students engaging with the teacher in the lecture and thus, this is the 1st phase of the 5E model known as the Engagement phase

(Dunne et al., 2013). The rest 4 phases of the 5E model are Exploration, Explanation, Elaboration and Evaluation.

However, Dunne et al. (2013) argues that usually the books would never ask students to apply what they learned outside the context of class and this eliminates the Elaboration phase. This claim was consistent with the findings of Aldahmash et al. (2016) that upon the books they analyzed, no questions required students to connect their knowledge to outer context. In addition to that, Dunne et al. (2013) assumes that evaluation is done by the teachers' own method and it is less likely to have teachers depend on the evaluation found within a book. For that, in most cases it is unlikely to find textbooks emphasizing evaluation. Thus, the evaluation form is eliminated too. Therefore, the major focus in inquiry analysis relies primarily on the 3 first phases (engagement, exploration and explanation). Dunne et al. (2013) claim that at least one of these 3 phases must be presented within the textbook activities.

Herron's scale, the 5 features of inquiry or the 5 E model focus mainly on activities having students engage in science, ask questions, investigate, think, analyze, experiment, interpret and most of all explain science knowledge and be able to communicate it. This in return would help students understand the nature of science and by that develop their inquiry skills. In other words, it is evident that the 3 models focus on students working on their own to learn science. However, each model has its unique characteristics. The 5 features inquiry model focuses more on activities that encourage students to ask questions and try to find answers using evidence and then be able to explain it and communicate their knowledge based on the evidence they came up with that help them prove their answers. On the other hand, Herron's scale focuses on students investigating science on their own. Here, they create and synthesize their own questions, think of ways and procedures to go through their investigation (experiment is not

presented, they develop their own) and after that, students work on finding the solutions based on their own analysis of what they went through and did. As such within Herron's model the whole work is done by the students.

### **The function of inquiry-based experience in textbooks**

Inquiry in textbooks isn't only about having tasks acquiring the different features of inquiry. Sometimes textbooks are considered inquiry based if they perform a number of specific functions. This means that, the evaluation of inquiry within textbooks is not only based on following a specific model of the 3 models. It can be evaluated based on the function inquiry-based textbooks can serve. According to Yacoubian et al., (2011) and Yang and Liu (2016), these functions include "(1) textbooks promoting scientific content knowledge, (2) textbooks promoting understanding science nature and science inquiry, and (3) textbooks sharpening inquiry skills. However, both had additional functions including textbooks providing procedural knowledge and developing positive attitudes towards science (Yacoubian et al., 2011) and textbooks helping students develop their higher order thinking (HOTS) (Yang & Liu, 2016). Yacoubian et al. (2011) rated textbook units on a scale 1-4 for each function. On the other hand, Yang and Liu (2016) adopted several theories/hierarchies and methods to evaluate the above functions including Gagne's learning hierarchy to evaluate using inquiry skills, Lederman's identification (2012) to evaluate understanding scientific inquiry and bloom's taxonomy with 21st century skills to evaluate HOTS. Using Lederman's identification Yang and Liu (2016) designed specific items for evaluation (observing, inferring, measuring, communicating, classifying, predicting, asking questions, formulating hypothesis, interpreting). Moreover, they claim that there is disagreement on whether Bloom's taxonomy's cognitive objectives (1st three) (analyze, evaluate and create) are considered HOTS or the 21st century skills like decision

making, critical thinking and creative thinking are the HOTS. Looking into this disagreement, bloom's taxonomy objectives are related and processed to develop the 21st century skills and thus, HOTS is a combination of both bloom's taxonomy and 21<sup>st</sup> century skills and all together serve in encouraging inquiry-based experience in textbooks.

### **Inquiry experience in the Lebanese educational system**

Lebanese curriculum emphasizes on implementing tasks that are more student centered. These tasks would serve in developing inquiry skills. According to Zeitoun and Hajo (2015), Lebanon rests below the average in the understanding of scientific knowledge and scientific inquiry. Meanwhile, Abed El Khalick et al. (2003) claims that the curriculum emphasis on inquiry is not enough in promoting inquiry skills in class and they refer to that due to two major reasons; one of them is the confusion of whether science should be taught as inquiry or science is taught through inquiry and the other one is that the curriculum elaboration about inquiry is still limited. They conclude that Lebanese teaching, textbooks and assessment practices still lack the alignment with the emphasis given to inquiry. This conclusion is consistent with the findings of Zeitoun and Hajo (2015); that after analyzing the process skills in 3rd cycle (grades 7, 8 and 9) Lebanese National textbooks, they found that the textbooks relied heavily and mostly on basic skills related to content and there was poor reliance on process skills that supply inquiry in the 3 domains of science (chemistry, physics and biology).

Nearly all the studies ended up with almost the same results; Inquiry based tasks were either not presented at all or poorly presented. The inclusion of the 5 features of inquiry in textbooks seemed to be rarely presented within the practical activities even the ones classified as inquiry tasks (Lewis, 2012 and Aldahmash et al., 2016). Moreover, Yacoubian et al. (2011) found that more than half of the books didn't promote any of their specified criteria except for

the development of positive attitudes towards science, where all the selected book did foster a positive attitude. However, they claim that fostering positive attitude is a normal result and it was expected in a science textbook. The studies performed gives a significance that even though the curriculum reform has a major emphasis on Inquiry in classroom, textbooks still lack the ability to provide inquiry-based tasks.

