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Reading Strategies in Science Literacy: An Exploratory Case Study of a Lebanese Private School

By

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Dedication

The production of this thesis is dedicated to my father and mother. I am grateful for all the support, care, and advise you have given me throughout the years. Thank you for teaching me that with hard work, patience, and determination life goals could be achieved. Thank you for having faith in me. Both of you mean the world to me.

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Reading Strategies in Science Literacy: An Exploratory Case Study of A Lebanese Private School

Yasmine Zakaria Diab

Abstract

The present study examined the difference between two educational programs (i.e. Lebanese Baccalaureate and American programs) in the Lebanese system and how each program integrates reading literacy with the science curriculum. A total of 69 middle and high school students in a private school in Lebanon were selected to be part of this research. Biology teacher, science coordinator, and English coordinator were also part of the study. Three instruments were used for data collection – observations of Biology sessions, interviews, and questionnaires. The effects of reading strategies used on students' science knowledge acquisition were analyzed. The results of the study showed that although reading literacy is integrated in the Lebanese program more than the American program, this integration is still at its premature stage and needs in-depth work and much effort to help students become proficient readers in science for maximal text comprehension, and hence, acquire the science subject material that ensures personal achievement not only in school but also in society. Further research regarding the integration of English literacies with the science curriculum is needed since it would be of great benefit for the Lebanese society.

Key words: Reading Literacy, Science Knowledge Acquisition, Reading Strategies, Text Comprehension, Proficient Readers

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Chapter one

Introduction

1.1 Background of the study

Many are unaware of the importance of language literacy in learning science since the science subject has been stereotyped as being an "empirical subject" (Wellington & Osborne, 2001, p.3). Learning science is a very difficult task to undertake since it requires the individuals full engagement, support, and interactions with the subject (Wang, Wang, Tai, & Chen, 2010, p.803).

1.1.1 Language and Science

The study of the role of language in science recognizes that language is more than just grammar and vocabulary. Language involves meanings and semantics. According to Lemke (1991) "Semantics is the study of meaning as it is expressed through language" (p. ix). This shows that through learning how to read science, students would be able to better communicate and understand that subject because "in order to talk science, or any other subject, we have to express relationships between the meanings of different concepts, and semantics is the study of how we use language to do this" (Lemke, 1991, p. ix). The language of science could be very complex due to "the richness of words and terms it uses" (Wellington & Osborne, 2001, p. 3). So, being exposed to various vocabulary words to expand one's vocabulary bank is crucial in scientific literacy since "vocabulary is the knowledge base that is important for many

aspects of psycholinguistic processing, and it is certainly tempting to attribute variability in vocabulary size to experiential differences" (Cunningham & Stanovich, 1997, p.935). As a graduate student having a background in Biological Sciences, I have observed that scientific terms such as describe, compare, evaluate, and so forth are used the most during a classroom discussion and/or writing assignments. Based on previous experience in the Lebanese Baccalaureate program, those terms were usually taught during high school years. However, those terms were only understood and properly communicated during undergraduate program years at the university level. As a college student, it was not until I undertook extensive research, readings, and hard work, that the language of science became clearer. While I worked on lab reports or any other writing assignments for Biology courses, the question of why my science teachers often failed in helping me understand the scientific terms while stressing rote techniques of learning these concepts recurred. According to Wellington and Osborne (2001):

> …we should all treat language with care, to be aware of its difficulties and to bear in mind that although pupils can and do use scientific terms in speech and writing this does not imply that they understand them…(p. 6).

I argue one reason why those scientific terms were memorized during high school years is that the science teacher was not able to integrate language with science. The teacher mostly relied on inquiry and problem solving processes instead of also integrating communication and classroom discourses such as discussions and readings. Usually, written texts are very different than oral discussions due to the richness of vocabulary words a written text could possess (Reichenberg, 2008, p.19) signifying that it is of utmost importance to expose students to print material and texts.

Based on a personal experience during my high school years, as students get promoted to higher grade-levels in their schools, the reading activity, especially in science, is lessened. By the time students reach high school level, reading activities somewhat disappear from some school curricula (Fang, Lamme, Pringle, Patrick, Sanders, Zmach, Charbonnet, & Henkel, 2008). Most supervisors, coordinators, and teachers view such activities in higher grade-levels as the least important and a waste of time since there are other major academic skills that should be focused on. In addition, many high school science teachers find it difficult to infuse reading with the science curriculum and as a result, students become uninterested in reading, thus, failing at understanding texts when reading (Fang & Wei, 2010, p.265). However, it is widely argued that reading is of utmost importance in Science education and should be an ongoing process from preschool to high school. Metzenberg (2000) stresses the following:

> It has become fashionable in science education to mold K-12 students around an *idee fixe* [obsession] of a modern scientist; formulating hypotheses, observing, measuring, and discovering through hands-on investigations. What has been left unsaid is that real scientists don't actually spend very much of their day "observing" and "measuring" They read! Reading for understanding of content is the core process skill of science, and there is no substitute for practice at an early age

This signifies that reading science is an important skill in scientific reasoning. Students of all grade levels and subjects are required to practice various reading skills in order to better comprehend the material in a critical way.

Understanding the language of science requires metacognition and metalinguistic awareness in order to reach higher-order thinking in the science subject matter.

Metacognition is essential since it aids readers to notice the details required to understand the topic and when something read is unclear, one would be able to use other strategies that could help understand the readings (DiGisi & Yore, 1992). Metalinguistic awareness is defined "as the ability to reflect and manipulate structural features of language" (Nagy & Anderson, 1995, p. 1); in other words, it is the ability to use language through thinking processes or metacognition. Both spoken and written languages require one to think about the ideas one intends to speak and/or write about. So, metalinguistic awareness plays a very effective role in not only acquiring reading skills (Nagy & Anderson, 1995; Nagy, 2007) but also in scientific inquiry. In science, being able to know how to use language through thinking processes allows one to better understand scientific reading texts and offer explanations for the data collected and observations witnessed, thus, acquiring science-content based knowledge.

1.2 The Statement of the Study

Extensive research has been done to show the importance of integrating reading with the science curriculum on lower grade levels; however, not much research has been conducted at later stages of schooling (i.e. secondary level). Also, not much research has been done on the different reading strategies used in the three different programs (i.e. high school, Lebanese Baccalaureate, and International Baccalaureate) in Lebanese schools.

1.3 Purpose of the Study

In this research study, the importance of reading literacy in being part of the science education in middle and high schools is addressed. Thus, based on a previous personal experience and due to the shortage in research work regarding the integration of

reading and science in middle and high schools, the purpose of this study was to examine whether reading literacy is integrated in the science curriculum in two different programs – Lebanese Baccalaureate and American High School - in a private School (X) in grades 8, 9, and 10.

In specific, this study aims to find answers for the following questions:

1. How is reading literacy integrated in the science curriculum in each of the two programs for grades 8, 9, and 10?
2. What are the reading strategies used in each program?
3. Is students' knowledge acquisition in science-content areas improved and further developed by being exposed to readings and practicing reading strategies on regular basis?
4. Do Biology teachers of grades 8, 9, and 10 in both programs motivate their students to read science-based reports, stories, books, and so forth? If yes, how are students motivated?

1.4 Significance of the Study

Findings of this study helped explain the difference between the two programs and the importance of reading strategies in the development of students' knowledge of science-content areas. Thus, Lebanese teachers could benefit from the findings of research in integrating readings and reading strategies for teaching science that would help students succeed in the science curriculum.

1.5 Lebanese Program versus American Program

The Lebanese educational system consists of three different programs: (1) International Baccalaureate program, (2) Lebanese Baccalaureate program, and (3)

American program. My study aims at comparing the last two programs only for accessibility reasons. The Lebanese program differs from the American high school program in several aspects. The Lebaneses program (1) is offered to students who carry the Lebanese nationality only, (2) is divided into four different tracks – Humanities, Sociology and Economics, Life science, and General science, (3) offers core subjects which students are obliged to take, (4) prepares students to sit for official exams at the end of grades 9 and 12, and (5) is based on national books written and compiled by a Lebanese committee and issued by the Center for Educational Research Development (CERD) under the supervision of the Ministry of Education in Lebanon. On the other hand, the American program (1) is offered to students who hold a foreign citizenship, (2) offers core subjects and electives, and students have the freedom to choose what subjects and electives to take, (3) prepares students for freshman year at college without the need to sit for official exams, and (4) is based on foreign books created and issued in the United States of America. Both programs are considered to prepare life-long learners.

1.6 The different stages of schooling in the Lebanese educational system

In Lebanon, there are four stages of schooling a person passes through before going to college. The first stage is known as pre-school and is divided into three levels – nursery, Kindergarten I, Kindergarten II. During this stage, there is a lot of emphasis on children's motor skills, teaching numeracy and literacies. The second stage is elementary school and is divided into six levels (i.e. Grade 1 to Grade 6). During this stage, students are exposed to several kinds of subjects but the main focus is teaching students multiplications and divisions. The third stage is middle or intermediate school and is divided into three levels (i.e. Grade 7 to 9). During this stage, students are taught various

subjects but the main focus is language literacies with preliminary analytical skills. The final stage is secondary school, and it is divided into three levels (i.e. Grade 10 to Grade 12). During this stage, students are taught various subjects in a more detailed way than middle school, but the main focus is working on the cognitive skills and analysis.

For this study, one school was chosen, and grades 8, 9, and 10 have been chosen to conduct the study for the following reason: those grades have been already taught three important literacies in English (i.e. Reading, writing, and speaking) along with analytical skills needed for the comprehension of texts.

1.7 Definition of Terms

The main terms that I chose to define before embarking onto the thesis are three: reading skill, scientific literacy, and content-based science knowledge.

According to O'Reilly and McNamara (2007), *reading skill* is a cognitive ability that allows one to "develop a coherent representation of the text that matches the intended message to the reader" (p.164). Reading is not an easy task but rather a "complex activity basically consisting of word decoding and comprehension" (Reichenberg, 2008, p.18). Many researches have shown that individuals have different reading abilities categorizing them as being either skilled readers or less-skilled readers. Unlike less-skilled readers, skilled readers are individuals who are able to not only use various reading strategies to understand the texts of any content area but also are able to generate inferences (O'Reilly & McNamara, 2007, p.164). Thus, skilled readers are able to acquire the knowledge of the content area being studied since they are active readers who "read for a purpose, using their experiences and knowledge of the world, their knowledge of vocabulary and language structure and their knowledge of reading

strategies when reading" (Reichenberg, 2008, p.19). As a result, student academic achievement of skilled readers would be much higher than less-skilled readers. Since science is not only an empirical subject but also a type of subject that requires literacies such as reading and writing, it is therefore important that students of science develop into skilled readers.

This brings our attention to the importance of *scientific literacy*. Scientific literacy education is needed not only to understand the content of scientific matter being studied but also to help communicate scientific research findings in a proper way that everyone could understand. According to the National Science Education Standards, scientific literacy is defined as the following:

> Scientific literacy means that a person can ask, find, or determine answers to questions derived from curiosity about everyday experiences. It means that a person has the ability to describe, explain, and predict natural phenomena. Scientific literacy entails being able to read with understanding articles about science in the popular press and to engage in social conversation about the validity of the conclusions. Scientific literacy implies that a person can identify scientific issues underlying national and local decisions and express positions that are scientifically and technologically informed. A literate citizen should be able to evaluate the quality of scientific information on the basis of its source and the methods used to generate it. Scientific literacy also implies the capacity to pose and evaluate arguments based on evidence and to apply conclusions from such arguments appropriately (National Research Council, 1996, p.22).

So, scientific literacy is important to acquire *content-based science knowledge*, which is the study's main focus. Content-based science knowledge means a person's

understandings of the science subject. In schools, it is assessed through observing students' achievements over a period of time using examinations and/or projects.

1.8 Thesis Division

The thesis is divided into six main chapters. Chapter one introduces the topic, i.e. language and science, the rationale, research questions, and definition of terms are spelled out. Chapter two reviews the literature available on the topic that is the importance for integrating reading literacy with science and its effects on students' knowledge acquisition. Chapter three lists and explains the choice of the instruments used to conduct the study. Chapter four presents the results. Chapter five includes a thorough discussion done on the importance of reading in science and how to motivate science reading by using findings from various researches conducted. Chapter six concludes the study by pointing out the limitations, suggesting recommendations and proposing further research study.

This chapter introduced the research topic. It posed the research questions, and defined the key terms. The next chapter will review the literature available on the topic.

Chapter Two

Literature Review

This section is divided into two sub-sections in which major ideas of this study are discussed. The first section discusses the importance of knowing how to read. The second section briefly illustrates the why students should be motivated to read and how. Thus, literature on science literacy is thoroughly discussed to pave the way to the research questions posed and operational definitions explained as well as the overall thesis topic.

2.1 Importance of Knowing How to Read

Reading is an important activity that should be implemented in the classrooms that requires people to not only know how to read but also be able to comprehend what is being read (Qanwal & Karim, 2014). Glynn and Muth (1994) emphasized that "…reading can support constructive learning, inquiry, and problem-solving" (as cited in Fang et al., 2008, p. 2068). Moats (1999) argued "…learning to read is a complex linguistic achievement…it requires effort and incremental skill development" (p. 14). This means that being able to read is an acquired skill where students should be taught how to read by extensive practice and "through regular exposure to interesting books and through discussions in which students respond to many kinds of texts" (Moats,

1999, p.14). In principle, when students are exposed to various kinds of texts, their reading fluency would improve. Also, their reading comprehension would improve since "oral reading fluency is highly correlated with and predictive of reading comprehension" (Carnine & Carnine, 2004, p. 205). As students are taught how to read, they should be constantly reminded that they should read for two purposes, education and pleasure. This is evident when Moats (1999) claimed that "the teacher must instruct most students directly, systematically, and explicitly to decipher words in print, all the while keeping in mind the ultimate purpose of reading, which is to learn, enjoy, and understand" (p. 14). One simple way to encourage students to read for pleasure is by starting a book club in the classroom where students are allowed to choose a book from a wide selection (Gibbons, n.d.) related to the topics discussed in the classrooms.

Teachers should not only be interested in the comprehension part of the reading activity but also in their use of different reading strategies. Readers who struggle in reading need to be taught various reading strategies to improve their reading comprehension (Reichenberg, 2008). One way to create skilled readers is by making reading a habit for students at an early age because if instructors do not encourage students to be "habitual of active reading, the students fail to construct accurate comprehension of the presented material" (Qanwal & Karim, 2014, p.1019). Another way to create skilled readers is to teach students the basic reading strategies which are the following: (1) scanning for specific ideas, (2) skimming for big, main ideas, and (3) making predictions using titles and images without having to read the text in full (Castillo & Bonilla, 2014). More advanced reading strategies would be as follows: (1) Cognitive strategies that require activation of prior knowledge, making predictions (basic strategy), and self-questioning, (2) compensation strategies that require

vocabulary identification (i.e. using contextual clues), drawing inferences, and making connections, (3) memory strategies that include the basic reading strategies mentioned earlier along (skimming and scanning) with being able to summarize, synthesize, and evaluate, and (4) test-taking strategies that allows one to be able to use reading comprehension to recall an idea (Qanwal & Karim, 2014). In *Teaching Reading*, Ueta (2005) stresses the importance of developing reading abilities in students throughout the school years especially in high school. Ueta (2005) elaborates further on this argument by drawing issues and challenges in second language. The author argues that L2 (i.e. second language) learners face difficulties in L2 reading due to the involvement of cognitive resources and language processing. This means that L2 learners face difficulties in the structure of the sentence being read and/or the language itself. So, developing L2 reading skills in L2 learners allows them to interact with the text no matter how long it is. This is important because nowadays entrance exams to universities across the world include written texts of varying sizes. Those texts also vary in content (i.e. one text could be about history and the other about science) and type (i.e. narrative and expository). Fang et al. (2008) contend:

> Through reading quality texts on a variety of science topics and applying relevant reading strategies, students broaden their domain knowledge about science, deepen their inquiry learning, and foster reading habits that can last a lifetime. They also learn to synthesize, analyse, and critique the information presented on science texts in ways real scientists do (p. 2068).

This signifies that being exposed to texts with good quality and enriched with vocabulary allows one to know how to understand the text and critically analyze it and thus, acquire the knowledge needed in the content area. Indeed Fang (2006) asserts that

certain "technical terms are important for accurately conveying the specialized knowledge of science" (p. 494).

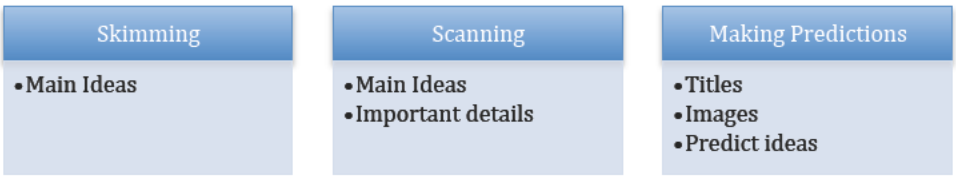

Figure 1: Types of basic reading strategies

The importance of being a skilled reader in science classes is not readily apparent since certain traditional approaches to teaching science might not recognize the role that language and reading play in scientific reasoning. However, in a major study conducted by Cromley (2009), multiple sub-studies were applied to study the relationship between reading and scientific literacy. The results of those studies showed that comprehension of scientific texts and reading are highly correlated. Also, several other research studies showed the impact of being a proficient reader on science knowledge acquisition and achievement. Fang et al. (2008) studied the effects of integrating reading with the science curriculum on middle school students through educating middle school teachers in applying the reading infusion project in their classrooms. The results of this study showed that "…an inquiry-based curriculum with reading infusion is more effective in improving sixth graders' science literacy than an inquiry-based science curriculum without reading infusion" (Fang et al., 2008, p.2078). This means that students who participated in the reading infusion program showed significant improvement in their science literacy showing the importance of integrating reading in the science curriculum. This is also evident in another study conducted by Fang and Wei (2010) where results showed that students in inquiry-based science plus reading (ISR) performed significantly better than students in inquiry-based science (IS) in both, the fundamental (i.e. general

reading ability) and derived (i.e. knowledge content) sense of science literacy. In addition, when reading strategies were implemented in the ISR classrooms, results showed that students' reading ability improved and thus causing their knowledge in the science content area to improve. The findings of several studies demonstrate that when students' science literacy improves, their performances and achievements in the science subject improve. This is evident in the study conducted by O'Reilly and McNamara (2007) which revealed that the main predictor of content-based science achievement is reading skill; the better the reading skill, the better the knowledge of science subject matter is acquired, and thus, the higher the student achievement in science content areas. Therefore, questions about content-based science knowledge acquisition should consequently incorporate the following question: how can students acquire good reading skills?

