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Reading Strategies for the Science Subject in Upper Elementary Classes that Follow English CBI in Northern Lebanon

Mireille Yaacoub*

Department of English Language and Literature, Doctoral School of Literature, Humanities, and Social Sciences, Lebanese University, Beirut, Lebanon
*Corresponding author: mireille.yaacoub@gmail.com

Abstract This article investigates instructional strategies that scaffold students' reading comprehension of science texts in Content-Based language Instruction (CBI) settings; especially, the reading strategies that enhance comprehension of content, language and *cognitive* Science Process Skills (SPSs). The subjects are upper-elementary science classes in five private and public schools that follow English CBI in Northern Lebanon. We implemented observation and causal-comparative studies that use both students' means of scores on reading assessment tests, and statistical tests of significance, to measure the effectiveness of the applied reading strategies. Results indicate that the student sample groups that used general classroom reading strategies, such as question/answer relationships and context-clue analysis, during and/or after teachers' explanation of the lesson, have insignificant differences among means of their test scores. The student sample groups that used these strategies before the lesson's explanation scored significantly lower averages than those that used them during and/or after. Other reading strategies, such as home reading, produced insignificant differences. The cognitive model of L2/FL acquisition and the cognitive academic language learning approach (CALLA) are used to substantiate these results.

Keywords: *CBI, reading strategies, SPSs, science subject, cognitive model of L2/FL acquisition, CALLA, upper elementary, reading comprehension*

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1. Introduction

In Content-Based language Instruction (CBI) settings, particularly in the science subject that is delivered in a Second or Foreign Language (L2/FL), students' reading comprehension of science texts is supported using an array of reading instructional strategies, and other instructional practices that are indirectly linked to reading [1-6]. The use of reading strategies support students' reading comprehension of L2/FL science texts by enhancing students' understanding and, ultimately, acquisition of science content and the related linguistic items, as well as by sharpening particular kinds of students' cognitive process skills [3,7]. The cognitive process skills that are specific to science inquiry are called Science Process Skills or SPSs [8].

Table 1. List of science process skills (SPSs) with the corresponding science text types or text-based tasks [6,8,11,12]

SPSs	Corresponding Science Text Types or Text-based Tasks
Basic SPSs:	
Observing	Describing
Classifying	Comparing/contrasting
Measuring	-
Inferring or explaining	Explaining (Cause/Consequence, Evidence/Conclusion, Problem/Solution, Action/Motivation)
Predicting	Predicting
Communicating (using written or oral discourse and/or graphic presentations)	Communicating (using written or oral discourse and/or graphic presentations)
Using number and mathematical relationship	-
Integrated SPSs:	
Making models	Making graphic representations of texts
Collecting data	-
Defining operationally	-
Interpreting data	Explaining, then inferencing or predicting
Formulating hypotheses	Hypothesizing
Designing Experiments	Explaining an experiment

Comprehending and analyzing different types of science texts require the implementation of certain kinds of SPSs. The science text types of description, comparison/contrast, explanation, and prediction correspond to the basic SPSs of observation, classification, explanation, and prediction, respectively (See Table 1). The text type of explanation is of different kinds, which are cause/consequence, evidence/conclusion, problem/solution, and action/motivation [9]. When explanation is coupled with inference or prediction, it corresponds to the integrated SPS of data interpretation. Furthermore, the science text types of hypothesizing and experiment reports, correspond to the integrated SPSs of hypothesis formation, and experiment designing, respectively. In addition, there are some text-based tasks that complement reading and that correspond to specific SPSs. They are as follows: the task of communication using written or oral discourse and/or graphic presentations corresponds to the SPS of communication; and the task of making graphic representations of texts corresponds to the SPS of making visual models or visual representations (See Table 1). The SPSs that do not correspond to any text type are: measuring; using number and mathematical relationships; collecting data for conducting experiments; and making operational definitions. Operational definitions are definitions that students deduce from an information list [10].