## **Conclusion**

It is clear that some textbooks across the world lack the ability to develop inquiry skills even after the emphasis on it within the curriculum. Some reasons may be due to the fact that some teachers are beyond understanding the actual functions of inquiry. Other reason is that some schools still didn't emphasize inquiry as critical part of its educational program and teachers need training programs for inquiry since, as commonly agreed they have the major role in fostering inquiry in classroom.

The research conducted in the different countries used a validated and critical methods in their analysis. However, national textbooks were not the interest of these studies. The evaluated books were adopted books. From the other side, the analysis was done on limited number of textbooks and this would not provide consistent results.

Moreover, the pre-mentioned research by Zeitoun and Hajo (2015) was the only research done in Lebanon on inquiry-based task in textbooks and it didn't attribute to inquiry in specific but to the presence of process skills as means of inquiry. However, it analyzes 3 national textbooks of 3 graders only. This calls for a further investigation on the presence of inquiry in the national Lebanese textbooks with a wider selection of textbooks within different grade levels especially elementary grades since these grades serve as the bases of inquiry implementation and development. In addition to comparing these textbooks with more developed countries' national

textbooks to check whether other factors of the country could contribute to the implementation of inquiry in textbooks or it is primary related to educational systems. One of these developed countries that would be of interest is Saudi Arabia. Would the evolution and development in this country shed the light on having textbooks that prepare students as citizenships by implementing inquiry and helping them gain scientific literacy, understand nature of science and develop the ability to communicate knowledge gained? Thus, the major question here is to what extent textbooks in Saudi Arabia and Lebanon differ in promoting inquiry experience in the process of learning and teaching?

### **Theoretical Framework**

Several frameworks were used upon researchers to conduct data analysis. Some used their own perspective to evaluate the content (like Chiappetta and Fillman, 2007 or Dunne et al, 2007) where they conducted the analysis based on difficulty or reliability of content, inclusion of subject matter or epistemological orientation.

In this research, data analysis was conducted based on the framework of Aldahmash et al., (2016) that used two main rubrics for evaluating Saudi Arabian textbooks in terms of inquiry presence. Aldahmash's et al. (2016) evaluates elementary textbooks in terms of inclusion of the 5 inquiry features. These textbooks are adopted from the U.S., and used by Saudi Arabian schools, and that's why they used the 5 inquiry features. The results of this study showed that 99% of the textbooks' materials included one or more of the 5 features (maybe because they were originally published according and in assistance with the American science standards). However, most of the activities ranged between the 2<sup>nd</sup> and 3<sup>rd</sup> level of Herron's scale.

The following rubrics were used by the researchers of this study;

### ***Inquiry Features Rubric***

The first rubric was the scientific inquiry “essential features” rubric that comprises the 5 essential features identifies by the ANSES (American National Science Education Standards). Aldahmash et al., 2016 used the 5 features model because the textbooks under analysis were the MC-GRAW HILL textbooks adopted from the U.S. These features evaluate how textbooks are able to;

Engage students in scientifically oriented questions (feature 1)

Have students use evidence in responding to questions (feature 2)

Have students form explanations from evidence (feature 3)

Encourage students to connect explanations with knowledge (feature 4)

And connect/ justify explanations to others (feature 5)

### ***Inquiry Level Rubric***

The second rubric was to evaluate the level of inclusion of each feature based on Herron’s scale of inquiry depending mainly on structure and guidance of each activity. At level one, the activity includes the question, procedure and provides the solution too where students have nothing to determine. At level 2, students are provided with the problem, guidance through the procedure and specific guidelines to help them come out with the solution or argument. Meanwhile, at the third level it is more student- centered, students are provided with the problem and left with several options to evaluate and detect data but the solution is open for them to decide what to argue about and how. At the last level, it is highly student centered. Students are left with the freedom to formulate and pose their own questions, develop the procedure and choose what data to be evaluated and how.

Based on this, the final rubric included the 5 main features each with the 4 items representing the level of each feature. Means, the rubric was of 5 items within 20 sub-items

## **Methodology**

### **Data Collection**

Elementary national science textbooks series were analyzed in terms of inquiry inclusion. The main goal of this analysis was to compare the extent to which inquiry is included in science textbooks of two countries (Lebanon and Saudi Arabia) based on the 5 features of inquiry and then check if the inquiry-based activities are teacher or student centered based on Herron's 4 scale of inquiry. The analysis included 10 science textbooks, 5 elementary textbooks for Lebanon (CERD, 2018 & CERD, 2019) and the other 5 for Saudi Arabia (CSAE, 2013).

The Lebanese national textbooks analyzed were digital copies downloaded from the website "CRDP.org" that are issued by the center of Educational Research and Development. All practical activities were analyzed. Each of the science textbooks has five units, each unit with a specific number of lessons. Grade 1 science textbook were the 2018's 17th edition that aims in having students adopt to different health and environmental attitudes. Each lesson includes pictures for observation as a start, small activity, observation pictures as a summary and 2 evaluation cards (one for evaluating the acquisition of knowledge and the other for evaluating students' acquisition of healthy attitudes) (144 pages). Grade 2 (165 pages) and 3 (183 pages) science textbooks were both 2018's 18th and 16th editions respectively. Each lesson includes observational questions, knowledge to be known, activity and practice exercises. However, grade 4 (252 pages) and 5 (237 pages) textbooks were designed differently. Grade 4 was the 2019's 19th edition and grade 5 was the 2018's 18th edition. Each lesson includes objectives as problems to be solved, activities with addressing questions based on the activity and practice exercises.