The results of a study conducted by Cunningham and Stanovich (1997) on fifty first-grade children that was followed for 6 years until students became in 11th grade showed that "early success at reading acquisition is one of the keys that unlocks a lifetime of reading habits" (p. 942). This means that early exposure to print material has a positive effect on students reading abilities in the long run. Even more, in another study conducted by Spence, Yore, and Williams (1999) results showed that providing students with explicit reading instructions not only improve students' metacognitive skills (i.e. awareness and self management) but also reading comprehension is improved. This is also argued by Pearson and Dole (1987) who stress that explicit reading instructions are required to improve students' metacognitive skills in readings (as cited in Craig & Yore, 1995). The results of their study showed that the metacognitive knowledge of good readers was higher than that of poor readers.

Exposing students to readings at an early age and providing them with explicit reading instructions weren't the only ways to help ensure content-based science knowledge acquisition and achievement. In a study conducted by Dani (2009) that aimed at studying teachers' purposes for teaching science, one of the results showed that the primary purpose of teaching science to students is to bombard them with basic knowledge (p. 293). This reveals that background knowledge is critical in comprehending science texts because according to Mikulecky (2008) when "a reader approaches a text with a huge store of prior knowledge and experience…" (What is reading section, para. 2); it would make it easier for the reader to understand the content of the text being read by connecting the dots between the facts presented in the text being read and the background knowledge possessed (Mikulecky, 2008). In another study conducted by Ozuru, Dempsey, and McNamara (2009) results showed that the individual difference factors (i.e. prior knowledge and reading skill) do affect science-text comprehension; however, prior knowledge seemed to be a significant predictor of text comprehension in comparison with reading skill. This is also evident in Cromley's (2009) study that showed that a third factor (i.e. prior knowledge) influences both science and reading proficiency. Though Guthrie et al. (1996) along with Poskiparta, Neimi, Lepola, Ahtola, and Laine (2003) emphasized that both "limited prior knowledge and inadequate reading strategies" lead to poor comprehension (as cited in Reichenberg, 2008, p.19). That is to say that both, prior knowledge and various reading strategies are required for knowledge acquisition in the content area being studied. Wang et al. (2010) also support this claim. They conducted a study to examine the effects of inquiry-based instruction on two individual differences – prior knowledge and reading ability. Results of this study showed that unlike students with low prior knowledge and weak language

abilities, students possessing more prior knowledge and good language abilities do not face many difficulties in learning the material (Wang et al., 2010).

What is more, students should also be exposed to various types of texts in order to be able to excel in science content areas. This is evident in the research conducted by Fang (2006) who focused on analyzing expository language by distinguishing the difference between the language of school science (LSS) and everyday language (EL). Results of this study showed that science requires hands-on activities to teach the scientific content along with scientific novels and texts. Being exposed to various types of texts helps one overcome linguistic challenges in comprehension and interact in a better way with the texts. So, he strongly believes that both activities and texts are needed in the curriculum to maximize knowledge acquisition in students and become comfortable with the science subject itself.

One important type of texts in science education is expository texts. Those kinds of texts are perceived as being factual texts that limit students to making inferences in order to "construct meaning from what they read" (Reichenberg, 2008, p. 35). Reichenberg (2008) conducted a comparative study on six teachers and sixty female students who were categorized as poor readers in which he aimed at comparing how discourse between teachers and students regarding expository texts varied before and after being introduced to a structured text talk. Results showed that during regular lessons, teachers tended to ask factual questions and students were obliged to extract information directly from the text in a passive way. However, after structured text talks were implemented the number of inferences and open questions were increased (Reichenberg, 2008, p.35) causing students to interact better with the text and allowing teachers to actually know who understood the text and who did not. In other words,

expository texts should be taught with care since those kinds of texts are used the most in science literacy especially in later stages of schooling such as high school.

The importance of the abovementioned studies extends the importance of developing reading skills in students for not only academic purposes but also for non-academic ones. Integrating reading with the science curriculum and exposing students to print texts at very early stages of schooling all the way to high school (Cunningham & Stanovich, 1997) ensures life-long learners in the science content area since science literacy is not only important for people who pursue scientific-based careers but also to become active citizens in their society (Dani, 2009). On daily basis, news about new diseases emerging, discoveries of cures, effects of global warming, and so forth hit the front pages of newspapers and magazines. So, people become curious and decide to read more about those because even if it does not affect everyone, it is still a major concern to everyone. Reading about such issues requires reading skills in order to comprehend the material and understand what is really going on in our world. A study conducted by McClune and Jarman (2010) aimed at promoting critical engagement through the integration of media literacy, specifically newspaper usage, with the science curriculum. Results showed that in order to be able to respond critically to science news texts people must (1) possess some background knowledge about what science is and how it is put into use, (2) possess knowledge about language and the different writing styles, (3) possess reading and inquiry skills, and (4) be curious, confident, and ready to interact with science news reports (McClune & Jarman, 2010). Hence, comprehending science texts in newspapers requires one to possess some knowledge about the nature of science, be exposed to different writing styles, and be willing to be engaged with the text.

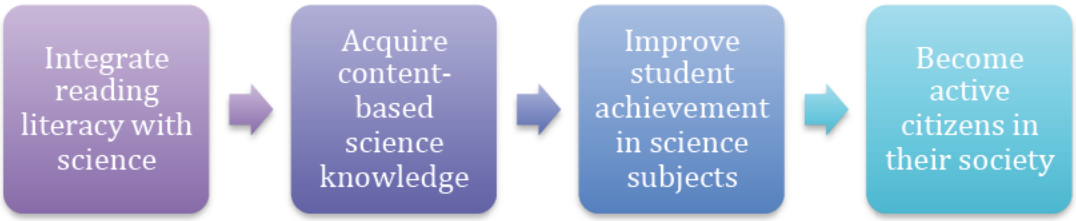

Figure 2: Importance of integrating reading literacy with the science curriculum

2.2 Motivating Science Reading

The findings discussed earlier were all evidence for the importance of reading in science and how much reading strategies along with prior knowledge and vast vocabulary could maximize science content-based knowledge and thus, lead to greater achievement. Integrating reading activities into the science curricula requires motivating students to read. Secondary students should possess metacognitive awareness when approaching a scientific text in order to achieve higher order thinking and be able to think like real scientists. This was supported by Guthrie and Wigfield (1999) who argue that if students are "not aware of the text, not attending to it, not choosing to make meaning from it, or not giving cognitive effort to knowledge construction, little comprehension occurs" (p.199). Teaching students reading metacognitive skills in one of the major subjects is a complex task since it requires skills and practice. Specifically, hard work is needed and motivation is valuable in making this happen. Guthrie and Alao (1997) conducted a research to study the effect of blending design principles and Content-Oriented Reading Instruction (CORI) program in increasing reading motivation in students for longer periods of time expecting those principles are applicable on any student regardless what the age, reading levels, settings, and learning goals are. CORI

program includes engaging students with hands-on activities and inquiry strategies with texts. Results showed that students in CORI classrooms were much more motivated than students in traditional classrooms. The study implied that CORI was more effective than other instructional programs since it engaged students into reading activities and thus, significantly improved their reading comprehension abilities and science knowledge. So, integrating advanced programs such as CORI is one way to be used to motivate students into reading since such literacy is crucial in the language demands of science education.

In conclusion, and based on the above discussion, I argue that acquiring reading skills is important to comprehend any text one could possibly encounter especially science texts. Practice, persistence, and motivation are needed in order to engage secondary students with science readings. According to Spence et al. (1999), "science reading comprehension instruction needs to be explicit, embedded, long-term, and multifaceted, involving domain knowledge, topic knowledge, science reading, and specific science reading strategies" (p.18). In other words, students should not only possess knowledge of a certain subject but also be able to put that knowledge into use (O'Reilly & McNamara, 2007) in order to create independent life-long learners. Consequently, I decided to assess how reading literacy is integrated with the science curriculum in two different programs in the Lebanese education and how it affects students' knowledge acquisition.

Chapter Three

Methodology

3.1 Method

This study examines how reading literacy is integrated with the science curriculum by exploring the different types of reading strategies used in two different science curriculums in middle and high school to determine which curriculum was more effective on students' knowledge acquisition in the science content area. The study used a holistic exploratory case study since I aimed to collect data about the main focus of this research by probing three different grade levels of heterogeneous groups of students taking different educational programs within one school. The reason why this research work was a case study is because it was a qualitative study that helped me to conduct a detailed investigation regarding the importance of the main focus of the study (Merriam, 1998; Yin, 2003) that is integrating reading literacy into the science curriculum. Based on previous experience as a student, it is assumed that the American program does not only stress reading strategies in science classes but also encourage students to engage in science readings more than the Lebanese program. This is because the American program focuses more on the language aspect and how to create active citizens with

fluent articulation to socially develop in ones own society whereas the Lebanese program focuses more on problem-solving and reasoning and how to develop individuals who can become good at decision-making.

3.2 Sampling Selection

Purposeful and convenient sampling was used to select the participants and setting of this study. Purposeful sampling was of great importance in this study since it allowed me as the researcher "to discover, understand, and gain insight" (Merriam, 1998, p.61) about the stated problem. Several instruments have been constructed to collect extensive data about the importance and effects of acquiring reading skills in acquiring science knowledge. Besides this, convenient sampling was chosen to select the participants and setting due to accessibility reasons. Not many private schools in Lebanon allow researchers to have access to their schools and students. The selected school was the only private school that allowed me to conduct this study in.

3.3 Participants and Setting

Reading activities lessen as students get promoted to higher-grade levels; so, using selective sampling method (Robson, 2000), grades 8, 9, and 10 students have been randomly selected to be the main subjects of this research. In each grade level, two different programs were explored: (1) 10 students from grade 8 in the Lebanese program, (2) 12 students from grade 8 in the American program, (3) 10 students from grade 9 in the Lebanese program, (4) 15 students from grade 9 in the American program, (5) 10 students from grade 10 in the Lebanese program, and (6) 12 students from grade 10 in the American program. So, the total sample size of this study was 69 students. All the students in the Lebanese program have Arabic as their first language

and English as their second. When in fact students in the American program were either foreigners whose first language is English or Lebanese who lived abroad possessing a second citizenship and whose first language might or might not be Arabic. In addition to that, selective sampling method was also used to select (1) middle and high school Science coordinator of both programs, (2) middle and high school English coordinator of both programs, (3) and Biology teacher of both programs to be part of the study through which they were interviewed individually. It should be noted here that only one Science coordinator, one English coordinator, and one Biology teacher were responsible for teaching grades 8, 9, and 10 of both programs.

The school is a very well known private school and is located in the suburban area of Beirut. It offers two different programs: Lebanese Baccalaureate and American High School. The language of instruction used at this school is English. Despite that, many students were French educated and had transferred to that school at later stages of schooling. It caters for students who come from middle to high socio-economic status.

3.4 Instruments

The main purpose of the study was to examine how reading literacy is integrated with the science curriculum in each of the two programs. However, the research focused on several elements related to reading literacy: (1) types of reading strategies, (2) importance and effectiveness of reading strategies on acquiring the proper knowledge in science, and (3) whether students are motivated to read science-based texts or not. Three main instruments were used to answer each of the research questions: interviews, questionnaires, and observations. The main reason why those three instruments were chosen is because this combination "allows for a holistic interpretation of the

phenomenon being investigated" (Merriam, 1998, p.111; see also Fraenkel & Wallen, 2010). In other words, the data collected using those instruments will allow me, as a researcher, to investigate as whole how reading literacy is integrated with the science curriculum in two different programs in the Lebanese educational system by checking if the results of each instrument are aligned using the principle of triangulation (Figure 3 on p. 29).

Observations and interviews were used to check how reading literacy is integrated with the science curriculum in both programs; observations, interviews, and the results of questionnaire #2 were used to check the types of reading strategies used in each program; interviews and questionnaire #1 were used to check the importance and effectiveness of reading activities and reading strategies on students knowledge acquisition; and finally interviews and questionnaire #2 were used to check whether students are motivated to read science-based texts or not.

Table 1. The different kinds of instruments used to address each research question

Purpose: To examine whether reading literacy is integrated with the science curriculum in both programs	
Research Questions	**Instrument(s)**
How is ***reading literacy*** integrated with the curriculum in each of the two programs of 8, 9, and 10?	Observations Interviews
What are the ***reading strategies*** used in each program?	Observations Interviews Questionnaire sheet #2
Are students' knowledge acquisition in science-content areas improved and further developed by being ***exposed to readings*** and ***practicing reading strategies*** on regular basis?	Interviews Questionnaire sheet #1
Does the Biology teacher of grades 8, 9, and 10 in both programs ***motivate*** his students to read science-based reports, stories, books, and so forth? If yes, how are students motivated?	Observations Interviews Questionnaire sheet #2

3.5 Data Collection

3.5.1 Observations

Non-participant classroom observations were conducted for a two-week period (10 hours in total). The hours of observations were limited to 10 hours only due to reasons such as statutory holidays and students having reading periods to study and review for their upcoming exams. During classroom observations, data regarding what students were being taught in Biology classes only and what kinds of literacy activities students were exposed to was collected; thus, I was caught up with "what to observe, what to remember, what to record" (Merriam, 1998, p.111). An instructional timeline (Table 2 in Appendix 5) adopted by the one Spence, Yore, and Williams (1999) used in their study was utilized to collect data about (1) Biology topics, (2) reading strategies,

(3) types of texts, (4) interaction of students with the text, and (5) whether motivation is used. So, the structure of the adopted timeline was taken as it is but the content was completely modified. Since this timeline was present in a published article, it wasn't necessary to ask for permission to use this timeline in my study from the researchers who had originally constructed it.

I attended grades 8, 9, and 10 Biology classrooms in both programs and recorded the observations in a written form as field notes (Appendix 4) and filled Table 2 (Appendix 5) with major headlines.

Observations were of great significance since they provided me with "a firsthand account of the situation under study" (Merriam, 1998, p.111). In other words, I was able to experience what the students do in Biology classes by observing what they were taught in those classes, how they were taught Biology, what reading strategies were used, and whether students acquired the content of the subject matter or not.

3.5.2 Interviews

Interviews allow us "to obtain a special kind of information" (Merriam, 1998, p. 71; Cohen, Manion, & Morrison, 2011) and are considered to be the "major source of the qualitative data needed for understanding the phenomenon under study" (Merriam, 1998, p.91; see also Fraenkel & Wallen, 2010). So, with the help of interviews, I was able to attain important details that are important for answering the major question of this study: Which program integrates reading literacy with the science curriculum and how? Coordinators, teachers, and some students were interviewed at the beginning of the study. The students who had been interviewed were selected at random by me. Interview questions, constructed by me, mainly revolved around (1) the objectives of

each program, (2) the purpose of teaching science in middle and high school, (3) the different types of texts the participants are exposed to in Biology class, (4) whether science reading motivation programs are used, (5) the importance of being efficient readers, and (6) the key factor(s) that contribute to maximal comprehension of science texts and thus, acquire important science knowledge (Appendix 1). Although the interview questions have been already specified, new ideas had emerged due to interviewee's answers. Thus, the interviews were semi-structured. Coordinators were the first to begin with since important information that can answer the research question of this study was provided. So, the science coordinator was mainly asked about the *objectives* of each program. As for the English coordinator, the interview questions mainly revolved around the types of texts students are exposed to the most and whether students are taught the different kinds of reading strategies or not. Due to the short time constraint in conducting this study, only one random student was selected from each grade level of each program to individually answer 7 questions. So, a total of 6 students were interviewed. The Biology teacher teaching those classes has also been interviewed individually to answer 7 questions. The types of questions asked to students somewhat varied in content in comparison to those asked to the coordinators and the teacher. However, there were three exact same questions that were asked to the Science coordinator, Biology teacher, and students. This was deliberately done to check whether there were consistencies in answers or not.

The interviews were recorded using my smartphone as an audio recorder that were then transcribed to be analyzed.

3.5.3 Questionnaires

Two questionnaire sheets were administered to all students of grades 8, 9, and 10 of both programs. Both questionnaires included questions about the science subject in general. However, before allowing students to answer the questions, I thoroughly explained the aim of this research and that the main focus was the Biology subject. The first questionnaire sheet was constructed by me and was administered a couple of days after the study was initiated. This sheet was mainly about the students' opinions concerning the importance of acquiring efficient reading skills in science (Appendix 2). Students were asked to answer 7 general questions by circling the number that best applies which varies from very important (1) to neutral (2) to unimportant (3). The second questionnaire sheet was a self-assessment one and was administered at the end of the study (after two weeks). The structure of this questionnaire was adopted by the one constructed by Chou (2013) which he used in his study to learn whether content-based instruction had been effective in improving students English listening abilities. In this questionnaire, students were asked a number of questions in which they assessed themselves in how they believe they are acquiring science content knowledge (Appendix 3).