Many countries, including Lebanon, have adopted CBI to teach L2/FL [13]. The Lebanese curriculum that uses English as FL1 usually delivers science in English [13]. Typical Lebanese science classes use teacher-centered methods that are limited to teachers' explanations of science lessons and the traditional provision of solutions to textbook exercises; and most Lebanese science instructors teach information void of the related SPSs [14]. Statistics on SPSs in typical schools in Lebanon show that students achieve lower than the national standards and lower than the international average [15,16]. These results have generated interest in researchers to discover the root cause of the problem. In this direction, Dagher and BouJaoude [17] have focused on science teachers' perceptions and discovered that most science teachers in Lebanon have limited views of the nature of science and do not promote science inquiry, or SPSs. In addition, Zeitoun and Hajo [18] have concentrated on the national science textbooks and discovered that questions in such textbooks activate few basic SPSs, such as observing and inferring, but ignore integrated SPSs, such as classifying and comparing. No research, however, has addressed science teachers' use of science text reading that supports students' SPSs.

In our research, we have chosen to focus on the instructional techniques that support students' reading comprehension of L2/FL science texts, especially reading instructional strategies. This is because such instructional techniques support students' understanding and acquisition of oral and written content and language items, and the commensurate SPSs [1,2,4]. For this purpose we implemented a four-step procedure: first, we determined the reading instructional strategies and related instructional practices that our subject teachers use; second, we evaluated the efficacy of the applied reading strategies based on reading assessment tests administered to students; third, we analyzed the findings based on the cognitive model of L2/FL acquisition and the cognitive academic language learning approach (CALLA); and fourth, we suggested feasible ways of integrating reading strategy instruction into the normal flow of science classes in CBI settings.

The rest of this article is structured as follows: Section 2 provides related work; Section 3 discusses the used methodology; Section 4 presents the results; Section 5 presents the data analysis; Section 6 provides a discussion based on the analysis of the results; and Section 7 concludes with some recommendations.

2. Literature Review

This section provides a brief explanation of CBI, specifies the instructional techniques that support students' reading comprehension of science texts in CBI settings, and presents both the cognitive model for learning in CBI settings, and the Cognitive Academic Language Learning Approach (CALLA).

2.1. Content-Based Language Instruction

CBI is an academic curricular approach that is built on the integration of academic content with language teaching objectives [19]. In CBI, content subjects, such as science, are taught in L2/FL [20]. In CBI, content becomes the organizing principle of the curriculum; and language structures, vocabulary and language functions, which are commensurate with the content, are also taught [21]. In the learning experience, students' attention is focused primarily on meaning while acquiring linguistic items [22], and exercising their cognitive skills [23]. CBI has different models that are applicable to school and/or university settings. The most popular ones are immersion, sheltered, adjunct, theme-based, content and language integrated learning (CLIL), language across the curriculum, and language for specific purposes [20,24].

2.2. Instructional Techniques that Support Students' Reading Comprehension of Science Texts in CBI Settings

In CBI settings, the following four instructional techniques can be used to support students' reading comprehension of science texts: use of the L2/FL, and, when necessary, limited and systematic use of L1; teaching of reading strategies; use of cognitively engaging tasks; and provision of student output opportunities. Next, each instructional technique will be described briefly.

2.2.1. Use of the L2/FL, and, When Necessary, Limited and Systematic Use of L1

The aural input that students receive should be in the L2/FL to maximize their opportunities of acquiring targeted content and linguistic items in the L2/FL [25]. Teachers should resort to different instructional techniques, such as realia and charts, for such purpose. If L1 is needed, it should be used limitedly and systematically [26,27,28], while adhering to the specific functions of L1 use, which are knowledge construction and transmission [29,30], classroom management [31,32], and classroom-climate humanization [33,34].