On the other hand, the Saudi Arabian national textbooks (CSAE, 2013) were also digital copies downloaded from their national website (<https://sughayyirah.wordpress.com/>) issued by the center of Saudi Arabian education in 2013. Not to mention that these textbooks were analyzed in their Arabic versions. Grade 1(72 pages) and 3 (146 pages) science textbooks were of 5 units. Each lesson included pictures for observations for launching the theme (with directions given to the teacher at the footer of each page), questions and answers about scientific knowledge and practice exercises (some activities were included in some lessons). Grade 2 (160 pages), 4 (138 pages) and 5 (130 pages) were of 4, 7 and 4 units respectively. Each lesson had a main question as launching the theme, followed by one to two experiments with addressing questions to answer the main question and practice exercises. However, grade 4 and 5 textbooks had a section for the objectives at the start of each unit. It is important to mention that each textbook had a section called “what science teach us” before starting with the units. A total of 332 activities.

A total of 797 activities were analyzed in both countries’ textbooks (465 Lebanese and 332 Saudi Arabian).

The whole series of textbooks were analyzed (from cover to cover). All “launching the theme” questions, activities, experiments and practice exercises were evaluated taking into consideration that activities and experiments with questions were evaluated as a whole. In other words, for example the experiment along with the questions following it were considered as one activity when counting the total number of activities analyzed in every textbook.

## **Data Analysis**

### **Procedure**

In order to address my research question, I followed the framework by Aldahmash et al., (2016) for an analytical analysis. First each book was evaluated separately. For each book, all experiments, activities, questions and practice exercises were under analysis. Objectives, definitions and information were excluded. As such, data was analyzed in a table. The 5 features were the criteria used in the table and a checkmark was placed whenever an experiment/ activity or question called for a feature. If any practical exercise called for more than one feature, more than checkmark was placed. Each grade level was analyzed separately.

After that, for every feature, all checkmarks were calculated. Then these numbers were expressed in terms of percentage after dividing the number of occurrences of each feature by the total number of practical exercises found within each book. For example, in grade 2 Lebanese science textbook, the whole book was made up of 106 practical exercises. The 106 questions were evaluated. 15 were able to engage students in scientifically oriented questions. Thus, the 15 were multiplied by 100 and then divided by the total 106 to get 14.1% which means that 14.1% exercises of this textbook engage students in scientifically oriented questions. The same procedure was used for all 10 textbooks.

In order to evaluate each activity in terms of the 5 inquiry features, the following criteria was followed;

For feature 1 (Textbooks are able to engage students in scientifically oriented questions), the experiment, activity or question should aid students in investigations among answering questions that help them understand the nature of a special phenomenon or how it works. These types of questions are likely to be “why” and “how” questions. For example, “How does the water change into water vapor?” (Page 163, Lebanese textbook, grade 2). Students are asked to explain this phenomenon based on the experiment and observations they went through.

Another example, “why there is no change in the temperature of the third cup?” (Page 93, Saudi Arabian textbook, grade 4). In this experiment students are to investigate why heat exists. All questions following the same format and conditions were counted for this feature.

Samples are provided in appendix 1

For feature 2: textbooks are able to get students respond to questions based on evidence.

Activities must engage students in collecting and analyzing data as an evidence to use when responding to questions in order to prove it. They use their senses and observations (labs, experiments) to answer. For example, “what does the kidney looks like? Touch it softly and press on it, how it feels?” (Page 67, Saudi Arabia, grade 5). In this activity, students work with a real kidney, they are able to visualize it, touch it in order to answer the questions about its shape, color, and smooth, rigid...

Another example, “what happens when you push up the membrane, and what happens when you pull down the membrane? Compare between the apparatus and the respiratory system (page 116, Lebanon, grade 5). In this activity students are working on an experiment about the respiratory system, they observe the action of the balloons in the bottle when they move the membrane and then answer the questions based on what they observed. After that they are asked to link it to the respiratory system which falls in the third feature of having students use evidence in order to form explanations. By comparing the apparatus to the respiratory system, they can come up with how inhalation and exhalation works

Samples are provided in appendix 2.

Feature 3: textbooks are able to get students form explanations based on evidence. Here, students must link their previous knowledge to what they are already observing or encountering through the experiment in order to formulate the new concept or explanation. Having students form

explanations based on evidence by their own help them understand more the nature of the phenomenon. For example, in an activity in Saudi Arabian textbook, animals were placed in different groups, questions were illustrated such as “what is common between these animals, what is different? How do these animals eat? How do these animals reproduce” (pages 26, 27, 28, grade 2) After having students answer the questions based on evidence from the pictures, they would be able to form explanation about the different groups of animals (mammals, reptiles, birds...) and how are they classified?

Samples are provided in Appendix 3.

Within the 4th feature textbooks help students communicate their explanations to scientific knowledge. These activities require students evaluate their explanations based on the experiment, results and evidence. For example, “do you know now why the bulb has to match the battery? How did you know?” After students performed the experiment and answered the questions based on their observations, they were asked to evaluate their knowledge based on what they concluded and see if they did really grasp the explanation (page 82, Lebanon, grade 5).

And finally, feature 5: students are able to communicate and justify knowledge. Here textbooks’ role relies on having students share their explanations, ask questions, identify different explanations, and indicate misconceptions.