When those questionnaires were administered, I explained to the students the items found on each questionnaire and what is the importance of each in the study as a whole. In fact, I stayed with the students from the time the questionnaires were administered till the time students gave those questionnaires back in just in case any student had further questions. Questions such as "what does early exposure to reading mean" and "what are reading strategies" were asked. Only basic reading strategies (skimming, scanning, and predictions) were given as examples of reading strategies.

Thus, I was there at all times and had answered all the questions regarding any unclear idea.

It should be noted that the questions asked in the interview and questionnaires were somewhat similar for reliability and validity reasons. As mentioned earlier, coordinators, teachers, and students were interviewed on day one of the study, then questionnaire sheet number 1 was administered two days later, and afterwards self-assessment questionnaire sheet number 2 was administered at the last day of the study. This order allowed seeing whether or not there are consistencies in the results attained at three stages of the study.

Before using the questionnaire sheets in the study, they were piloted on Lebanese students who possessed more than one language (i.e. Arabic, English, and/or French) at an American style university in Lebanon in order to ensure that the content and wordings of each item are clear and understandable.

3.6 Data Analysis

Since this is a qualitative study, discourse analysis was used to analyze the collected data from observations and interviews (Fraenkel & Wallen, 2010; Robson, 2000). Conversely, regarding the responses of the questionnaires, excel was used to calculate the percentages in order to compare the results between the two different programs.

3.7 Reliability and Validity

This is a holistic exploratory case study that is based on events happening in real life and has the tendency to change with time (Merriam, 1998; Yin, 2003). Due to that, the effectiveness of reading activities and reading strategies in acquiring the science

knowledge was based on teachers' and students' perception deduced from items available in the questionnaires and from interviews. Observations were a third instrument and are considered "the primary instrument of data collection and analysis in qualitative research" (Merriam, 1998, p.203). So, for reliability and validity reasons three main instruments were used to conduct this study that serve the ultimate purpose of this research – how is reading literacy integrated in both programs. Although the study was conducted in only one school, similar studies were applied on three different grade levels in two different programs. Thus, in order to reach reliability the same study was repeated three times (i.e. grade 8, 9, 10) for each program. Merriam (1998) argued, "reliability in a research design is based on the assumption that there is a single reality and that studying it repeatedly will yield the same results" (p.205). So, consistencies in answers to similar questions in the three different grade levels of each program showed that the study was reliable. Concerning validity, Merriam (1998) stated, "internal validity deals with the question of how research findings match reality" (p.201). So, by referring back to the results of each instrument used, internal validity was measured. Since the usage of three different instruments led to similar results, the validity of this study was increased. However, what was measured in this study is ever changing which means the effectiveness of each program measured in the Lebanese educational system could be further improved with great effort causing the end results I have reached in my study to change. Using the principle of triangulation, it was used to check if there were any alignment in the results obtained from the observations, interviews, and questionnaires.

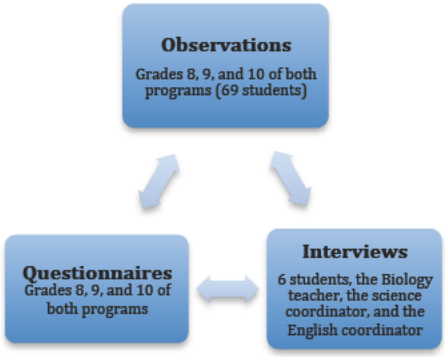

Figure 3: Principle of Triangulation

3.8 Ethical Considerations

Since the study involved human subjects, I had to complete the National Institutes of Health (NIH) Web-based training course "Protecting Human Research Participants." This course taught the importance of protecting humans while conducting the study. After completing this course, an IRB application was submitted to the IRB committee at Lebanese American University for the office to approve on conducting the study. After receiving the approval, I went to the school where I conducted the study and asked the participants to sign a form if they agree to be part of the study. I even sent forms with the students 'for their parents' to sign for allowing their child to be part of the study.

In short, this research is a qualitative study in which purposeful and convenient sampling was used to select the participants and setting of this study. Participants were students in grades 8, 9, and 10 enrolled in the Lebanese program or American program, Biology teacher, science coordinator, and English coordinator. The study took place at a very well known private school located in the suburban areas of Beirut. Three instruments were used to collect the data – interviews, questionnaires, and observations.

Content analysis and excel were used to analyze the content of these instruments. The following chapter presents the findings of this study.

Chapter Four

Results

4.1 Findings

Content analysis was used to analyze observations and interviews. As for the questionnaires, excel was used to calculate the percentages for every question answered by the participants.

4.1.1 Observations

During observations, I made sure that everything that happened in class was written down. Then, using the instructional timeline (Table 2 – Appendix 5), important points were allocated under each category. Most of the sessions observed were initiated by reviewing what has been explained in the session before by using prior knowledge. For example, in the session observed on March 10th, 2015 in grade 9 (American program) the Biology teacher began the session by asking the students who is able to remind the class about the different parts of the Nervous System which required students to activate their memories and use prior knowledge; after listening to a few responses, the teacher proceeded with explaining the rest of the lesson. On that same day, when observing grade 9 students enrolled in the Lebanese program , the Biology teacher began the session the same way he did in grade 9 American program. A short revision about pedigrees in genetics took place during which the teacher asked the students a series of

questions that required them to use prior knowledge in order to be able to answer the questions (Appendix 4). The Biology teacher used a common technique in explaining the lessons in both programs, which was explaining new concepts, and ideas orally and then wrote detailed information (paragraph form and/or bulleted form) on the board for students to either copy it on their copybooks or take a picture using their iPads (Figure 12 in Appendix 4). Also, the Biology teacher would use graphic images (Figure 4 and Figure 10 in Appendix 4) or semantic mappings to explain the lesson such as:

- Direction of nerve impulse in a synapse

  Dendrites ➔ Cell body ➔ Axon ➔ Dendrites ➔ Cell body

Also, the Biology teacher would assign in-class reading activities as part of understanding the lesson. Reading activities were done either by silently reading short paragraphs (Figure 6 in Appendix 4) and/or questions (Figure 5 in Appendix 4) or reading out loud. For example, in the session observed on March 11th, 2015, a short reading activity was done in class. The Biology teacher asked students to silently read a short text about the concept *Hearing* (Figure 6 – Appendix 4) and based on the selected reading students were asked to answer the following question: what is the pathway of sound vibrations into the ear and what are the different parts that make up an ear?

Students took turns during reading activities in which they would read the question out loud and then answer it. For instance, during the session observed on March 16th, 2015, students were asked to work on *Probing the activity* exercise (Figure 9 – Appendix 4) which is series of questions that required students to possess prior knowledge, vocabulary, and good reading skills in order to be able to answer the questions. During such activities students in the Lebanese program would ask questions

about both literary and scientific terms unlike students in the American program who mainly asked about the meanings of scientific terms. Also, although there happened to be some code switching from English to Arabic and vice versa, the language of instruction was mostly English in both programs.

In short, most of the Biology sessions started with short revisions of what has been explained the session before. When proceeding with explaining new concepts, the Biology teacher would explain them orally and then write them on the board for students to copy. Graphic images and/or semantic mappings were also used to explain some of the concepts in Biology. During in-class reading activities, short paragraphs and/or questions were read out loud or silently, which required the activation of prior knowledge and the possession of scientific vocabulary words to understand the content of the texts and questions read.

4.1.2 Interviews

One student from each grade level of every program, the Biology teacher, the English coordinator, and the Science Coordinator were interviewed. So, a total of 9 people were interviewed. The interview questions were semi-structured. The duration of interviews ranged between 4 and 10 minutes. Some of the interviewed students did not know the difference between narrative and expository texts. For example, when a grade 10 student enrolled in the American program was asked about the difference between narrative and expository texts, the students stated that he/she doesn't know the difference. The same thing applied to students in grades 8 and 9 American program; however, it wasn't the same case when students in the Lebanese program were interviewed about that subject (Appendix 6) since they knew the difference between the two kinds of texts. Also, some students did

not know what the types of reading strategies are. Thus, I had to explain some terms and gave examples for students to be able to answer some of the questions. All the students informed me that their interactive books were the only resource for them to refer back to and study from. Some of the answers were common among all the interviewed participants (i.e. Students, Biology teacher, and coordinators). For instance, when the participants were asked about the importance of being efficient readers in acquiring the science knowledge, they all gave similar answers such as to understand the text better and notice little details. The following excerpt demonstrates the importance of being skilled readers in science according to the science coordinator.

> Excerpt 1
>
> Me: In your opinion, what is the importance of being efficient readers in science texts?
>
> Science Coordinator: Being efficient readers when reading science texts you have to perhaps know what's the aim of the scientific text, you know what I mean? And be able to find perhaps the hypotheses, the data, the results, the conclusion because at a certain point in year 9 of the Lebanese program, they give them a text in the official exams and they ask them [students] what's the hypothesis; therefore, the students must be able to find the hypothesis from the text.

Another example was when participants were asked whether the expansion of scientific knowledge is achieved through hands on activities only or not. Participants responded that conducting experiments isn't the only way to learn more about scientific issues and that texts should be present for maximal comprehension. In other cases, answers to questions varied from one student to another. For example, when the participants (i.e. students, Biology teacher, and science coordinator) were asked about the importance of possessing reading strategies along with other several factors such as prior knowledge, vocabulary, and

being exposed to various types of texts in improving and increasing science knowledge acquisition, some participants responded that vocabulary is the most important factor while others believed that all factors have equal importance. The following excerpt demonstrates that science knowledge acquisition is improved and increased by possessing reading strategies, prior knowledge, vocabulary, and being exposed to various texts according to the Biology teacher.

Excerpt 2

Me: Along with reading strategies, do you believe that other factors such as possessing prior knowledge and vocabulary, and being exposed to various types of texts play a role in science knowledge acquisition?

Teacher: Sure, sure.

Me: Do they have equal importance? Or is one factor more important than the other?

Teacher: I believe having background knowledge is a bonus in acquiring the science knowledge…also, vocabulary…

Me: Okay, so is there a main factor?

Teacher: You mean here in English or Biology?

Me: Biology, of course. Which one of these factors is important?

Teacher: Of course, being exposed to various types of texts. But also vocab and prior knowledge are important I think.

Me: So, all factors are important?

Teacher: Yes.

In short, students in the Lebanese program know the difference between narrative and expository texts unlike students in the American program. Regarding reading strategies, findings showed that students in both programs were taught the basic types of reading

strategies. Also, findings showed that all the interviewed participants (i.e. students, Biology teacher, and science coordinator) agreed that it is important to be efficient readers in science to be able to extract the information needed from scientific text and that scientific knowledge is achieved through hands on experiments associated with texts. However, when the participants were asked about the importance of reading strategies with other factors discussed earlier, the majority said that all the factors have equal importance in increasing science knowledge acquisition and one of the participants said that possessing a wide bank of vocabulary is the most important factor.

4.1.3 Questionnaires

In questionnaire sheet number 1 (Appendix 2), students were asked about their points of view regarding the importance of acquiring efficient reading skills in science (i.e. Biology).

A. Grades 8, 9, and 10 Lebanese program

Table 3: Questionnaire sheet 1 results for grade 8, 9, and 10 students in the Lebanese program

Questions	Total sample size (N) - Grades 8, 9, and 10 Lebanese program	Average - Important (%)	Average - Neutral (%)	Average - Unimportant (%)	Total Average
Early exposure to texts is	30	90%	7%	3%	100%
Frequent reading practices in science is needed throughout the year is	30	87%	13%	0%	100%
Prior knowledge is needed to better understand the science subject is	30	87%	13%	0%	100%
Being a skilled reader improves knowledge of science is	30	73%	13%	13%	100%
Being a skilled reader enhances critical thinking in science is	30	63%	33%	3%	100%
Acquiring various reading strategies i	30	87%	13%	0%	100%
Improving and expanding your vocabulary in science is	30	93%	7%	0%	100%

Table 3 illustrates the results of questionnaire sheet 1 for students in grades 8, 9, and 10 enrolled in the Lebanese program. Using table 3, 90% of the students believe that early exposure to texts is important while only a small percentage (3%) believe it is not important. The remaining 7% were neutral about it. 87% of the students believe that reading practices in science is needed very frequently throughout the year. No one believes it is not important; however, 13% of the students were neutral about it. Regarding the importance of possessing prior knowledge to understand the science subject better, 87% of the students believe that is important and only 13% are neutral about it. When students were asked about the importance of being a skilled reader in improving science knowledge, 73% believe it is important, 13% believe it is unimportant, and 13% were neutral about it. Concerning the importance of being a skilled reader in enhancing critical thinking in science, 63% believe it is important, 3% believe is unimportant, and 33% were neutral about it. As for the importance of acquiring various reading strategies, 87% believe it is important and only 13% were neutral about it. Also, 93% believe that it is important to improve and expand ones vocabulary in science and only 7% were neutral about it.

B. Grades 8, 9, and 10 American program

Table 4: Questionnaire sheet 1 results for grade 8, 9, and 10 students in the American program

Questions	Total sample size (N) - Grades 8, 9, and 10 American program	Average - Important (%)	Average - Neutral (%)	Average - Unimportant (%)	Total Average
Early reading exposure to texts is	39	58%	36%	6%	100%
Frequent reading practices in science is needed throughout the year is	39	82%	18%	0%	100%
Prior knowledge is needed to better understand the science subject is	39	82%	13%	5%	100%
Being a skilled reader improves knowledge of science is	39	51%	46%	3%	100%
Being a skilled reader enhances critical thinking in science is	39	79%	19%	2%	100%
Acquiring various reading strategies is	39	74%	24%	2%	100%
Improving and expanding your vocabulary in science is	39	89%	3%	8%	100%

Table 4 illustrates the results of questionnaire sheet 1 for students in grades 8, 9, and 10 enrolled in the American program. Using table 4, 58% of the students believe that early exposure to texts is important while only a small percentage (6%) believe it is not important. The remaining 36% were neutral about it. 82% of the students believe that reading practices in science is needed very frequently throughout the year. No one believes it is not important; however, 18% of the students were neutral about it. Regarding the importance of possessing prior knowledge to understand the science subject better, 82% of the students believe that is important, 5% believe it is unimportant, and only 13% were neutral about it. When students were asked about the importance of being a skilled reader in improving science knowledge, 51% believe it is important, 3% believe it is unimportant, and 46% were neutral about it. Concerning the

importance of being a skilled reader in enhancing critical thinking in science, 79% believe it is important, 3% believe is unimportant, and 19% were neutral about it. As for the importance of acquiring various reading strategies, 74% believe it is important, 2% believe it is unimportant, and 24% were neutral about it. Also, 89% believe that it is important to improve and expand ones vocabulary in science, 8% believe it is unimportant, and only 3% were neutral about it.

In questionnaire sheet number 2, students were asked to assess themselves based on 7 items in which each had sub-item(s). Those items are key factors important in acquiring science (i.e. Biology) knowledge.

A. Grades 8, 9, and 10 Lebanese program

Table 5: Questionnaire sheet 2 results for grade 8, 9, and 10 students in the Lebanese program

Items	Sub-items	Total sample size (N) - Grades 8, 9, and 10 Lebanese program	Average - Agree (%)	Average - Disagree (%)	Total Average (%)
Prior Knowledge	I possess sufficient background knowledge in the science topics being taught at this grade level	30	83%	17%	100%
Vocabulary	I understand many scientific vocab words in scientific texts	30	80%	20%	100%
	I am frequently taught new scientific vocab words in class	30	100%	0%	100%
Exposure to Texts	I was exposed to reading texts at a very early age at school	30	63%	37%	100%
	I was exposed to reading scientific texts in elementary school	30	60%	40%	100%
	I was exposed to reading scientific texts in middle school	30	80%	20%	100%
	I was exposed to reading scientific texts in high school (Grade 10 students only)	10	90%	10%	100%
Text Types: Narrative vs Expository	I was taught the difference between narrative and expository texts	30	67%	33%	100%
	I am exposed to narrative scientific texts more than expository texts in science classes	30	30%	70%	100%
	I am exposed to both kinds of texts equally in science classes	30	47%	53%	100%
Reading and Reading Strategies	My science teacher encourages me to read scientific texts during my free time	30	43%	57%	100%
	My science teacher assigns reading scientific texts as classwork and/or homework	30	60%	40%	100%
	I am taught different reading strategies in science classes	30	60%	40%	100%
	I am encouraged to practice different reading strategies in science class	30	60%	40%	100%
	I use at least one reading strategy when reading a scientific text	30	75%	25%	100%
Lesson Content	I could understand the content of each lesson when reading assigned chapters in the science textbook	30	73%	27%	100%
	Understanding the lesson content helped me to better comprehend scientific texts	30	83%	17%	100%
Teaching and Activities	In-class reading activities improved my reading ability	30	80%	20%	100%
	In-class reading activity improved my science knowledge	30	83%	17%	100%

Table 5 illustrates the results of questionnaire sheet 2 for students in grades 8, 9, and 10 enrolled in the Lebanese program. Using table 5, in the first key factor in acquiring

science knowledge – prior knowledge, 83% of the students agree that they possess enough background knowledge in the science topics being taught at their grade level, whereas 17% believe they do not possess enough prior knowledge in science. Regarding vocabulary, 80% of the students assessed themselves as being able to understand many scientific terms in scientific texts and 20% of the students assessed themselves as being unable to understand scientific terms. Also, all students (100%) claimed that they are frequently taught new scientific terms in Biology class. As for the third key factor, exposure to scientific texts – the majority of the students assessed themselves as being exposed to scientific texts during preschool, elementary, middle, and high school. For example, 63% of the students were exposed to texts at an early age, 60% of the students were exposed to texts in elementary, and 80% of the students were exposed to texts in middle school. In the fourth key factor, text types, the majority of the students claimed that they know the difference between expository and narrative texts. For instance, 67% of the students assessed themselves as knowing the difference between expository texts and narrative texts, whereas 33% claimed otherwise. In the fifth key factor, reading and reading strategies, 43% of the students claimed that their Biology teacher does not encourage them to read scientific texts during their free time; however, 60% claimed that he does assign reading scientific texts as classwork and/or homework. In addition, 60% of the students claimed that they are taught different reading strategies in science class; however, 60% of the students claimed that they are not encouraged to practice reading strategies in science class. 75% of the students claimed that they use at least one reading strategy when using a scientific text. Regarding lesson content in science, 73% of the students claimed that they could understand each science lesson if reading activities are assigned in their science textbooks and 83% of the students claimed that

understanding the lesson content helps one to comprehend scientific texts better. As for the last key factor, teaching and activities, very high percentages of students claimed that in-class reading activities improved their reading ability and science knowledge. For instance, 80% claimed that in-class reading activities improved their reading ability and 83% claimed that in-class reading activities improved their science knowledge.