Table 2. Text Types and the Corresponding Information Structure Units (adapted and extracted from [35])

Text Type	Information Structure Units
Description of Physical Structure	Part → location + Property + Function
Narration of a Natural Process	State or Form of Object/Material → Location + Time or Stage + Instrument or Agent + Property or Structure + Action
Explanation of Scientific Principle	Law or Principle → Conditions + Instances + Tests/Measures + Application of Principle

2.2.2. Teaching of Reading Strategies

There are three main categories of reading strategies that support students' comprehension of science texts that are written in L2/FL. The first category is detailed textual genre analysis "which explicitly raises student awareness of specific text structuring; that is, specifically pointing out to students the structure of the description, or the problem-solution organization, [for example]" [3]. Textual genre analysis has been adapted from Halliday's systemic linguistic theory and "elaborated as a set of discourse structures that guide the use (and shape) of written discourse" [3]. Johns and Davies have compiled a taxonomy comprised of twelve text types, which they call "function types" or "macrostructures", and the pertaining information structure units, which "can be either obligatory or optional" (cited in [6]). Table 2 gives examples of three text types and their information structure units. The information structure units to the left of the arrow are obligatory and those to the right are optional. In addition to the text itself, visual representations, such as charts and graphs that accompany the text can be incorporated in this strategy [6]. As such, scaffoldings of text types and the corresponding structure units are completed by students.

The second category is general textual genre analysis that "develops student awareness of text structure through more general graphic organizers [or graphic thinking representations]" [3]. Examples of general graphic organizers are Venn diagrams, fish bones, charts, semantic maps, outline grids or graphic outlines, and tree diagrams [36,37].

The aforementioned detailed and general textual genre analyses do not contain a linguistic component; that is, they do not focus on the linguistic items that are commensurate with information units and functions. The written-text analysis form in CBI settings that Fortune and Tedick [2] have compiled compensates for the missing linguistic component. Based on Fortune and Tedick's [2] written-text analysis form, we infer that if the above two techniques of detailed and general genre analysis are to be effective in scaffolding students' understanding and acquisition of language, content and cognition simultaneously, a language component should be added. An example of the linguistic component would be teaching students the grammatical connectives that are commensurate with texts of comparison and contrast.

The third category of reading strategies is general reading strategies that can be used in the science subject. Again, most of these strategies focus mainly on content and SPSs; thus, they should also be used to focus on the commensurate language. We here give a description of these general reading strategies and indicate the SPS that they work on. Some of these strategies are as follows [36]:

- Directed reading/thinking – This strategy consists of two steps: in the first, students use background knowledge, and preview the text and the attached illustrations to make predictions about the text; in the second students set a purpose for reading, use the information in the text, and "then make evaluative judgments" about the predictions they have made before reading the text. Based on our comparative study of the related literature, we have determined that this strategy is particularly useful for the SPSs of hypothesizing and predicting.
- Question/answer relationship – This is a strategy with four levels. The first level, called 'Right There!', answers, uses questions whose answers are directly found in the text. For example, in a lesson about plant leaves a 'Right There' question might be how many forms of leaves are there? The second level, called 'Think and Search', uses questions whose answers are indirectly found in the text. Again, with the lesson about plant leaves, a second-level question might be: why are leaves indispensable for plants? The third level, called 'You and [the text]', consists of questions that students can answer using both their background knowledge and textual information. An example is: which kind of plant leaves do you have in your garden? The fourth level, called 'On Your Own', poses questions for which answers must come from students' background knowledge. An example is: what do you think would happen if we cut off this plant's leaves? Based on our comparative study of the related literature, we have determined that this strategy is useful for the SPSs of inferencing, analyzing, and predicting.
- KWL chart – This strategy is called Know/Want-to-know/Learned (KWL) in which students reveal the following: first, what they already know about the topic; second, what they want to know about the topic; and last, what they have learned, after reading the text. Based on our comparative study of the related literature, we have determined that this strategy activates all SPSs.
- Anticipation guide – This strategy consists of "a series of statements that require students to use their background knowledge and make predictions" [36]. Teachers prepare these statements and ask students to read them before they read the text, and decide whether they agree or disagree with the statements. After students read the text, they review their answers to the statements. Based on our comparative study of the related literature, we have determined that this strategy works on all SPSs.
- Use of context clues for understanding words – This strategy is based on seven types of context clues that apply to factual texts, which are definitions, examples or illustrations, comparison-contrast relationships, logical relationships (such as similes), root words and affixes, syntactical cues, and cause and effect examples.