### ***Determining the level of inquiry***

Each activity/ question or experiment was evaluated based on its level of inquiry on a scale 1 to 4. For each material, and after placing a checkmark in the specific feature, it was evaluated based on the level of inquiry. Beside each checkmark, the level was evaluated and stated by adding a number (1 – 4). When the evaluation was done, each level was calculated for every feature and the final results were presented in two tables for each grade level and each country.

After placing all data in tables, the results were compared for each grade level among both countries. The comparison was done within grade levels of each country in terms of inquiry features then level of inquiry.

The final interpretation compared the whole series of elementary textbooks between Saudi Arabia and Lebanon in terms of inquiry features and levels too. In order to do that, first for every feature the occurrences were counted in each grade level and then divided by the whole number of features presented to get the frequency of occurrence of each feature in the elementary level for both countries. After that, the total number of inquiry features presented was divided by the total number of practical exercises for each country to analyze the percent of inquiry inclusion in the elementary level for each country textbook in terms of the 5 features. Sample and results are provided in table 6.

## Results

In this section I started by presenting the frequency and percentage for each of the 5 features of inquiry in science textbooks within each grade level of both countries and then compared them. The frequency of levels of inquiry were also presented and compared in terms of grades among both countries. After that, the frequency and percentage of each inquiry were compared in general for both countries (the whole elementary level).

**Table 1**

*Sample Table Comparing the Number of Activities Within Each Feature and Their Percentage between Saudi Arabia and Lebanon in Grade 1*

Grade 1	Saudi Arabia		Lebanon	
	Number of activities	Percentage (in %)	Number of activities	Percentage (in %)
Scientifically oriented questions	5	14.70	0	0
Use evidence in responding to questions	3	8.82	0	0
Formulate explanations from evidence	7	20.58	0	0
Connect explanations to scientific knowledge	2	5.88	0	0
Communicate/ justify explanations to others	1	2.94	0	0
<b>Total</b>	<b>18</b>	<b>52.92</b>	<b>0</b>	<b>0</b>

Table 1 shows the percentage of the features of inquiry in grade 1 in both Lebanon and Saudi Arabia. The results show that the Lebanese national textbook for grade one didn't include any of the 5 inquiry features. This was clear while analyzing the chapters of the book, where

each chapter had only pictures, asking students to observe the pictures and read the information below it or a question in the opening followed by pictures that answer it. However, the practice exercises were also about pictures asking students to put an 'X' or a checkmark for right and wrong actions. Thus, the whole book was about observing pictures and there was no engagement of students. This reveals the results that there wasn't any inquiry feature included.

On the contrary, 52.92% (18 out of 34) of the exercises included one or more of the inquiries features in the grade 1 Saudi Arabian national science textbooks. The results indicate that feature 3, textbooks make students form explanations using evidence, was the dominant. The percentage of the inclusion of this feature was 20.58% (7 out of 34). Meanwhile, feature 1, textbooks engage students in scientifically oriented questions, was nearly more representative 14.70% (5 out 34) than the remaining features. However, feature 5, textbooks help students communicate and justify knowledge, was the least representative 2.94% (1 out 34). This means only one activity was able to engage students in communicating knowledge and it was mainly the result of group work and debate. Features 2 and 4 were nearly presented at the same range 8.82% and 5.88% respectively

**Table 2**

*Sample Table Comparing the Number of Activities Within Each Feature and Their Percentage between Saudi Arabia and Lebanon in Grade 2*

Grade 2	Saudi Arabia		Lebanon	
	Number of activities	Percentages (in %)	Number of activities	Percentages (in %)
Scientifically oriented questions	4	4.45	15	14.1
Use evidence in responding to questions	6	6.67	8	7.54
Formulate explanations from evidence	13	14.45	7	6.60
Connect explanations to scientific knowledge	3	3.34	2	1.88
Communicate/ justify explanations to others	5	5.56	4	3.77
	31	34.47	36	33.89

Table 2 represents the percentage of inquiry inclusion features in grade 2 national textbooks in Saudi Arabia and Lebanon. Feature 3 was more representative in the Saudi Arabian grade 2 textbook with a percent 14.45% (13 out of 90) while in the Lebanese textbook with a percent of 6.60% (7 out 106). However, feature 1 was included more in the Lebanese textbooks with 14.1% whereas in the Saudi Arabian textbook with 4.45% (4 out of 90). On the other hand, feature 4, was the least included within the textbooks of both countries with a 3.34% for Saudi Arabia and 1.88% for Lebanon. Feature 2 and 5 were nearly represented equally with a slight difference, 6.67% and 5.56% for Saudi Arabia and 7.54% and 3.77% for Lebanon respectively.

The overall evaluation shows that Saudi Arabian grade 2 science textbooks include 34.47% (31 out of 90) exercises with one of the 5 features while the Lebanese ones include 33.89% (36 out of 106) which is slightly less.