B. Grades 8, 9, and 10 American program

Table 6: Questionnaire sheet 2 results for grade 8, 9, and 10 students in the American program

Items	Sub-items	Total sample size (N) - Grades 8, 9, and 10 American program	Average - Agree (%)	Average - Disagree (%)	Total Average (%)
Prior Knowledge	I possess sufficient background knowledge in the science topics being taught at this grade level	37	67%	33%	100%
Vocabulary	I understand many scientific vocab words in scientific texts	37	55%	45%	100%
	I am frequently taught new scientific vocab words in class	37	84%	16%	100%
Exposure to Texts	I was exposed to reading texts at a very early age at school	37	67%	33%	100%
	I was exposed to reading scientific texts in elementary school	37	52%	48%	100%
	I was exposed to reading scientific texts in middle school	37	74%	26%	100%
	I was exposed to reading scientific texts in high school (Grade 10 students only)	10	70%	30%	100%
Text Types: Narrative vs Expository	I was taught the difference between narrative and expository texts	37	48%	52%	100%
	I am exposed to narrative scientific texts more than expository texts in science classes	37	44%	56%	100%
	I am exposed to both kinds of texts equally in science classes	37	34%	66%	100%
Reading and Reading Strategies	My science teacher encourages me to read scientific texts during my free time	37	58%	42%	100%
	My science teacher assigns reading scientific texts as classwork and/or homework	37	58%	42%	100%
	I am taught different reading strategies in classes classes	37	55%	45%	100%
	I am encouraged to practice different reading strategies in science class	37	35%	65%	100%
	I use at least one reading strategy when reading a scientific text	37	48%	52%	100%
Lesson Content	I could understand the content of each lesson when reading assigned chapters in the science textbook	37	71%	29%	100%
	Understanding the lesson content helped me to better comprehend scientific texts	37	86%	14%	100%
Teaching and Activities	In-class reading activities improved my reading ability	37	82%	18%	100%
	In-class reading activity improved my science knowledge	37	87%	13%	100%

Table 6 illustrates the results of questionnaire sheet 2 for students in grades 8, 9, and 10 enrolled in the American program. Using table 6, in the first key factor in acquiring science knowledge – prior knowledge, 67% of the students agree that they possess enough background knowledge in the science topics being taught at their grade level, whereas 33% believe they do not possess enough prior knowledge in science. Regarding vocabulary, 55% of the students assessed themselves as being able to understand many scientific terms in scientific texts and 45% of the students assessed themselves as being unable to understand scientific terms. Also, 84% claimed that they are frequently taught new scientific terms in Biology class, and only 16% claimed otherwise. As for the third key factor, exposure to scientific texts – the majority of the students assessed themselves as being exposed to scientific texts during preschool, elementary, middle, and high school. For example, 67% of the students were exposed to texts at early age and 74% of the students were exposed to texts in middle school. The percentages of students not exposed to texts during those years were lower but not very low. For example, 48% of students claimed they weren't exposed to scientific texts in elementary school. In the fourth key factor, text types, the percentages are close; however, the majority of students claimed that they do not know the difference between expository and narrative texts nor are they exposed to those kinds in class. For instance, 52% of the students assessed themselves as not knowing the difference between expository texts and narrative texts, whereas 48% claimed otherwise. In the fifth key factor, reading and reading strategies, 58% of the students claimed that their Biology teacher does not only encourage them to read scientific texts during their free time but also assigns reading scientific texts as classwork and/or homework. In addition, 55% of the students claimed that they are taught different reading strategies in science class; however, 65% of the students

claimed that they are not encouraged to practice reading strategies in science class. Only 48% of the students claimed that they use at least one reading strategy when using a scientific text. Regarding lesson content in science, 71% of the students claimed that they could understand the of each science lesson if reading activities are assigned in their science textbooks and 86% of the students claimed that understanding the lesson content helps one to comprehend scientific texts better. As for the last key factor, teaching and activities, very high percentages of students claimed that in-class reading activities improved their reading ability and science knowledge. For instance, 82% claimed that in-class reading activities improved their reading ability and 87% claimed that in-class reading activities improved their science knowledge.

In short, observations showed that both programs integrate reading literacy with the science curriculum and that students are exposed to only expository texts that require prior knowledge, good vocabulary, and good reading skills in order to grasp the material as supposed to. Also, students in the Lebanese program struggle with scientific and literary terms more than students in the American program. Regarding interviews, they showed that students in both programs, the Biology teacher, and coordinators all agree that it is important to be efficient readers for maximal text comprehension along with the possession of prior knowledge, good vocabulary, and/or good reading skills/strategies. As for the questionnaires, the majority of students of both programs believe that early exposure to texts during primary years of schooling, possessing prior knowledge and various reading strategies, improving and expanding ones vocabulary in science, and being efficient readers are all important factors in acquiring the science content knowledge. When the students assessed themselves using questionnaire sheet 2, slight differences in the results between the two programs existed; however, major differences

existed when students were asked about text types – the majority of students in the Lebanese program claimed that they know the difference between expository texts and narratives unlike the majority of students in the American program who claimed otherwise. Reasons to the results obtained using those three instruments are discussed in the next chapter.

Chapter Five

Discussion

The study examines whether reading literacy integrated in the science curriculum while comparing two different programs used in the Lebanese educational system. The importance of reading literacy is emphasized in this study to show its significance in acquiring science content knowledge since acquiring a reading skill is a predictor of science achievement and not reading strategy knowledge (O'Reilly & McNamara, 2007).

In addressing the first research question (i.e. How is reading integrated in grades 8, 9, and 10 in both programs?) results of the observations (Appendix 4 and 5), interviews (Appendix 6), and questionnaire sheet number 2 (Appendix 3) were used to figure out the answer. Based on the notes (Appendix 4) taken during observation, I found out that reading activities were practiced in Biology classes in both programs. During interviews, students in grades 8, 9, and 10 in the Lebanese program all gave one common answer when asked if they are exposed to various kinds of texts in their Biology class. Their answers were *yes* they are exposed to various kinds of texts; however, the texts were mostly expository kinds of texts. In contrast, students of grades 8, 9, and 10 in the American program stated that they are rarely exposed to readings in

Biology classes and that they only refer to their iBooks when needed. So, this means that students in the Lebanese program rely on both, their iBooks and the teacher's notes unlike students in the American program who rely more on the teacher's notes. When the science coordinator was interviewed, she claimed that students in the Lebanese program are exposed to readings more than the American program. Moreover, when the Biology teacher and I were engaged in a side discussion during recess time, he mentioned that he integrates Biology with reading literacy in the Lebanese program more than the American program. However, the results in questionnaire sheet number 2 (Appendix 3) showed the opposite. Using tables 5 and 6, 60% of the students in the Lebanese program claimed that their Biology teacher assigns reading scientific texts as classwork and/or homework, and 58% of the students in the American program claimed that their Biology teacher integrates reading with the subject matter. The percentages are close showing that reading literacy is integrated in both programs. Moreover, when the English coordinator was interviewed, she stated that there actually is integration of science in English classes during which students read scientific articles during 'article hour' that is assigned once per week for grades 8, 9, and 10 of both programs. Nevertheless, the science coordinator stated during the interview that English literacies are not integrated with the science curriculum. So, the observations showed the opposite to what the science coordinator stated; the different kinds of literacies learned in English classes are put into use in Biology classes for comprehension of the material. Thus, reading literacy is integrated with the science curriculum in both programs through assigned in-class reading activities but informally and not in great depth. This finding proves what I discussed earlier in this research about the absence of integration of reading literacy with the science curriculum at those grade levels. This is evident when

Fang et al. (2008) claimed, “the shortage of research may be the reflection of the reality that reading-science integration rarely occurs in middle and high schools” (p.2069).

In addressing the second research question (i.e. what are the reading strategies used in each program?), observations (Appendix 4 and 5), interviews (Appendix 6), and questionnaire sheet number 2 (Appendix 3) were used to find answers. Based on the observations, the two main reading strategies used were cognitive strategies (i.e. activation of prior knowledge and making predictions) and memory strategies (skimming and scanning) that Qanwal and Karim (2014) discuss in their study. This shows that the basic reading strategies discussed by Castillo and Bonilla (2014) were actually taught to students and they were practiced in order to be able to find answers to questions. This was also evident when students were asked during the interviews if they use different basic reading strategies while reading scientific texts; they all agreed. Furthermore, when the Biology teacher was asked about the types of reading strategies he encourages all his students to use in his class, his response was scanning and making predictions. On the other hand, the science coordinator stated during the interview that making predictions was the only reading strategy students are taught how to use. Although there were slight differences in replies among the students, the Biology teacher, and the coordinator, findings show that they all agree that at least one type of basic reading strategy is used in both programs in middle and high school when approaching scientific texts. By way of contrast, the results in questionnaire sheet number 2 (Appendix 3) were different. Using tables 5 and 6, one of the questions asked was whether their Biology teacher encourages them to practice different reading strategies in science class. Results showed that 35% of the students in the American program agreed, whereas 60% of the students in the Lebanese program agreed. In

another question, students were asked if they use at least one reading strategy when reading scientific texts. Results showed that 48% of the students in the American program agreed, whereas 75% of the students in the Lebanese program agreed. This shows that students in the Lebanese program are not only encouraged to use reading strategies while approaching scientific texts but also they practice them in their Biology classes. Hence, this could support what the coordinator and the teacher have said earlier about integrating reading literacy with the science curriculum in the Lebanese program more than the American program. This was also evident when grade 10 (Lebanese program) took an exam about the Nervous System that required students to use three main reading strategies all at once - Memory,

cognitive, and test-taking strategies (Qanwal & Karim, 2014) (Appendix 4).

In class, readings done were either out loud or silent, fast or slow. In addition to readings and being exposed to texts, students in grades 8, 9, and 10 of both programs were also taught Biology using semantic organizers and imagery. The students' iBooks are filled with texts and images in which students had to use both in order to grasp the content of the subject matter and understand the major headlines and details of every Biology lesson introduced. The most common techniques used in class by the Biology teacher were either asking students to take turns in reading the questions found in their iBook and answering them using prior knowledge and/or the texts in the chapter or he would randomly choose a student to read the question out loud and ask that student to answer the question also using prior knowledge and/or the texts in the chapter they are at.

In both programs, silent readings were usually done during exams and during assigned in-class activities that required individual work. During those kinds of

activities, students would scan the texts and questions to be able to provide answers. Reading out loud was usually done during in-class activities in which the teacher required the students to work as a whole team. Whether the students were writing an exam or working on in-class activities, students in the Lebanese program would ask questions about the meanings of certain terms that could be considered as scientific and/or literary terms. For example, a grade 8 student once asked what the term *derived* meant. In the same program, another student in grade 10 asked the teacher what the word *annotation* meant. When defining those words, the Biology teacher would only explain them by substituting the terms with other terms such as *deduce* and *label* respectively. This shows that the reason why some students are weak in knowing the meaning of certain words is because either the Biology teacher does not put much effort in explaining scientific words in a detailed manner or students weren't taught in English subjects to use contextual clues to know the meaning of unfamiliar or tough terms, or it could be both. Although students in the American program did face similar problems with scientific words, they did not struggle with literary terms as much. When in fact, the results of the questionnaire sheet number 2 (Appendix 2) show different results. Using tables 5 and 6, when students were asked about whether they understand scientific vocabulary words in scientific texts, only 55% of the students in the American program agreed whereas 80% of the students in the Lebanese program agreed.

In regards to the types of texts students are exposed to the most in Biology classes, using Table 2 (Appendix 5) students happen to engage with only one kind of text – expository texts. When asked about the difference between expository and narrative texts in questionnaire sheet 2 (Appendix 3), 67% of the students in the Lebanese program stated that they were taught the difference between those types of

texts; however, they are mostly exposed to expository texts since 70% claimed that they are exposed to expository texts more than narrative texts (Table 5). Even when students in the Lebanese program were interviewed and asked whether they know the difference between those types of texts or not, they said yes. In contrast, only 48% of the students in the American program claimed that they were taught the difference between those types of texts and 56% claimed that they are exposed to expository texts more than narrative texts. Most students did not know the differences between expository texts and other kinds of texts such as narrative although the English coordinator stated during the interview that students are exposed to various types of texts in English classes. So, as Reichenberg (2008) indicated in his research, expository texts are the most used types of texts in science education.

In addressing the third research question (i.e. Is students' knowledge acquisition in science-content areas improved and further developed by being exposed to readings and practicing reading strategies on regular basis?), interviews (Appendix 6) and questionnaire sheet 1 (Appendix 2) were used to find the answer. Interviews provided me with teachers' perception whereas questionnaire sheet 1 provided me with students' perception. When the coordinator, teacher, and students were asked about the importance of being efficient readers, they all stated that it is important to comprehend the text better and find little details that require several close looks to be found and thus, acquire the science knowledge. This is supported by the studies conducted by (1) Cromely (2009) who stated that comprehension of scientific texts and reading literacies are highly correlated, (2) Fang et al. (2008) who indicated that the integration of reading with science has a positive effect on students knowledge acquisition and thus, improve student performance, and (3) O'Reilly and McNamara (2007) who claimed good reading

skill predicts science achievement. When they were asked about whether conducting experiments in Biology is the only way to acquire knowledge, nearly all of the interviewed participants claimed that experiments with *texts* are important for knowledge acquisition. Yet, when they were asked about which factor (i.e. prior knowledge, vocabulary, reading activities) other than reading strategies is important in acquiring science knowledge, responses varied. The Biology teacher and science coordinator along with a couple of students agree that all factors are of equal importance in science knowledge acquisition. But other students view that possessing a wide bank of vocabulary is integral in the acquisition of science knowledge since many scientific terms act as a barrier for students in comprehending scientific texts. However, according to the Biology teacher's and science coordinator's points of view, science knowledge acquisition is achieved to a great extent when students know how to read and comprehend a text by using reading strategies, prior knowledge, and knowing the meaning of scientific terms. When students were asked about the importance of acquiring efficient reading skills in science (mainly Biology) to increase science knowledge acquisition, results of both programs slightly varied but led to one conclusion. Using table 3, 73% of the students in the Lebanese program believe that being a skilled reader is important to improve knowledge of science whereas only 51% of the students in the American program (Table 4) believe so. However, 63% of the students in the Lebanese program believe that being a skilled reader is important in enhancing critical thinking in science and 79% of the students in the American program believe so. When asked about the importance of prior knowledge in understanding the science subject, 73% of the students in the Lebanese program and 87% of the students in the American program claimed that it is important. Furthermore, very high percentages

in both programs (i.e. 87% students in the Lebanese program and 74% students in the American program) believe that acquiring various reading strategies is important for science text comprehension. In a like manner, high percentages in both programs (i.e. 93% students in the Lebanese program and 89% students in the American program) believe that it is important to improve and expand one's vocabulary in science. This means that, according to students, prior knowledge, vocabulary, knowing how to read, and using various reading strategies when approaching science texts are needed to acquire science knowledge. These findings show that individual difference factors – prior knowledge and language abilities – contribute to maximal text comprehension in science (Cromely, 2009; Ozuru, Dempsy, & McNamara, 2009; Wang et al., 2010).

In addressing the fourth research question (i.e. Do Biology teachers of grades 8, 9, and 10 in both programs motivate their students to read science-based reports, stories, books, and so forth? If yes, how are students motivated?), observations (Appendix 4), interviews (Appendix 6), and questionnaire sheet number 2 (Appendix 3) were used to find the answer. Based on the observations, the kinds of motivations that the Biology teacher used to encourage students to read in class was done by using positive reinforcements and incentives such as giving 5 points to whoever reads and answers whatever question is assigned by him or found in the iBook or by randomly choosing a student to read and answer the questions through guidance. However, the teacher never assigned any readings as homework whether from their interactive textbooks or other additional supplements. Based on the interview responses, students in the Lebanese programs approved that their Biology teacher motivates them to read; on the other hand, students in the American program claimed that their Biology teacher does not motivate them to read science-based texts other than their iBooks. Also, when the science

coordinator was asked whether reading motivation programs are used in science classes, she looked surprised and answered no. However, when asked about the importance of experiments *only* in the expansion of science knowledge, she mentioned that both, experiments and guided inquiry strategies with texts, are needed for the expansion of science knowledge. Using tables 5 and 6, slightly less than half of the students in the Lebanese program claimed that their Biology teacher encourages them to read scientific texts during their free time; whereas slightly more than half of the students in the American program claimed that their Biology teacher encourages them to read scientific texts during their free time. So, basically, motivating students to read were done using traditional ways of teaching by providing them with positive reinforcements only and not through professionally established programs such as CORI that helps increase reading motivation in students for long periods of time through hands-on activities and inquiry strategies (Guthrie & Alao, 1997).