**Table 3**

*Sample Table Comparing the Number of Activities Within Each Feature and Their Percentage between Saudi Arabia and Lebanon in Grade 3*

Grade 3	Saudi Arabia		Lebanon	
	Number of activities	Percentages (%)	Number of activities	Percentages (%)
Scientifically oriented questions	6	8.82	10	11.12
Use evidence in responding to questions	7	10.29	9	10
Formulate explanations from evidence	5	7.35	5	5.56
Connect explanations to scientific knowledge	2	2.94	1	1.12
Communicate/justify explanations to others	2	2.94	3	3.34
	22	32.34	28	31.14

. Features 1 and 2 were the most representative in both countries' textbooks, having feature 1 the most representative in the Lebanese textbook 11.12% (10 out 90) and feature 2 with 10% (9 out of 90) while feature 2 was more representative 10.29% (7 out of 68) than feature 1 8.82% (6 out of 68) in the Saudi Arabian grade 2 science textbooks. On the other hand, feature 4 was the least representative in both countries' textbooks but in Saudi Arabia feature 5 was represented equally with feature 4 2.94% (2 out of 68), while in the Lebanese textbook feature 5 was represented more than feature 2 with percentages 3.34% (3 out of 90) and 1.12% (1 out of 90) respectively. Meanwhile, feature 3 was represented equally in both (5) countries' textbooks

but with different percentages (7.35% Saudi Arabia and 5.56% Lebanon) due to the total number of practical exercises presented.

The overall analysis was similar to that of grade 2. Lebanese grade 2 science textbooks included 28 out of practical exercises with one or more feature more than the ones included in the Saudi Arabian textbooks 22 out of. But the percentages varied differently (31.14% Lebanon and 32.34% Saudi Arabia) and this as previously discussed might be due to several reasons especially that the percentages also varied slightly with 1.2 difference.

**Table 4**

*Sample Table Comparing the Number of Activities Within Each Feature and Their Percentage between Saudi Arabia and Lebanon in Grade 4*

Grade 4	Saudi Arabia		Lebanon	
	Number of activities	Percentages (%)	Number of activities	Percentages (%)
Scientifically oriented questions	7	8.75	2	2.10
Use evidence in responding to questions	16	20	8	8.42
Formulate explanations from evidence	9	11.25	7	7.36
Connect explanations to scientific knowledge	3	3.75	2	2.10
Communicate/ justify explanations to others	1	1.25	2	2.10
	36	45	21	22.08

Table 4 represents the frequency and percentages of the inclusion of the 5 features of inquiry in Saudi Arabia and Lebanese grade 4 science textbooks. Feature 2, was the most representative in both countries' grade 4 science textbooks but with different ranges. In the Saudi Arabian textbook, it was more presented 20% (60 out of 80) than in the Lebanese textbook 8.42% (8 out of 95). Feature 3 was the 2nd representative feature in both countries too. And also, it was more presented in the Saudi Arabian textbook 11.25% (9 out of 80) whereas, in the Lebanese textbook the percentage was 7.36% (7 out of 95). The other 3 features (1, 4 and 5) were represented equally in the Lebanese textbook with a percent of 2.10% (2 out of 95) each. However, in the Saudi Arabian textbook these values varied. It was more for feature 1 and 4 with

8.75% (7 out of 80) and 3.75% (3 out of 80) respectively. While, it was less for the 5th feature with a percentage 1.25% (1 out of 80).

**Table 5***Sample Table Comparing the Number of Activities Within Each Feature and Their Percentage**between Saudi Arabia and Lebanon in Grade 5*

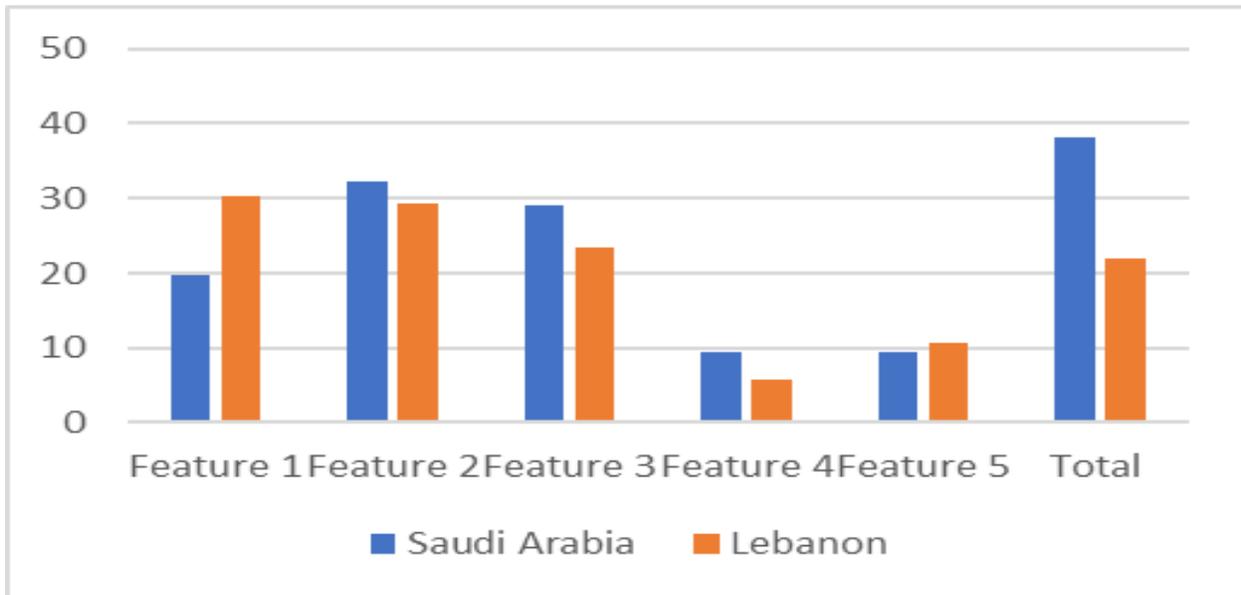
Grade 5	Saudi Arabia		Lebanon	
	Number of activities	Percentages (%)	Number of activities	Percentages (%)
Scientifically oriented questions	3	5	4	4.45
Use evidence in responding to questions	9	15	5	5.56
Formulate explanations from evidence	3	5	5	5.56
Connect explanations to scientific knowledge	2	3.34	1	1.12
Communicate/ justify explanations to others	3	5	2	2.23
	20	33.34	17	18.92

Feature 2 was the most representative in the Saudi Arabian grade 5 textbook 15% (9 out of 60) and more than in the Lebanese textbook 5.56% (5 out of 90). Meanwhile, feature 3, was represented in the same percentage of feature 2 in the Lebanese textbook and the other features 1, 4 and 5 were the least presented 4.45%, 1.12% and 2.23% respectively. However, feature 3, was represented in the same percentage of feature 1 and 5 in the Saudi Arabian textbook with 5% (3 out of 60) whereas, feature 4 was the least presented 3.34% (2 out of 60).

## Elementary Level

**Figure 1**

*A graph showing the total distribution of inquiry feature within the whole elementary level between Saudi Arabia and Lebanon.*



According to figure 1, feature 2 was the most representative feature 32.28% in the elementary level (41 out of 127) in the Saudi Arabian textbooks. However, in the Lebanese elementary level, feature 1 was the most representative 30.39% (31 out of 102) out of the 5 features. Meanwhile, in both countries' textbooks the first 3 features were the most representative among the 5 features and the last 2 features were the least representative.

Moreover, out of the 332 practical exercises in the Saudi Arabian elementary science textbooks only 127 exercises included inquiry features which are less than half the exercises with a percent (38.25). However, this percentage is higher than the percentage of inquiry inclusion in the Lebanese elementary science textbooks, where only 102 out of the 465 practical exercises included inquiry features.

## **Inquiry levels**

**Table 7**

*A Table Representing the Distribution of Each Feature Within Each Grade Level with Respect to Herron's Scale of Inquiry in Lebanon's Science Textbooks*

Lebanon	Level	Feature 1	Feature 2	Feature 3	Feature 4	Feature 5
Grade 2	1		1	1		
	2	13	5	4	2	3
	3	2	2	2		1
	4					
Grade 3	1					
	2	10	9	5	1	3
	3					
	4					
Grade 4	1					
	2	2	3	3	2	
	3		1	1		2
	4					
Grade 5	1			5	1	2
	2		2			
	3	2	1			
	4					

**Table 8**

*A Table Representing the Distribution of Each Feature Within Each Grade Level with Respect to Herron's Scale of Inquiry in Saudi Arabia's Science Textbooks*

Grade	Level	Feature 1	Feature 2	Feature 3	Feature 4	Feature 5
Grade 1	1	1		1	1	
	2	3	2	2	1	1
	3	1		2		
	4		1	2		
Grade 2	1				1	
	2	1	1	4	1	
	3	3	3	4		4
	4			2	1	1
Grade 3	1	3				
	2	2	4	3		2
	3	1	1	2	1	
	4				1	
Grade 4	1					
	2	6	11	9	1	
	3				1	
	4					
Grade 5	1					
	2	2	9	2	1	
	3	1		1	1	3
	4					

Tables 7 and 8 represent the variation of the levels of inquiry in the practical exercises of the Lebanese and Saudi Arabian elementary textbooks. As discussed before, within the Lebanese

textbook of grade 1 there was no representation of inquiry, for that, levels weren't analyzed. On the contrary, table 8 shows that the dominant level in grade 1 Saudi Arabian science textbook is level 2 (9 exercises) while the other 3 levels varied equally (3).

### ***Grade 2***

Table 7 shows that in grade 2 Lebanese science textbook level 2 was the dominant level (23) while in the Saudi Arabian one level 3 was the dominant (14). The lowest level was level 4 in the Lebanese textbook (0) and level 1 in the Saudi Arabian textbook (1). This shows that mainly both textbooks' exercises vary among level 2 and 3. However, Saudi Arabian textbook included more exercises with level 4 (4). In this grade level, Saudi Arabian textbooks and the Lebanese ones provided students with the major problem and steps and procedure to perform the activity. However, in the Lebanese books, there was a list of questions to be answered in order to get the final solution while in the Saudi Arabian the students were left on their own to guess and provide the suitable solution.

### ***Grade 3***

Tables 7 and 8 shows that level 2 was the most dominant in both textbooks and level 4 was the least dominant. However, level 2 was more dominant in Lebanese textbook (28) than the Saudi Arabian textbook (11). But it included more exercises varying in levels 1, 3 and 4 (3, 5 and 1 respectively) than the Lebanese textbook with all levels 0. This is due the fact that both textbooks did include experiments but they gave the students the procedure and steps to perform this experiment along with the general problem. The books also provided the students with step-by-step questions to be answered in order to reach the solution.

### ***Grade 4***

For grade 4 textbooks of Saudi Arabia and Lebanon, level 2 was the most dominant of all levels in both textbooks as shown in tables 7 and 8. However, it was more in the Saudi Arabian textbooks (27) while in the Lebanese textbook (10). Meanwhile, both textbooks had no exercises within levels 1 and 4 and little exercises in level 3 where Saudi Arabia textbook had only one exercise within level 3 and Lebanon had 4.