The results of this study were surprising since what I initially hoped to see turned out to be different. Although both programs used in the Lebanese educational system integrate reading literacy with the science curriculum, the Lebanese program was more serious about it than the American program. For example, during observation hours, students in the Lebanese program showed more interest in Biology subject and made more effort in acquiring the content of the subject, especially in grade 9 who have to sit for official exams at the end of the year. Yet, this integration is still at the superficial level. Both programs used at least basic reading strategies when approaching scientific texts. Regarding discrepancies in findings (i.e. students questionnaires) between both programs, it could be interpreted due to the fact that in the Lebanese program, vocabulary instruction and reading rules are stated more explicitly than in the American

program. So, unlike students in the American program, students in the Lebanese program are taught science through rote learning as well as how to scan and detect certain keywords to solve problems especially for the sake of governmental exams. Findings of this study support other studies discussed earlier that focus on the importance of integrating reading literacy with the science curriculum. Comprehension of scientific texts requires one to possess the following: (1) a good reading skill, (2) exposure to various kinds of texts (not only expository), (3) usage of various reading strategies, (4) possess prior knowledge, and (5) know the meaning of scientific and literary terms. Thus, results of this study showed clear differences between the Lebanese and the American programs that are further discussed in the last chapter along with the limitations of the study and what further research is suggested.

Chapter Six

Conclusion

Conducting this study showed that there are differences in the science curriculum between two different programs in the Lebanese educational system. The Lebanese program integrates reading into the science curriculum more than the American system; however, this integration is only superficial in both programs. Thus, in-depth integration between reading literacy and Biology is needed for maximal acquisition of the subject matter. When speaking of science, it should not be correlated immediately with experiments and memorization. However, this does not mean that memorization is not essential in science subjects; on the contrary, it is important to acquire a very wide bank of scientific vocabulary terms and prior knowledge. But, becoming efficient readers facilitates one's interaction with various types of scientific texts; thus, making it easy to comprehend those texts. A good start would be by exposing students to scientific texts during their primary years of schooling up until high school. To become efficient readers requires one to adopt reading as a habit and should be an ongoing process. A curriculum strategy should be constructed and adopted by teachers in order to make that happen. So, it is recommended that English teachers/coordinators and science teachers/coordinators sit together and work on integrating reading literacy with the science curriculum. It is

not enough to teach students how to read in English classes and bombard students with scientific facts for students to memorize in science classes. Also, students should be exposed to various text types in their science classes. Being exposed to expository kinds of texts only could be very boring and thus, students lose interest in the subject matter. In view of this fact, creative in-class reading activities would be one way to grab students attention such as 'article hour' the students at this school engage in once per week which should be more frequent. Furthermore, it is the science teachers' duty to teach their students how to implement various reading strategies when approaching scientific texts since I strongly believe that teaching reading strategies is not only the English teachers' responsibility. Teaching and assessing reading in science should be taken into careful consideration since it helps students' progress in communication, discourse, inquiry, and problem solving skills. Integration of different subjects is crucial in creating well-rounded, life long learners who can positively impact their society.

6.1 Limitations

A few limitations existed while conducting the study that might explain the slight deviations in the results witnessed. First of all, as mentioned earlier, only one school has been used to conduct the study due to accessibility reasons. Also, only 6 out of 69 students were interviewed due to limited time. So, the sample size being interviewed was very low. Additionally, the school had students who transferred from French schools so there was a huge language barrier making it hard for them to understand the items of the questionnaires despite explaining the content of each questionnaire multiple times. Also, while observing students fill out the questionnaires, it was obvious that some students were randomly filling them out showing no interest in reading the content

of the questionnaires; thus, they randomly circled numbers and/or checked agree or disagree.

6.2 Suggestions for further research

As mentioned earlier, not much research has been conducted on the integration of reading literacy with the science education in middle and high school. This research alone is not enough to cover the shortage that exists in this field; thus, it is suggested that further research with similar studies is required in hopes of finding solutions to fill such gaps in science education in specific and the field of education in general. The Lebanese educational system is not only composed of those two programs – Lebanese and American. There is also a third program that is very interesting and has been trending for the past 10 years. This program is known as the International Baccalaureate. Further research regarding the integration of English literacies with the science curriculum in those three programs all together is needed since it would be of great benefit for not only students and teachers but also the society itself.

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Appendices

Appendix 1

Interview - Coordinators, teachers and students of grades 8, 9, and 10

Science Coordinator(s):

The coordinators of each program are asked the following questions:

1) What are the general objectives for each science curriculum in grades 8, 9, and 10? (Biology in specific)

2) What are the specific objectives of the science curriculum for each program in grades 8, 9, and 10?

3) Are reading strategies a part of each curriculum? Why or why not?

4) Are there reading motivation programs used in the science curriculum in grades 8, 9, and 10? If so, what are they?

5) In your opinion, what is the importance of being efficient readers when reading science texts?

6) In your opinion, is the expansion of scientific knowledge achieved through hands-on activities (i.e. experiments) only? Why or why not?

7) Along with reading strategies, do you believe that other factors such as possessing prior knowledge and vocabulary, and being exposed to various texts play a role in science knowledge acquisition? Do all theses factors have equal importance? If yes, why? If no, what is the main key factor in science knowledge acquisition?

Additional questions:

1) Do you think students in the Lebanese program are exposed to texts more than students in the American program? Or is the other way around? Or are students in both programs exposed to texts?
2) Based on your work experience, how do you think students can excel at acquiring science knowledge in Biology? What should students do to be able to acquire science knowledge and attain the goals and objectives of the science subject?
3) What is your opinion about memorization in Biology?
4) Do you think it would be a good idea for English and Biology teachers to sit together and work on integrating both subjects in their classroom?

5) Have you ever noticed how students approach a text in Biology? In grades 8,9, and 10 do you think they are comfortable with texts or are they more comfortable with diagrams and images?

English Coordinator(s):

1) Are students of grades 8, 9, and 10 of both programs exposed to various types of texts in the classroom?
2) Are students taught various reading strategies?
3) In your opinion, being efficient readers is only important in the English subject?
4) Based on your work experience, how do you think students can become efficient readers?
5) Do you think early exposure to reading is important?

Biology Teacher(s):

1) What is the main purpose of teaching Biology? (For basic knowledge only or is there more to that?)
2) Is there a reading program you rely on the most in explaining the Biology lessons?
3) What reading strategies do you use in your classrooms?
4) Do you motivate your students to read science texts? If so, how?
5) In your opinion, what is the importance of being efficient readers when reading science texts?
6) In your opinion, is the expansion of scientific knowledge achieved through hands-on activities (i.e. experiments) only? Why or why not?
7) Along with reading strategies, do you believe that other factors such as possessing prior knowledge and vocab, and being exposed to various texts play a role in science knowledge acquisition? Do all theses factors have equal importance? If yes, why? If no, what is the main key factor in science knowledge acquisition?

Additional questions:

1) How long have you been working before?
2) Based on your work experience, how can you ensure that your students are actually acquiring the needed knowledge in Biology?
3) If you see students struggling in acquiring the science knowledge, what would you do?
4) Based on your 20 years experience, what factors would help student excel in Biology and acquire the needed material? For example, we talked about the importance of prior knowledge before, possess a wide bank of vocabulary, being exposed to various types of reading texts and use various reading strategies when approaching texts…
5) What is your opinion about memorization in Biology?
6) Do you think students in the Lebanese program are exposed to readings in Biology classes more than American?
7) Do you think if English teachers and Biology teachers work together would be a good idea? For example, establishing some kind of program that could help students acquire the proper scientific knowledge?

Students:

1) Are you exposed to various texts in your Biology classes? If yes, what is the most kind of text are you usually exposed to?

2) Are you introduced to new reading strategies every once in while? If yes, does it impact your ability in acquiring the learning outcomes of each unit?

3) Does your teacher motivate you to read? If so, how?

4) In your opinion, what is the importance of being efficient readers when reading science texts?

5) In your opinion, is the expansion of scientific knowledge achieved through hands-on activities (i.e. experiments) only? Why or why not?

6) Along with reading strategies, do you believe that other factors such as possessing prior knowledge and vocabulary, and being exposed to various texts play a role in science knowledge acquisition? Do all theses factors have equal importance? If yes, why? If no, what is the main key factor in science knowledge acquisition?

Appendix 2

Questionnaire sheet #1

Age: _____ Gender:_____

Grade level: _____

Indicate your view of the following aspects about the importance of acquiring efficient reading skills in science

Circle the number that applies

I = Important N = Neutral U = Unimportant

I believe that:

	I	**N**	**U**
Early reading exposure to texts is	1	1	3
Frequent reading practices in science is needed throughout The year	1	2	3
Prior knowledge is needed to better understand the science subject	1	2	3
Being a skilled reader improves knowledge of science	1	2	3
Being a skilled reader enhances critical thinking in Science	1	2	3
Acquiring various reading strategies is	1	2	3
Improving and expanding your vocabulary in science is	1	2	3

Appendix 3

Questionnaire sheet #2

Self-assessment questionnaire of using key factors in acquiring science knowledge

Age: _____ Gender: _____

Grade level: _____

SELF-ASSESSMENT ITEMS	DISAGREE	AGREE
Prior Knowledge		
1. I possess sufficient background knowledge in the science topics being taught at this grade level		
Vocabulary		
1. I understand many scientific vocab words in scientific texts		
2. I am frequently taught new scientific vocab words in class		
Exposure to Texts		
1. I was exposed to reading texts at a very early age at school		
2. I was exposed to reading scientific texts in elementary school		
3. I was exposed to reading scientific texts in middle school		
4. I was exposed to reading scientific texts in high school		
Text Types: Narrative versus Expository		
1. I was taught the difference between narrative and expository texts		
2. I am exposed to narrative scientific texts more than expository texts in class		
3. I am exposed to both types of texts equally in class		
Reading and Reading Strategies		
1. My teacher encourages me to read scientific texts during my free time		
2. My teacher assigns reading scientific texts as classwork and/or homework		
3. I am taught different reading strategies in science class		
4. I am encouraged to practice different reading strategies in science class		
5. I use at least one reading strategy when reading a scientific text		

SELF-ASSESSMENT ITEMS	DISAGREE	AGREE
Lesson Content		
1. I could understand the content of each lesson when reading assigned chapters in the science textbook		
2. Understanding the lesson content helped me to better comprehend scientific texts		
Teaching and Activities		
1. In-class reading activities improved my reading ability		
2. In-class reading activity improved my science knowledge		

Appendix 4

Field notes (Observations)

Tuesday March 10th, 2015

9A –
The session began at 7:50 am and ended at 8:50 am. The instructor began the session with a brief revision by asking students about the different parts of the nervous system. Then, he moved on to continue explaining chapter 4 that was about the Nervous System. In explaining the lesson, the instructor mainly relied on using English most of the time. Each concept explained to students was done by writing on the board the following: (1) Titles and details under each title in bulleted form, (2) labeled diagrams, and (3) symbols such as arrows. The following is an example of how the instructor explains each concept:

- What is a synapse?

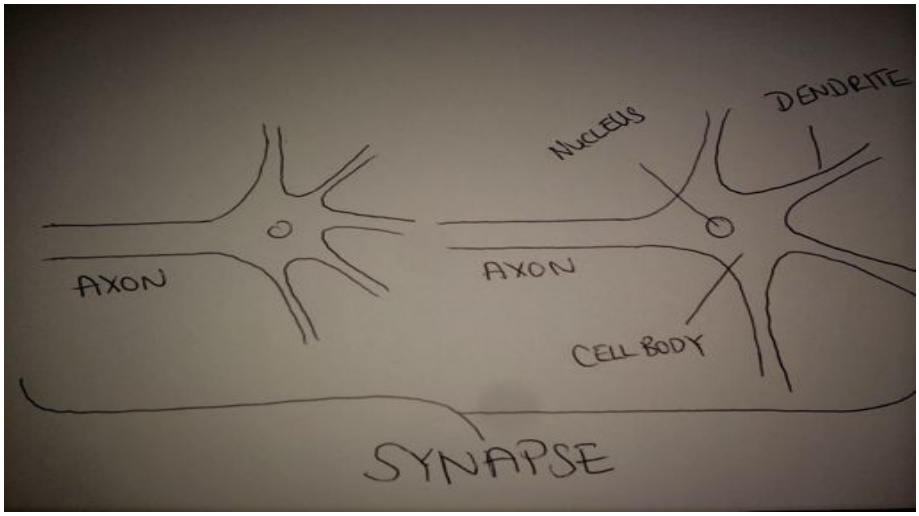


Figure 4: The basic structure of a synapse copied off the board

- It is the connection between 2 neurons.
- The nerve ending of one neuron is close to the dendrites of another neuron.

- Direction of nerve impulse in a synapse

  Dendrites ➔ Cell body ➔ Axon ➔ Dendrites ➔ Cell body

As the lesson was being explained, students did not engage much with the teacher. In addition, whenever the teacher asks students to copy the information of off the board,

nearly all students would take out their iPads and take a picture of what was written on the board.

9L –

The session began at 8:55 am and ended at 9:50 am. The instructor began the session with a brief revision about pedigrees in genetics. Then, he moved on to correct the homework he had assigned a day before with the whole class. In explaining the lesson, the instructor used Arabic more than English. The instructor picked a student to draw the pedigree on the board. Afterwards, the students began sharing their answers based on the pedigree given. Before answering the questions, the teacher would choose a student to *read* the question out loud. In the next half of this session, the teacher and students moved on to a new activity that required discussions and more readings. During this half, the teacher would call on a students name to read the question in their iBook on their iPads. Questions were answered using short texts and images. However, it should be noted here that students only read the questions out loud and not the texts. When reading the questions, some students were fluent and others faced difficulties in pronouncing certain key words such as *analysis.*

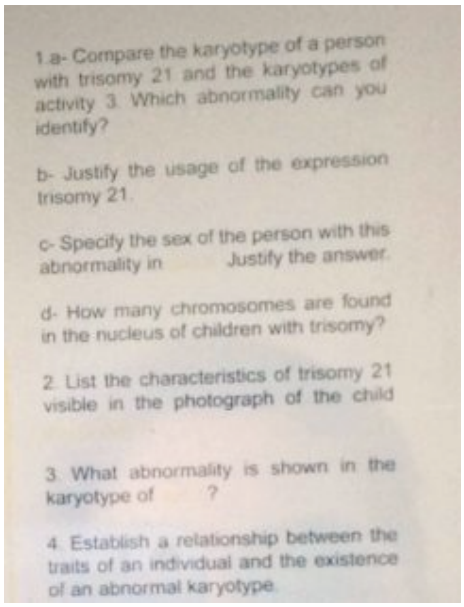


Figure 5: A sample of the questions read out loud by selected students

Using Figure 2, the way the selected students read the questions was as follows:

- A female student was selected to read the first question (part a). She was able to read it without any difficulties; however, her answer was incorrect.
- A male student was selected to read the first question (part b). He was able to read it without any difficulties and answered correctly.
- Another male student was selected to read the first question (part c). He was able to read it without any difficulties and answered correctly.
- Another male student was selected to read the first question (part d). He read the question very rapidly and had some difficulties reading it through; however, he was able to answer correctly.

- Another female was selected to read the second question. She was able to read well at a good pace and managed to answer it correctly.
- Another male student was selected to read the fourth question. He was able to read it at a good pace and without any difficulties. His response was also correct.

Wednesday March 11, 2015

10A –
The session began at 11:25 am and ended at 12:25 pm. The teacher began the session by activating students' prior knowledge. He asked the following: "Who still remembers from grade what are the different parts that make up an eye?" After listening to students' responses, the teacher asks them to open their iBooks on a page that demonstrates the different parts of an eye.
Using the figure of a human eye demonstrated in the iBooks, the teacher began explaining the lesson. Then, he asked the following question: "What do we mean by we see with our brains and not by our eyes?" After listening to students' responses, the teacher provided them with the correct answer by giving the following example: "if you don't have a background what a rectangle shape looks like or what the color white is then looking at those for the first time will look unclear to you."

The teacher then explained the pathway of light through the eye. After being done with explaining the concept, he wrote the following:

- Pathway of light

Cornea ➔ Iris ➔ Pupil ➔ Aqueous humor ➔ Lens ➔Vitreous humor ➔ Retina ➔Optic nerve ➔ Brain

Halfway through the session, the teacher asked the students to open their iBooks to p.1,680 for a short in-class reading activity. The teacher asked the students to silently read a short text (Fig. 6) and answer questions (i.e. what is the pathway of sound vibrations into the ear and what are the different parts that make up an ear). He was able to motivate students by giving them an incentive (i.e. who ever answers correctly will receive additional five points on the upcoming exam).

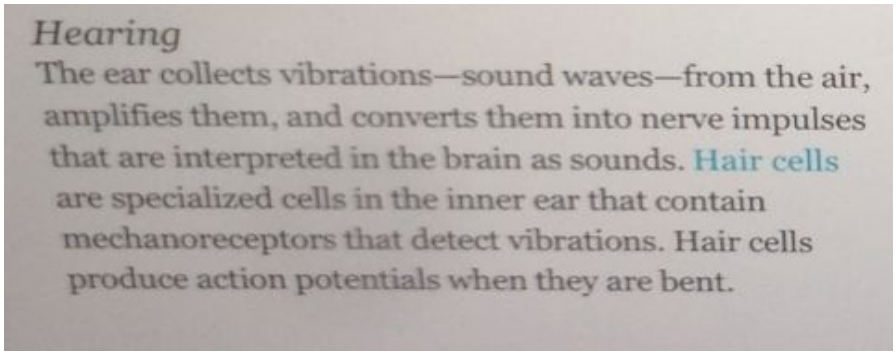
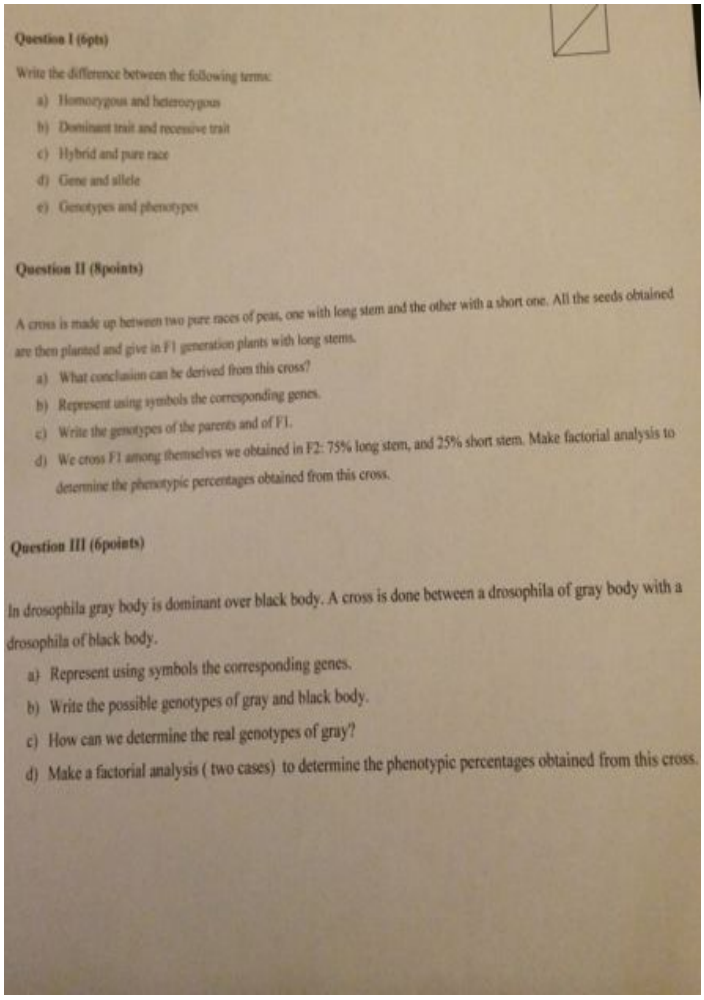

Hearing
The ear collects vibrations—sound waves—from the air, amplifies them, and converts them into nerve impulses that are interpreted in the brain as sounds. Hair cells are specialized cells in the inner ear that contain mechanoreceptors that detect vibrations. Hair cells produce action potentials when they are bent.

Figure 6: Text used by students to read as in-class activity

8A-

The session began at 1:30 pm and ended at 2:30 pm. Students had an exam in genetics. The exam was composed of three questions, two of which were very short texts made up of two sentences each (Fig.4).



Question I (6pts)

Write the difference between the following terms:

a) Homozygous and heterozygous
b) Dominant trait and recessive trait
c) Hybrid and pure race
d) Gene and allele
e) Genotypes and phenotypes

Question II (8points)

A cross is made up between two pure races of peas, one with long stem and the other with a short one. All the seeds obtained are then planted and give in F1 generation plants with long stems.

a) What conclusion can be derived from this cross?
b) Represent using symbols the corresponding genes.
c) Write the genotypes of the parents and of F1.
d) We cross F1 among themselves we obtained in F2: 75% long stem, and 25% short stem. Make factorial analysis to determine the phenotypic percentages obtained from this cross.

Question III (6points)

In drosophila gray body is dominant over black body. A cross is done between a drosophila of gray body with a drosophila of black body.

a) Represent using symbols the corresponding genes.
b) Write the possible genotypes of gray and black body.
c) How can we determine the real genotypes of gray?
d) Make a factorial analysis (two cases) to determine the phenotypic percentages obtained from this cross.

Figure 7: Grade 8A Exam

Students asked questions related to key terms such as "what do you mean by difference?" (question I)

Friday March 13, 2015

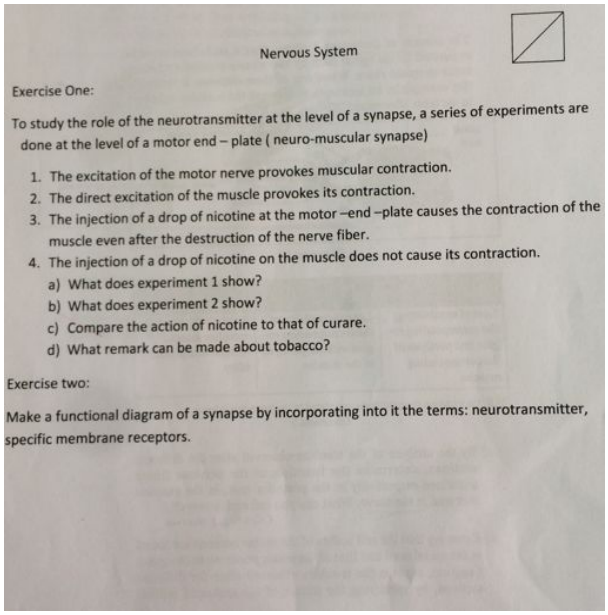
8L –

The session commenced at 9:45 am and ended at 10:45 am. Grade 8 students (Lebanese program) had a genetics exam. When asking for a copy of the exam, the teacher said it is the same exam as the one administered in grade 8 (High school program) a day before. As soon as students entered the class, they started asking their teacher questions about the following: (1) what is the difference between dominance and co-dominance, (2) what does hybrid mean, and (3) what is a recessive. The teacher was shocked with their questions but took a few minutes to explain each briefly. Then, the teacher administered the exam. Before allowing students to begin writing the exam, the teacher quickly went

over the exam to briefly explain each question. He said, "first question asks for definitions." Then, he read the second question out loud as it is. As he was reading the second question and read the word "derived", a male student interrupts him and asks about the meaning of *derived.* The teacher explains it by substituting it with *deduce*. The student nodded and the teacher moves on to read the rest of the part of question 2 and afterwards, question 3. Based on student's questions and what the teacher had read from the exam paper, the exam was based on genetics; but it was centered on how to solve genetics problems using factorial analysis. As students began writing the exam, a female student calls the teacher to check her answer to the first question. The teacher's comment was as follows, "No, because you gave examples…not definitions." The rest of questions asked by students throughout the remaining period were all related to asking the teacher to check their answers whether they are correct or not. The teacher did not answer such questions. Some students finished writing the exams by around 10.20 am; the rest took the full hour to finish.

10L –

The session commenced at 11:10 am and ended at 12:00 pm. The students immediately took their seats and the teacher administered the exam. Before the students began writing their exam, the teacher read the questions out loud. After the teacher was done, the students moved on to answer the questions. A male student asked the teacher what *motor-end plate* meant – a word found in the exam paper (Figure 8a). The teacher explained it briefly as being a "motor having nerves in the end." Also, another male student asked what the teacher meant by the following question: "What remark can you make about tobacco?" The teacher answered by saying: "What conclusion can you make…conclude" (Figure 8a). A few minutes later, another male student asked the same the question as his classmate regarding the same question. This time, the teacher elaborated more by saying: "Deduce the effects of tobacco on the secretion of neurotransmitter."



Nervous System

Exercise One:

To study the role of the neurotransmitter at the level of a synapse, a series of experiments are done at the level of a motor end – plate (neuro-muscular synapse)

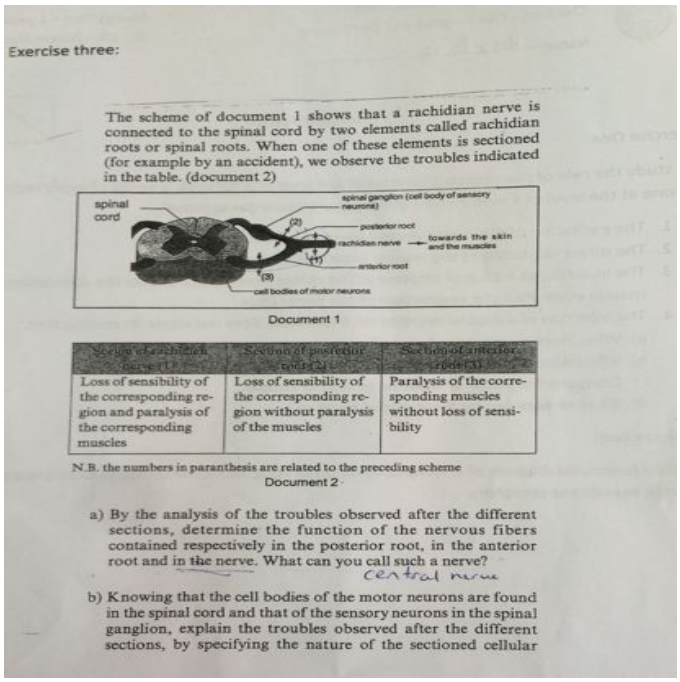
1. The excitation of the motor nerve provokes muscular contraction.
2. The direct excitation of the muscle provokes its contraction.
3. The injection of a drop of nicotine at the motor –end –plate causes the contraction of the muscle even after the destruction of the nerve fiber.
4. The injection of a drop of nicotine on the muscle does not cause its contraction.
   a) What does experiment 1 show?
   b) What does experiment 2 show?
   c) Compare the action of nicotine to that of curare.
   d) What remark can be made about tobacco?

Exercise two:

Make a functional diagram of a synapse by incorporating into it the terms: neurotransmitter, specific membrane receptors.

Figure 8a: Grade 10L exam

After a few minutes, a male student asked the teacher the following: "what do mean by what can you call such a nerve?" The teacher responded by saying: "it means the type of nerve." That same male student asked the teacher to explain part b in question 3. Another male student asked the teacher what the term *dissociated* nerve means (Figure 8b). The teacher explained it as to "separate something." Another male student asked the teacher whether the term *sensation* meant *sensibility*. The teacher said yes. Afterwards, a male student asked the teacher the following: "without paralysis means relaxation?" This time, the teacher didn't respond. A few minutes later, that same student asked the teacher the following: "What do you mean by *transversal section?"* The teacher replied: "It means it's cut (modeled it using his hands). Then, the student replied back saying: "You mean horizontal?" The teacher said: "Yes." The student, then, asked: "What does *annotation* means? The teacher replied: "label." In question 3, part d (Figure 8c), a female student asked the following: "In part d, do you mean I only say point out which is for which?" The teacher replied: "Yes." A male student asked: " Is relaxed the same as no effect?" The teacher said: "Somehow."



Exercise three:

The scheme of document 1 shows that a rachidian nerve is connected to the spinal cord by two elements called rachidian roots or spinal roots. When one of these elements is sectioned (for example by an accident), we observe the troubles indicated in the table. (document 2)

Document 1

Section of rachidian nerve (1)	Section of posterior root (2)	Section of anterior root (3)
Loss of sensibility of the corresponding region and paralysis of the corresponding muscles	Loss of sensibility of the corresponding region without paralysis of the muscles	Paralysis of the corresponding muscles without loss of sensibility

N.B. the numbers in paranthesis are related to the preceding scheme

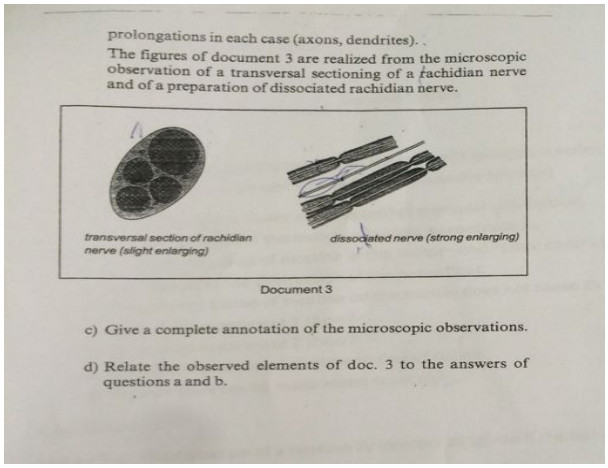
Document 2

a) By the analysis of the troubles observed after the different sections, determine the function of the nervous fibers contained respectively in the posterior root, in the anterior root and in the nerve. What can you call such a nerve?

central nerve

b) Knowing that the cell bodies of the motor neurons are found in the spinal cord and that of the sensory neurons in the spinal ganglion, explain the troubles observed after the different sections, by specifying the nature of the sectioned cellular

Figure 8b: Grade 10L exam


prolongations in each case (axons, dendrites).

The figures of document 3 are realized from the microscopic observation of a transversal sectioning of a rachidian nerve and of a preparation of dissociated rachidian nerve.

transversal section of rachidian nerve (slight enlarging)

dissociated nerve (strong enlarging)

Document 3

c) Give a complete annotation of the microscopic observations.

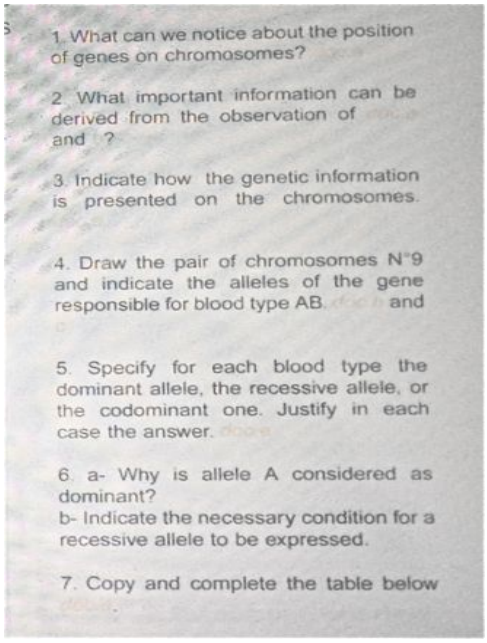
d) Relate the observed elements of doc. 3 to the answers of questions a and b.

Figure 8c: Grade 10L exam

Monday March 16, 2015

9L –

The session commenced at 12:00 pm and ended at 12:50 pm. During this period, the students' tasks were to do some exercises found in their iBooks. The first activity was working on "Probing the activity."


1. What can we notice about the position of genes on chromosomes?

2. What important information can be derived from the observation of and ?

3. Indicate how the genetic information is presented on the chromosomes.

4. Draw the pair of chromosomes N°9 and indicate the alleles of the gene responsible for blood type AB. and

5. Specify for each blood type the dominant allele, the recessive allele, or the codominant one. Justify in each case the answer.

6. a- Why is allele A considered as dominant?
b- Indicate the necessary condition for a recessive allele to be expressed.

7. Copy and complete the table below

Figure 9: The questions used for this session in 9L

A male student was selected to begin reading the first question. He read the question very fast and immediately answered without even thinking about the question. His answer was incorrect so the teacher guided him to the correct answer. Another male student answered incorrectly so the teacher repeated question 2 by saying the following: "What information can you *deduce* or *derive* from doc A and doc B?" Afterwards, the teacher further explained what the question was asking for. A female student was then chosen to read question 3. She couldn't answer correctly so the teacher asked her whether she understood the question. The student said no. So, the teacher started explaining the question by first defining what *genetic information* is by saying the following: "It means we are talking genes." Question 4 was read out loud by the teacher and then he immediately answered it by drawing the following on the board:

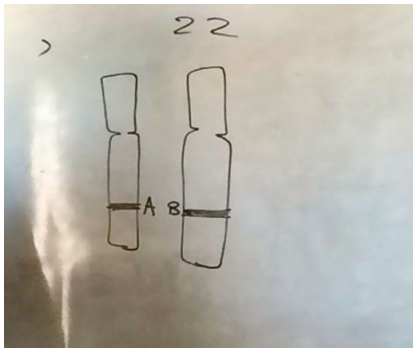
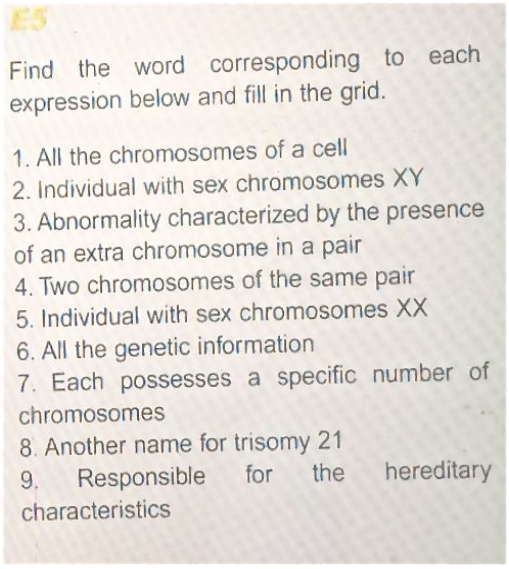


Figure 10: Chromosome 22 drawn by the Biology teacher on the board

Regarding question 5, the teacher chose another male student to read it out loud. As soon as the student finished reading it, the teacher immediately began guiding the students in answering this question. It should be noted that most of the class were interested in this question since some of them started making up stories about real-life situations. For example, one student asked about how do the people who save injured soldiers during wars know what the soldiers' blood types are. However, the teacher didn't answer and continued working on question 5. The last two questions were skipped. Grade 9 (Lebanese system) moved on to do other exercises such as multiple choice, true/false, and definitions.