### ***Grade 5***

In the last elementary grade, the results were different. According to tables 7 and 8, level 1 was dominant in the Lebanese textbook (8) while level 2 was dominant in the Saudi Arabian textbook (14). Moreover, in the Saudi Arabian textbook, levels 1 (8) and 4 (2) were more dominant than in the Lebanese textbook where both levels were 0. However, level 3 was less dominant in the Saudi Arabian textbook with one exercise whereas in the Lebanese textbook, level 3 was within 6 exercises.

### ***Elementary level***

After comparing the 5 grades textbook for each country, the results showed that, both countries' elementary textbook had level 2 the dominant level above all within 64 exercises of the Lebanese textbooks and 64 of the Saudi Arabian textbooks which are slightly different by only 4 values. Moreover, the least dominant level was level 1 in the Saudi Arabian textbooks (7) and level 4 in the Lebanese textbook (2). Meanwhile, more exercises were within level 4 in the Saudi Arabian textbooks (8) and level 1 was more in the Lebanese textbooks (10). Finally, level 3 was more within the exercises of the Saudi Arabian textbooks (29) where in the Lebanese textbooks it was (12).

## **Discussion and Conclusions**

### **Conclusions**

### **Inquiry Features**

#### ***Grade 1***

The percentages reveal that exercises mostly acquired students to use evidence in order to come up with explanations. This is due the fact that the book mainly consisted of activities that ask students to deduce the concept or what they conclude based on the experiment results. And the fact that some of these experiments start by a major question, increased the inclusion of the first feature where questions were scientifically oriented.

52.92% is a low percent of inquiry inclusion in the Saudi Arabian grade 1 textbook. However, when comparing it with the fact that Lebanese national grade 1 textbook had no inquiry inclusion, it stays at a better level.

#### ***Grade 2***

Feature 3 was the most representative in Saudi Arabian textbooks. Both countries had textbooks that encourage students to form explanations using evidence based on the observation and analysis of different experiments but the reason that this feature was higher in Saudi Arabian textbook is that the textbook had more experiments with addressing questions. Meanwhile, feature 1 was more representative in Lebanese textbooks. The reason of this is that in the Lebanese textbook, more chapters included questions that are derived scientifically (related to the concept) whereas in the Saudi Arabian textbooks question were addressing more direct observations of the experiment. Not to mention that, feature 2 was the 2nd most representative feature in both countries' textbooks. This means that Saudi Arabian grade2 science textbooks

provide students with experiments and observations followed by addressing questions that could be answered using evidence in order to form the explanations. Lebanese grade2 science textbooks also provide experiments followed by addressing questions, however these questions are more scientifically oriented.

Overall, the difference in the inclusion of inquiry-based tasks in grade 2 science textbooks of both countries was slightly notable since it was only 0.58% and this can be due to several reasons (mistake in calculation especially that we are working with decimals and percent, difference in the number of units or chapters or in the number of practical exercises given) and on the other hand, it is important to notice that in fact the Lebanese had more practical exercises including the features than the Saudi Arabian textbooks but the difference in the overall material resulted in this result.

### ***Grade 3***

The results of grade 3 textbooks of both countries as shown in table 3 were nearly consistent with the results of grade 2, mainly because grade 2 and 3 were developed and published in the same way. This means that also both countries' grade 2 textbooks had activities that addressed questions to be answered based on evidence and some of the questions were scientifically oriented.

### ***Grade 4***

The results show that features 2 and 3 were the most dominant for both countries. Grade 4 textbooks in both countries included mostly experiments followed by questions in order to develop a scientific knowledge however; these questions were direct and addressed the experiment in particular rather than the overall knowledge or concept. And this reveals the low percent in features 1, 4 and 5.

The final percentage of all inquiries for both countries for grade 4 was highly different in contrast to the previous grades. Saudi Arabian grade 4 science textbook had 36 out of 80 questions representing one or more of the features (45%) while the Lebanese one had only 21 out of 95 representing the features (22.08%) which is much less especially that the Lebanese had extra 15 practical exercises compared to the Saudi Arabian textbook exercises. The reason of this may be due to the fact that Lebanese textbook focused more on providing the objectives and logical knowledge at this grade level while in the Saudi Arabian the focus was more on experiments.

### ***Grade 5***

Again feature 2 was the dominant in both countries' textbooks. Grade 5 textbooks are slightly published in the same way of the previous grade levels textbooks. But mainly, grade 5 textbooks had evidence-based questions but with a low percent.

In all, the inclusion of the 5 features in the Saudi Arabian textbook was 33.34% (20 out of 60) more than the inclusion of features in the Lebanese textbook 18.92% (17 out of 90).

After evaluating the whole textbooks of the elementary level in both countries, the results show that features 1 and 5 were more presented in the Lebanese elementary textbooks than in the Saudi Arabian ones. However, features 2,3 and 4 were presented more in the Saudi Arabian elementary level textbooks. The whole comparison reveals that Saudi Arabian elementary textbooks provide more inquiry-based experience than the Lebanese ones but the percentage of this inclusion was less 50% which doesn't reveal an adequate and good inclusion. This low percentage in both countries' textbooks do not promote inquiry experience and as such there is a need to improve inquiry-based experience in the textbooks.