As usual, students took turns in reading each question and answering them. As the students were working on in-class exercises, a male student interrupts and says to the teacher the following: "Can't we just say the answers? You think we don't know how to read?" But the teacher ignored the comment and proceeded with the in class activity. In the last exercise (Figure 8), students found a hard time associating the given phrases with definitions. In question 4 for example, the correct answer is *heterozygous*. One student was able to answer it correctly; however, another student asked the teacher why isn't the answer *hybrid*? The teacher's reply was the following: "No. Let's consider it heterozygous."



E5

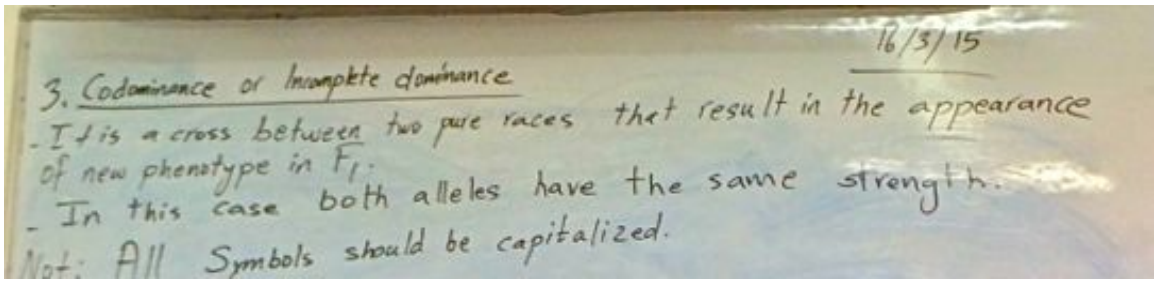
Find the word corresponding to each expression below and fill in the grid.

1. All the chromosomes of a cell
2. Individual with sex chromosomes XY
3. Abnormality characterized by the presence of an extra chromosome in a pair
4. Two chromosomes of the same pair
5. Individual with sex chromosomes XX
6. All the genetic information
7. Each possesses a specific number of chromosomes
8. Another name for trisomy 21
9. Responsible for the hereditary characteristics

Figure 11: Associating definitions exercise

8L –

The session began at 1:25 pm and ended at 2:20 pm. This period was about introducing "Codominance or Incomplete dominance." The teacher began the lesson with asking students the following: "Why do we sometimes get a new color when crossing two species?" Students' responses varied. Then, the teacher explained the definition of the term *codominance* in which later on he wrote it on the board for students to copy.



16/3/15

3. Codominance or Incomplete dominance

- It is a cross between two pure races that result in the appearance of new phenotype in F_1.
- In this case both alleles have the same strength.

Not: All Symbols should be capitalized.

Figure 12: Definition of Codominance

As the discussion held in class about this topic went on, the following incidents occurred: (1) a male student asked what the *type of cross* means; the teacher explained it in Arabic, (2) a female student asked what crossing species *among themselves* means; the teacher explained it as "*F1 x F1"* only, (3) a male student asked what *codominance* means even though the teacher had explained it earlier.

Wednesday March 18, 2015

8A –

The class commenced at 1:30 pm and ended at 2:30 pm. During this session, no reading strategy was used. Instead, the teacher asked students to practice working on a problem solving activity related to sex linkage.

Friday March 20, 2015

10L –

The class commenced at 11:10 am and ended at 12:10 pm. During this session, the teacher corrected the test that students had wrote on March 13th, 2015. The teacher read each question out loud and then answered it orally. Afterwards, the teacher would write the answers on the board for students to copy.

Appendix 5

Table 2. Instructional timeline of the Biology topics introduced in class, reading strategies used, types of texts students are exposed to, and whether students were motivated to learn the lessons or not.

Time	**Science Topic** (prior knowledge used, type of language used…)	**Reading Strategy** (type)	**Type of Text**	**Interaction of students**	**Motivation used**
March 10, 2015 **9A** (Full hour)	**Nervous System** – Began the session with reviewing the parts of the nervous system; Prior knowledge was used; Language used was mainly English	**Cognitive Strategies (Prior knowledge, Prediction)** Semantic organizers were used to explain the lesson – images of neurons, synapses, nerves, and nerve fibers; used throughout the whole period	**Expository**	**Minimal interaction**	**No motivation was used**
9L (Full hour)	**Genetics** (Pedigree) – Began the session with a short revision; Prior knowledge was used; Language used was a mix of English and Arabic	**Cognitive Strategies (Prior knowledge, Predictions)** Semantic organizers were used to explain the lesson – an image of a pedigree; used during the first half of the period **Memory Strategies (Skimming)** Reading aloud/Answering questions – by referring back to texts and images provided in their iBooks; used during the second half of the period	**Expository** **Expository**	**Students interacted very well with the lesson**	**Guiding students** Teacher called on students names to read the questions aloud; The teacher guided the student whenever they weren't able to find responses to the questions
March 11, 2015 **10A** (Full hour)	**Senses** – Began the session with a brief revision; Prior knowledge was used; Language used was mainly English	**Cognitive Strategies (Prior knowledge)** Semantic organizers were used to explain the lesson – showing the pathway of light through the eye; **Memory Strategies (Scanning/Skimming)** Silent Reading/Answering questions; by referring back to texts and images provided in their iBooks	**Expository** **Expository**	**Neutral** **Students were excited while doing this activity**	**No motivation used** **Motivation was made by using oral positive reinforcement**

8A (Full hour)	**Genetics Test** (Pedigree) – Students asked questions; Prior knowledge was used; Language used was mainly English	**Memory and Cognitive Strategies (Scanning, Prior knowledge)** Silent reading/Answering questions – by referring back to short texts in the exam given	**Expository**	**Most students were focused in reading and writing the exam**	**Motivation was done by teacher moving around to explain terms or questions not understood very well by students**
March 13, 2015 **8L** (Full hour)	**Genetics Test** (Factorial Analysis)- – Students asked questions; Prior knowledge was used; Language used was a mix of English and Arabic	**Memory and Cognitive Strategies (Scanning, Prior knowledge)** Reading aloud/Answering questions – by referring back to short texts in the exam given	**Expository**	**Most students were focused in reading and writing the exam**	**Motivation was done by teacher moving around to explain terms or questions not understood very well by students**
10L (Full hour)	**Nervous system Test** – Students took their seats to prepare writing the test; Prior knowledge was used; Language used was a mix of English and Arabic	**Memory and Cognitive Strategies (Scanning, Prior knowledge); Test-taking Strategies** Silent reading/Answering questions – by referring back to short texts in the exam given	**Expository**	**Most students were focused in reading and writing the exam**	**Motivation was done by teacher moving around to explain terms or questions not understood very well by students**
March 16, 2015 **9L** (Full hour)	**Genetics session** – Q/A session (in class activity); Prior knowledge was used; Language used was a mix of English and Arabic	**Memory and Cognitive Strategies (Scanning, Making predictions, Prior knowledge)** Reading aloud/Answering questions – by using prior knowledge	**Expository**	**Students were very interactive with this activity**	**Motivation was made by guiding students to the right answer and using oral positive reinforcement**
8L (Full hour)	**Genetics session** – Teacher explained a new topic (Codominance); Prior knowledge was used; Language used was a mix of English and Arabic	**Cognitive Strategies (Prior knowledge)** Semantic organizers were used to explain the lesson – Factorial Analysis	**Expository**	**Most students were focused understandin g the lesson**	**Teacher asked questions to keep students focused and have their attentions at all times**
March 18, 2015 **8A** (Full hour)	**Genetics session** – problem solving; Prior knowledge was used; language used was mostly English	**Cognitive Strategies (Prior knowledge and prediction)**	**Expository**	**Some students were focused understandin g the lesson**	**Teacher asked questions to keep students focused and have their attentions at all times**
March 20, 2015 **10L** (Full hour)	Correction of Nervous System test; Language used was mostly Arabic	**No readings** were assigned during this hour	**-**	**Students were interactive**	**No motivation used**

Appendix 6

Transcriptions:

10A student –

Me: Are you exposed to various types of texts in your Biology class? Such as narrative and/or expository texts?
10A: Um… basically we're learning from the interactive book it's an interactive book. So like say we have a topic say like meiosis or something where it would include phases it's more of pictures and visual aids…and like descriptions. Mostly that's how it is.

Me: Do you know the difference between narrative and expository texts?
10A: No, not really.

Me: Are you introduced to new reading strategies in your English classes every once in a while?
10A: Um…with English of course. But Biology it has always been the same. Same book, interactive pictures, some visuals, like videos.

Me: Does your science teacher motivate you to read?
10A: Ahh somehow.

Me: Such as?
10A: But, but mostly like I feel…it's more about him getting us to understand the topic and like making us like apply in like real life situations or like…in understanding like how we would help the world.

Me: In your opinion, what is the importance of being efficient readers when reading science texts?
10A: As in noticing the details and like remembering all those?

Me: Yes, somehow.
10A: Ahh yes of course.

Me: So, it's important to be efficient readers not only in English but also in Biology?
10A: Yes, of course.

Me: In your opinion, is the expansion of scientific knowledge achieved through hands-on activities such experiments only?
10A: Of course, no. Research, experiments, teamwork,…like it can't just be one guy there should be like a team…everyone should have a job.

Me: Okay, so doing experiments is not the only way to teach Biology?
10A: No, but of course it's a main part of it.

Me: Along with reading strategies, do you believe that other factors such as possessing prior knowledge and vocabulary, and being exposed to various texts play a role in science knowledge acquisition?
10A: Of course…yes.

Me: Do they all have equal importance? Or is one more important than the other?
10A: I'm guessing it's going to vary through the student…like it depends on the student.

Me: Okay, but how about for you?
10A: I'm more um.. Like I like experiments more I think like they help me understand the topic more…you know…like say I'm in class and he's [Biology teacher] teaching us something about DNA and then like I feel like I'll comprehend it more once he takes up to the lab and like actually like I physically see like myself doing it.

Me: But do you know what is the key factor for science knowledge acquisition? For you as a student how do you acquire science knowledge? Is it by reading or is by possessing prior knowledge…?
10A: Mostly it's in the classroom I guess when Mr. X says when he's explaining it…when he helps me understand it like say I'm just going to read it like there might be parts where I'm not going to understand or I'm just not comprehending…Mr. X would like always give us examples and like support it somehow he like would always find ways to make us understand

Me: So, sometimes you do face difficulties in comprehending texts?
10A: Ahh yes. You cant just give me a book and tell me read it and tell me to come do a test…I don't feel I would do well.

Me: Okay, thank you very much.
10A: You're welcome!

10L student –

Me: Are you exposed to various types of texts in your Biology class? Such as narrative and/or expository texts?
10L: Ahh yes in the book

Me: What is the most kind of text are you exposed to?
10L: umm you mean in like Biology text that we use?

Me: Yes, are the expository? Are they narrative?
10L: More like experimental texts. They talk about experiments or they like…they don't really narrate anything. They explain things…

Me: Such as facts?
10L: Yes, facts.

Me: Are you introduced to new reading strategies in your English classes every once in a while?
10L: Reading strategies as in…?

Me: Skimming, scanning, and making predictions.
10L: Ahh yes.

Me: When using those reading strategies in Biology readings, does it impact your ability in acquiring the learning outcomes of each unit taught?
10L: Umm yes, yes especially in tests like if you have something like an experiment you can skim through very fast and just look for key terms and solve the problem.

Me: Does your science teacher motivate you to read?
10L: Read science things like for extra knowledge?

Me: Yes.
10L: Yes, of course.

Me: How?
10L: Let's say watching discovery channel or reading articles about space or something which will help us in everything like enhance our knowledge.

Me: In your opinion, do you the importance of being efficient readers when reading science texts?
10L: Okay, first you understand it more; second, you will like do it faster and read it.

Me: In your opinion, is the expansion of scientific knowledge achieved through hands-on activities such experiments only?
10L: No, also while lets say watching or reading something scientific so it doesn't have to be all hands-on activities only.
Me: Along with reading strategies, do you believe that other factors such as possessing prior knowledge and vocabulary, and being exposed to various texts play a role in science knowledge acquisition?
10L: Yes, of course. Vocabulary for example helps you understand scientific words and as for prior knowledge would also give you like a boost that you could know things more to be easier for you and help you.

Me: Do they all have equal importance? Or is one factor more important than the others?
10L: I could say prior knowledge would help you more in knowing like scientific things. Vocabulary is important for understanding the question.

Me: What about practice reading various texts?
10L: Reading texts of they're like common with the scientific experiment would also like help.

Me: So, what you're saying is prior knowledge is the most important factor?
10L: Yes.

8A student –

Me: Are you exposed to various types of texts in your Biology class? Such as narrative and/or expository texts?
8A: Umm…
Me: Do you know what are narrative texts and what are expository ones?
8A: No, not really.
Me: Narrative texts are texts written in a story form that can narrate facts, fiction, and the like. Expository texts are made up of factual information. Expository could be part of narrative texts too.
8A: Rarely.
Me: Rarely?
8A: Yes.

Me: So, you weren't taught the difference between both kinds of texts?
8A: No, I really don't know.

Me: Are you introduced to new reading strategies in your English classes every once in a while? Examples of reading strategies are skimming, scanning, and making predictions.
8A: Yes.

Me: Okay, when using those reading strategies in Biology readings, does it impact your ability in acquiring the learning outcomes of each unit taught?
8A: Yes.

Me: Does your Biology teacher motivate you to read scientific texts?
8A: Umm no.

Me: In your opinion, what is the importance of being efficient readers when reading science texts?
8A: I'm sorry I didn't understand the question.
Me: I mean is it important to be good readers when approaching science texts?
8A: I guess, I guess yes. Like I'm supposed to understand what I'm reading. It kind of helps me a lot.
Me: So, it's important to be efficient readers?
8A: Yes, it's very important.

Me: In your opinion, is the expansion of scientific knowledge achieved through hands-on activities such experiments only?
8A: What do you mean?
Me: If you want to expand your science knowledge, do you think it's only achieved through conducting experiments only?
8A: Umm no. Experiments are probably something that you do to understand things better Like if umm you're like…if the teacher or the lab instructors are talking about like a cell or something and you don't really know what it looks like or so whatever…like you're really not going to have like a better experience.

Me: Along with reading strategies, do you believe that other factors such as possessing prior knowledge and vocabulary, and being exposed to various texts play a role in science knowledge acquisition?
8A: Yes, I guess.

Me: Do you think they have equal importance? Or is one factor more important than the other?
8A: I think there is a factor more important than the other.
Me: What factor would that be?
8A: Umm like umm knowing like vocab words is like more important because like when you know vocab words like you kind of can figure it out in your mind.
8A: So, you think that the main key factor in acquiring science knowledge is possessing a wide bank of vocabulary is more important than practicing to read various kinds of texts and being exposed to those texts on regular basis?
8A: As in reading texts? Like actual texts?
Me: Yes.
8A: Yes true. Yes, I do think that vocab is the most important factor in acquiring science knowledge.
Me: It's because it helps you understand the content of the text more?
8A: Yes.

8L student –

Me: Are you exposed to various types of texts in your Biology class? Such as narrative and/or expository texts?
8L: Umm…yes.
Me: Various types such as…?
8L: Such as Scientific's about the atoms, different stuff, different knowledge. Also, the powerpoints, there is paragraphs about the history of people who developed stuff about Biology.
Me: So, it's facts? You're exposed to al lot of facts?
8L: Yes.

Me: Are you introduced to new reading strategies in your English classes every once in a while? Examples of reading strategies are skimming, scanning, and making predictions.
8L: Yes, of course.
Me: And do you apply this in your Biology classes?
8L: I think in our Biology class and our English class.

Me: Okay, when using those reading strategies in Biology readings, does it impact your ability in acquiring the learning outcomes of each unit taught?
8L: Yes.
Me: Positively?
8L: Yes, positively.

Me: Does your Biology teacher motivate you to read?

8L: Yes, but mostly it's our English teacher that motivates us to read. Yes, but our Biology teacher also motivates us to read. Actually, our Biology teacher motivates us to read the history about genetics and these stuff.
Me: Okay, so in general he does motivate you to read, right?
8L: Yes.

Me: In your opinion, what is the importance of being efficient readers when reading science texts?
8L: It makes you read different ideas, makes you notice different stuff like you know different topics in one paragraph.
Me: Okay, you mean know the details by knowing how to read between the lines?
8L: Yes.

Me: In your opinion, is the expansion of scientific knowledge achieved through hands-on activities such experiments only?
8L: No, not actually.
Me: Then how?
8L: Through reading paragraphs and PowerPoint presentations.

Me: Along with reading strategies, do you believe that other factors such as possessing prior knowledge and vocabulary, and being exposed to various types of texts play a role in science knowledge acquisition?
8L: Yes, yes.
Me: Do they all have equal importance? Or is one more important than the other?
8L: I believe that vocab is more important since there is more scientific words that are used in the text more than the others.
Me: Okay, so vocab is more important than being exposed to different types of texts for example?
8L: No, but different types of texts…it helps on top of the vocab.
Me: So, what you are trying to say is that if you know the vocab then you can understand the text.
8L: Yes.