### **Herron's scale**

After evaluating the inquiry tasks based on Herron's scale of inquiry and comparing the results of both countries' textbooks, I found that both countries' textbooks had activities mainly within the second level of Herron's scale that provides students with problem and procedure and asks them to develop their own solutions based on what is given. This shows that the countries' textbooks are based on both student and teacher interaction but with more role to the teacher in explaining and providing the concept. However, Saudi Arabian textbooks had more exercises in level 4 than the Lebanese textbooks that had more exercises within level 1. This means that, Saudi Arabian textbooks at some point encourage students' own investigation, analysis, questioning and experimenting by having them develop the problem, procedure and solution but still in a limited way contrary to the Lebanese textbook exercises that had very low percent of exercises within the 4<sup>th</sup> level but more within the 1<sup>st</sup> level that is more teacher centered and provides the students with the problem, procedure and solution that would only result in them memorizing and grasping the concept. This won't help students understand the nature of science and how science works they even cannot relate science to their real life.

### **Recommendations**

Based on the findings of this research, it is highly recommended that publishers of the science elementary textbooks, whether in Lebanon or Saudi Arabia, align the textbook materials with the American National Science Education Standards (NRC, 1996) in a way that encourages the 5 inquiry features in the textbook's activities, questions, experiments and activities.

Moreover, they should be aware to have teaching materials that are more student centered where textbooks encourage students to investigate, analyze, question, search, think and experiment on their own and as such more materials within the 3<sup>rd</sup> and 4<sup>th</sup> level and very less within the 1<sup>st</sup> and 2<sup>nd</sup> level.

Another recommendation is that the educational system encourages inquiry in teaching through preparing teachers for inquiry-based experiences by emphasizing on the importance of inquiry during their practice and having them attend programs that help them grasp inquiry and its importance and how to apply it in their classroom. This would help teachers to know how to use the science textbook in a way that encourages inquiry experience even if the textbook didn't encourage it.

### **Limitations of the Study**

This study evaluated only the national textbooks of both countries. Taking into consideration that in Lebanon different schools use different textbooks depending on the school policy, it is important that inquiry-based experience be evaluated among the different textbooks (especially those that are used commonly and widely among schools) and not only the national ones. Meanwhile, the Saudi Arabian textbooks evaluated were of an older version this recommends that more studies should be made on the new publications of the textbooks.

On the other hand, it is not enough to predict inquiry experience based on the evaluation of the textbook only since as previously said, different publications of books are used in different schools within the same country. In addition to the fact that not all teachers rely on the textbooks in their teaching process. Some teachers tend to incorporate their own strategy or add up experience to the textbook so that it fits their purpose. The curriculum, educational system, classes atmosphere and textbooks should be studied to have a full evaluation of inquiry experience.

More studies can be made to compare textbooks between different Arab countries and non-Arab ones also.

### **Action Plan**

The results of this study did impact my plan and the way I look into teaching and mainly the results of the Lebanese textbooks. I learned through these textbooks in my elementary level and used to enjoy the science experience I went through but after learning about inquiry and having a small experience within it everything changed. As I was comparing and looking through the elementary Lebanese textbooks and reading the activities, I really felt that all what was presented says nothing about science. Science is more fun, more engaging, science is about investigating, experimenting, analyzing and much more. It is part of our everyday life. However, textbooks present it as a matter of memory, set of rules and concepts that students should know and memorize.

As a future teacher especially that my emphasis is science, the study made me learn a lot. At first, I would go for evaluating the textbook the school I teach in uses and if the policy states that I should use this textbook with no replacement I would definitely use the textbook as a second resource (guide for students, backup or summary for the lesson...) but I would never use it as a primary resource in teaching or at least I would learn more about inquiry and how to adapt inquiry to traditional textbook activities so that I can use it in an inquiry-based structure.

My aim is to have students enjoy science, understand the nature of it and how it works, I want students to look at science as a part of their life and not something that they should memorize. I would go for having students engage, experiment, analyze and investigate on their own and of course the atmosphere would be more student-centered.

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## Appendices

### Appendix 1- Sample activities of the presentation of Feature 1

#### *in Lebanese textbooks*

grade 2- Page 70

1. Does the fish have gills? Do the lizard and snake have gills? Why?
2. Can animals in picture 2 live far away from water? Why?
3. Can the animals in picture 1 live far away from water? Why?

#### *Saudi Arabian textbooks*

Grade 1-Page 97

ماذا حدث للبالون؟

لماذا؟

## Appendix 2- Sample activities of the presentation of Feature 2

### *in Lebanese textbooks*

grade 5- Page 116

Notice the apparatus (a) and (b).

What happens when you pull down the membrane?

What happens when you push down the membrane?

Grade 2 -Page 33

Using figure 1, observe then answer

When does the farmer plant tomato plant?

When does the farmer pick the tomatoes?

### *Saudi Arabian textbooks*

Grade 4- Page 68

ماذا يشبه شكل الكلية؟

تحسس ملمس الكلية باصابعك ثم اضغط عليها برفق

ماذا تلاحظ؟

Grade 1- Page 98

الق نظرة عامة على هذا الحيوان

ماذا يغطي جسم هذا الحيوان؟

افحص اقدام هذا الحيوان: صفها

### **Appendix 3- Sample activities of the presentation of Feature 3**

#### ***Lebanese textbooks***

Grade 2- Page 73

What means of defense and protection are the animals of the picture equipped with?

#### ***Saudi Arabian Textbooks***

Grade 3- Page 26

بماذا تتشابه هذه الحيوانات؟

على ماذا تتغذى هذه الحيوانات؟