9A student –

Me: Are you exposed to various types of texts in your Biology class? Such as narrative and/or expository texts?
9A: What does expose mean?
Me: Okay, in other words, do you practice reading different kinds of texts?
9A: You mean in our book?
Me: Yes, in your book and other than your book…are you exposed to various kinds of texts? You know what texts are?
9A: Yes…if I'm interested in the subject matter, then yes I would.
Me: But I mean does your Biology teacher expose you to different kinds of texts? Or no?
9A: Teachers sometimes gives us a summary of the lesson which is based on the book…in the book you can find the text about the lesson.

Me: So, you're only exposed to texts available in your book?
9A: Yes, we only use the book.

Me: Are you introduced to new reading strategies in your English classes every once in a while? Examples of reading strategies are skimming, scanning, and making predictions.
9A: No.
Me: No?
9A: No. But we know them.
Me: How do you know them if your English teacher hasn't taught you those?
9A: Because if you don't have time you read them quickly…if you have time you read them slowly.
Me: But you've taught to do this, right?
9A: Yes, by logic yes.

Me: So, those reading strategies, do they affect your ability in acquiring the content of the Biology subject?
9A: If I have a small amount of time and a lot of lesson to study, I read very quickly and find some times to find the very important details which I have to study. But usually I read slowly because it will be easier for you to understand because its important to understand.

Me: Does your Biology teacher motivate you to read?
9A: in Biology, it's only the lesson in which we have to read. SO, now I'm in grade 9 so we don't have any formulas…we have to understand whats happening in our body. So, without reading you wont get any good grades…so, that's it we have to read.
Me: So, what your trying to say is that your Biology teacher obliges you to read for education only and not for both, fun and education at the same time?
9A: No, he doesn't force us…but we should practice reading to understand any text.
Me: So, your Biology teacher doesn't motivate you to read?
9A: No.

Me: In your opinion, what is the importance of being efficient readers when reading science texts?
9A: It's very important to be umm…efficient readers because you have to read the text fast and understand because for me it's hard to understand something in English…I understand in another language after I translate it back to English. So, for me it's very important to efficient reader.

Me: In your opinion, is the expansion of scientific knowledge achieved through hands-on activities such experiments only?
9A: So, for sure it's very important to know how to read texts with some activities such as experiments because you have more pers…chance to understand more but the text are I think the most important in studying.

Me: Along with reading strategies, do you believe that other factors such as possessing prior knowledge and vocabulary, and being exposed to various types of texts play a role in science knowledge acquisition?

9A: Yes, they all play a role in acquiring science subject.
Me: Yes, so they do?
9A: Yes, they do.
Me: Okay, Do you think that all these factors have equal importance?
9A: Umm…yes, I think that…some of them, in small amount, more or less important but you have to do a lot….everything is important for me.

9L student –
Me: Are you exposed to various types of texts in your Biology class? Such as narrative and/or expository texts?
9L: Yes, of course…in the Biology book there are many texts on many different cases in Biology…it depends on the topic.

Me: Okay, so what kinds of texts are you exposed to the most?
9L: What do you mean?
Me: I mean we have different types of texts such expository and narrative.
9L: Yes, I see your point. We are exposed to both together.

Me: Are you introduced to new reading strategies in your English classes every once in a while? Examples of reading strategies are skimming, scanning, and making predictions.
9L: Yes, of course…we are actually doing this in the English class at the moment. You read the paragraph to get the main idea….sometimes you get new stuff by focusing on the main sentence…sometimes it has the main idea.
Me: Do you use those strategies in Biology?
9L: Of course. It helps in the tests…
Me: So, it helps you acquiring the learning outcomes of each unit, right?
9L: Yes.

Me: Does your Biology teacher motivate you to read?
9L: Of course.
Me: How?
9L: In the tests he gets stuff from the textbook…I mean in the questions, that's why I have to read…This is how I get motivated to read.

Me: In your opinion, what is the importance of being efficient readers when reading science texts?
9L: Of course it's important…for example, being able to know the main idea of a text always has what you need to know…so, when you get the main idea then that is it you will know what the text is about.

Me: In your opinion, is the expansion of scientific knowledge achieved through hands-on activities such experiments only?
9L: Experiments are important but there should be texts for me to read and understand the texts better.

Me: Along with reading strategies, do you believe that other factors such as possessing prior knowledge and vocabulary, and being exposed to various types of texts play a role in science knowledge acquisition?
9L: Of course. All those factors are important.
Me: Are they all of equal importance?
9L: Yes, they are all important but in a way….for example, in reading a text you need the vocab…prior knowledge and know kind of text you are reading…so yes they are all important.

Grade 8, 9, and 10 Biology teacher:
Me: In your opinion, what is the main purpose of teaching Biology? Is it for basic knowledge only? Or is there more to that?
Teacher: Not basic knowledge only…it's more you can apply to life, activities, etc. It will help them in the future.

Me: Is there a reading program you rely on the most in explaining Biology lessons?
Teacher: Usually we rely mostly on their books you know? They have in every lesson after the explanation…they have probing the activities they should do that are based on readings in the book.

Me: What reading strategies do you use in your Biology class? For example, do you tell them to skim, scan, and or make predictions?
Teacher: Usually, I prefer to go into details so I ask students to scan the texts required for reading. But nowadays, we are not using these techniques a lot.
Me: You mean reading strategies?
Teacher: Yes. But when it comes to Biology, I prefer scanning and making predictions.

Me: Do you motivate your students to read science texts?
Teacher: Sure, sure.
Me: How?
Teacher: Usually I ask questions where students have to go look for answers in their books. Otherwise, they can't solve the questions.

Me: In your opinion, what is the importance of being efficient readers in science texts?
Teacher: It depends on English, you know? They should have good English in order to understand the concepts…
Me: So, you think it's very important to be efficient readers in Biology?
Teacher: Yes, of course. The language plays a very important role here in order to be able to read and comprehend science texts.

Me: In your opinion, is the expansion of scientific knowledge achieved through hands-on activities such experiments only?
Teacher: No, there are a lot of ways, Okay? It's not only that…you can do a lot of activities in order to let them [students] understand the objectives.
Me: Okay, so what you're trying to say is that science isn't only about experimentations?

Teachers: Yes, of course.

Me: Along with reading strategies, do you believe that other factors such as possessing prior knowledge and vocabulary, and being exposed to various types of texts play a role in science knowledge acquisition?
Teacher: Sure, sure.
Me: Do they have equal importance? Or is one factor more important than the other?
Teacher: I believe having background knowledge is a bonus in acquiring the science knowledge…also, vocabulary…
Me: Okay, so is there a main factor?
Teacher: You mean here in English or Biology?
Me: Biology, of course. Which one of these factors is important?
Teacher: Of course, being exposed to various types of texts. But also vocab and prior knowledge are important I think.
Me: So, all factors are important?
Teacher: Yes.

(Additions) –
Me: How long have you been working before?
Teacher: Twenty years experience in teaching.
Me: Based on your work experience, how can you ensure that your students are actually acquiring the needed knowledge in Biology?
Teacher: Usually we assess them, you know? Using the tests, we can have an idea whether students are understanding the biology material or not. Not only tests, even through classwork activities for example, you know? It will give us a good idea if they understood the science subject.
Me: Okay, so it's assessment basically?
Teacher: Yes.
Me: If you see students struggling in acquiring the science knowledge, what would you do?
Teacher: We would re-teach the material, you know? We re-teach the objective another time. Or I would give them extra work to do such as extra sheets.
Me: Based on your 20 years experience, what factors would help student excel in Biology and acquire the needed material? For example, we talked about the importance of prior knowledge before, possess a wide bank of vocabulary, being exposed to various types of reading texts and use various reading strategies when approaching texts…
Teacher: Usually, if you try to make it more fun or to link it to daily activities students would be more interested in the subject matter. They can understand more the material. Better than only lecturing the students.

Me: What's your opinion about memorization? Do you think it's a good technique for students to use in order to acquire science knowledge?
Teacher: It's not the best technique but sometimes they need it. But eventually, they are going to forget the memorized material…it's not going to last for a long term.

Me: Do you think students in the Lebanese program are exposed to readings in Biology classes more than American?

Teacher: Yes, way more. But you know…every year this integration is decreasing…

Me: Do you think if English teachers and Biology teachers work together would be a good idea? For example, establishing some kind of program that could help students acquire the proper scientific knowledge?
Teacher: Yes, for sure it would be the best idea.
Me: So, you think integrating English and Biology would be a good idea?
Teacher: I'm sure it wont be 100% cooperative between both departments but I they can help each other to help students…
Me: They back-up each other, right?
Teacher: Yes, definitely.

Science Coordinator –

Me: What are the general objectives in the science curriculum for grades 8, 9, and 10?
Coordinator: In general, we prepare students to be life-long learners. This our aim. So, therefore they need to learn how to solve problems related to their daily life. This why we should focus on solving problems related to life issues, what they encounter in life, and we try to link what we learn in classrooms to everyday life so learning makes sense to them; so they don't ask the question: why are we learning this? So, when they link it to something in their environment or in their life therefore, they'll excel in it and they'll do better.

Me: Okay, what about the specific objectives?
Coordinator: You mean by specific objectives by chapters?
Me: Let's say by skills.
Coordinator: By skills?
Me: Yes.
Coordinator: They would be able to analyze graphs, they would be able to read diagrams, they would be able to apply their knowledge into situations, they would have the ability to think critically about certain solutions.

Me: Are reading strategies a part of the science curriculum for both programs, Lebanese and American?
Coordinator: What do you mean by reading strategies?
Me: Skimming, scanning, and making predictions.
Coordinator: No…making predictions yes as a part of the scientific theory but not skimming and scanning…no…because we cover them in the English department.

Me: Are their any reading motivation programs used in the science curriculum in grades 8, 9, and 10 of both programs?
Coordinator: No, we don't have this….in these classes only we don't have this.

Me: In your opinion, what is the importance of being efficient readers in science texts?
Coordinator: Being efficient readers when reading science texts you have to perhaps know what's the aim of the scientific text, you know what I mean? And be able to find perhaps the hypotheses, the data, the results, the conclusion because at a certain point in

year 9 of the Lebanese program, they give them a text in the official exams and they ask them [students] what's the hypothesis; therefore, the students must be able to find the hypothesis from the text.
Me: What about the American program?
Coordinator: Also the same. We try to make the students predict the hypothesis or predict the results also based on the text given.

Me: Do you think students in the Lebanese program are exposed to texts more than students in the American program? Or is the other way around? Or are students in both programs exposed to texts?
Coordinator: Umm..in Lebanses…in 9 Lebanese, for example, yes because there is always in the official exams a part related "pick from the text"…so yes, Lebanese more than American.
Me: Yes, I've seen this during my observations.
Coordinator: Yes…pick from the diagram.

Me: In your opinion, is the expansion of scientific knowledge achieved through hands-on activities such experiments only?
Coordinator: Only doing experiments, no, because my thesis in masters was about inquiry in science classroom. And the best way was guided inquiry meaning you give the students a brief summary of what they will be doing. They will do the experiment, they will analyze but at the end their will be a need for some guidance from the teachers.

Me: Along with reading strategies, do you believe that other factors such as possessing prior knowledge and vocabulary, and being exposed to various types of texts play a role in science knowledge acquisition?
Coordinator: Yes, especially in Biology because sometimes the students if they have language difficulties or language barrier, they tend to not achieve high grades in Biology. Chemistry and Physics it's less limited because you have direct questions, you have calculations, etc.

Me: So, do all those factors have equal importance in the acquisition of science knowledge? Or is one factor more important than the others?
Coordinator: I think they're all of equal importance.

(Addition) –
Me: How long have you been teaching for?
Coordinator: 13 years.
Me: Based on your work experience, how do you think students can excel at acquiring science knowledge in Biology? What should students do to be able to acquire science knowledge and attain the goals and objectives of the science subject?
Coordinator: In Biology?
Me: In Biology, yes.
Coordinator: They [students] have to have correct vocab, the have to be trained to think critically and therefore, analyze. So, they need vocab also so definitely they need vocab and prior knowledge.

Me: What about being exposed to readings and possessing reading strategies? Aren't those important as well?
Coordinator: Yes, of course. I mean where do you think students get prior knowledge and new vocab terms? From reading selections, of course.
Me: Yes, that's true. So, it's not just class notes?
Coordinator: No, no. Class notes if the student is weak, it will help him/her achieve 50% of the knowledge but if he/she has prior knowledge, he/she has the vocab…if he/she is weak, he/she can achieve better.

Me: What about memorization? What's your opinion on that?
Coordinator: Nowadays, it's not about memorization. Okay, some umm some…like in level 1 you need memorization because if they don't…if students can't give definition of an animal, or plant, or whatever…there should be memorization for a start but later on, no.

Me: Do you think it would be a good idea for English and Biology teachers to sit together and work on integrating both subjects in their classroom?
Coordinator: We are integrating sciences and math at school for the time being and I know from 9L that some texts are related to science in English like volcanoes I think…so, I think it's more towards the Lebanese. Now, at our school we are currently thinking of this kind of integration. We started sciences and math because it's the easiest, and English and Arabic. Later on in the future we will integrate all of them together.
Me: So, you think integrating Biology and English would help?
Coordinator: Yes, definitely it would help.

Me: Have you ever noticed how students approach a text in Biology? In grades 8,9, and 10 do you think they are comfortable with texts or are they more comfortable with diagrams and images?
Coordinators: I think they are more comfortable with texts because we have 8 hours of English in our school and most of them speak English so they know better. But sometimes in diagrams it's easier to find the information while in texts sometimes the information is hidden somewhere…in diagrams it's easier to pick. But when it comes to analyze I think in texts they do better.

Me: I've interviewed students and I've noticed some of them they said they prefer experiments, the prefer diagrams, because it can help them understand what they are learning more through these. So, I've come to the conclusion that students function backwards meaning they before understanding the theory they should apply it first. Do you think this is a good thing for them?
Coordinator: This is what I was talking about when I told you about inquiry so they are exposed to the lesson inside the lab but of course with the guidance of the teacher. In middle school classes and high school classes, for each grade there are 1-2 labs per week so, sometimes it doesn't happen that they are first introduced to the topic inside the lab. SO, sometimes they are introduced to the topic in class and then they do the experiments in the lab. Perhaps, we might think about changing that strategy but with the availability of staff…it's hard for now.

English Coordinator –

Me: Are students of grades 8, 9, and 10 of both programs exposed to various types of texts in the classroom?
E. Coordinator: What do you mean by various types of texts?
Me: Such as narrative, expository, descriptive…
E. Coordinator: Yes, of course.
Me: What are they exposed to the most?
E. Coordinator: Usually we start with the narrative and you know how the narrative has got the descriptive, expository…
Me: Everything actually…
E. Coordinator: Yes, everything. But it's mostly narrative because we are dealing with literature mainly.
Me: Are students taught various reading strategies?
E. Coordinator: Key reading strategies…that's what we start with in order to prepare them for not only exams at school but also for SAT and other types of entrance exams.
Me: So, they are taught how to skim, scan, and make predictions?
E. Coordinator: Definitely, more then skim and scan actually.
Me: How certain are you that students actually use various reading strategies when they read texts?
E. Coordinator: Well, I ask them to underline the main idea in the paragraph, to circle the connectors, sometimes the evaluation or assessment is done orally so I ask them about the paragraph or the entire texts before we talk the questions. I spend a lot of time on reading strategies usually at the beginning of the year.
Me: It's a must anyways…
E. Coordinator: Yes, otherwise they cant answer the questions.

Me: In your opinion, being efficient readers is only important in the English subject?
E. Coordinator: Umm no, of course. I mean in English mainly but it affects all the other subjects. So, it's not only reading the texts, it's reading the questions as well. So, we have a problem in reading all types of situations.
Me: So, do you think being efficient readers is important for Biology subject?
E. Coordinator: Definitely. How are they going to understand the question? And I know that in Biology there is a difference between let's say certain key verbs…that's what the Biology teachers usually tell us…such as identify, outline, list, justify…so, this is related to English.

Me: How many years have you been teaching?
E. Coordinator: 18 years.
Me: Based on your work experience, how do you think students can become efficient readers?
E. Coordinator: First, we should quit this traditional way of asking students to read a page or two. For example, we had a teacher when I was young who used to come in class, relax and ask us to read like 4 pages so nobody was actually reading. So, there should be a purpose for reading. It should be an active reading not a passive one.

Me: Do you think early exposure to reading is important?
E. Coordinator: Yes, because it's a habit. So, we can work on this habit and strengthen reading strategies.

Me: Do you think it would be a good idea for English and Biology teachers to sit together and work on integrating both subjects in their classroom?
E. Coordinator: Yes, actually we do it in English. We expose our students to scientific texts so…I don't know about Biology teachers…but we integrate science in our readings. For example, every week in middle school classes we have an **article reading hour**. It's one hour, so we have an update article, usually it is related to science or history and we read it, work on the reading strategies, we answer questions, and eventually we end up with their own opinion and own analysis.
Me: Do you do that in all grade levels?
E. Coordinators: Yes, all grades starting from grade 7.
Me: And how do you find students when approaching scientific texts? Do you feel like they are comfortable with it?
E. Coordinator: With respect to science they are very comfortable with it but when it comes to history they have to fill gaps. But with scientific articles students tell me that they took this and that in sciences. So, it is good that they have certain background knowledge.
Me: So, prior knowledge is important in sciences such as Biology?
E. Coordinator: Yes, of course.