Other than the abovementioned reading strategies, there are instructional practices indirectly linked to reading that have the potential to enhance students' SPSs and content and language acquisition, as well as being vital for written-text comprehension. These instructional practices will be described next.

2.2.3. Use of Cognitively Engaging Tasks

Cognitively engaging tasks are tasks that provide enough challenge and motivation for students to acquire linguistic and content items and SPSs that aid in the reading comprehension of science texts [26]. The kinds of cognitively engaging tasks that trigger such acquisition are experiential and collaborative. Experiential tasks stem from the Vygotskian theory [38] of experiential learning, in which students undergo different experiences linked to science and perform scientific experiments, which help students to store learned content, language and cognitive knowledge in their long- rather than short- term memory. Collaborative tasks are those that are performed in groups or pairs. They are particularly effective, since students carry out collaboratively what they cannot execute alone; consequently, they learn and assimilate content, linguistic and SPS knowledge better [39,40,41,42].

2.2.4. Provision of Student Output Opportunities

Based on the cognitive model of L2/FL acquisition, output opportunities in the target language help students substantiate their newly acquired content and linguistic knowledge [43]. The following kinds of output opportunities provide optimum environment for students' acquisition of targeted material: peer explanations, students' choice of activities, metatalk, and debates. Peer explanation is when peers explain content to each other, thus increasing opportunities for students to store knowledge in their long-term memory [41]. Allowing students to choose the activities they like also motivates them in the learning process. Metatalk, which is the talk about the language that students use when they communicate science content [42], helps students become more aware of targeted items in the L2/FL and thus become more strategic readers. Debate propels students' language development as they practice various sorts of reading skills in search for facts to use in the debate, and they acquire more L2/FL items in the input and output skills involved in debates [44].

2.3. Cognitive Model of Learning in CBI Settings and CALLA

In CBI settings, acquisition of content and L2/FL targets and cognitive skills, specifically SPSs in the science subject, occurs at the same time. The cognitive model of L2/FL acquisition in CBI settings specifies the cognitive processes involved in the acquisition of L2/FL targets. Thus, the same cognitive processes are necessarily activated during the acquisition of the content and cognitive skills that are commensurate with these L2/FL targets. In this section, the stages of the cognitive model of L2/FL acquisition are explained and the stages of an offspring of such a model, which is the Cognitive Academic Language Learning Approach (CALLA), are also delineated.

The cognitive model of L2/FL acquisition in CBI settings consists of three main stages: input, information processing, and output [45]. Cognitive input occurs when students receive information and become aware of the targeted information. Information processing happens when students notice this information, save it in their short-term memory while comparing it to the knowledge they have previously stored, and transfer it to their long-term memory by applying such information. Output happens when students use this information to carry out an activity, thus activating the knowledge that is saved in their long-term memory, and expediting its retrieval in accomplishing other tasks.

CALLA [1,46] mainly aims to teach students learning strategies, of which are the three kinds of reading strategies that correspond to the science genre-text types explicated above. CALLA is comprised of six stages. The first stage, the preparation stage, is when teachers remind students of strategies that they have already learned. The second stage, the presentation stage, is when teachers model the new strategy while simultaneously using think-aloud to explain the metacognitive processes involved. The third stage, the practice stage, is when students practice the newly-taught strategy. In the fourth stage, the self-evaluation stage, students assess the efficacy of their use of such strategy. In the fifth stage, the expansion stage, students apply such strategy to new tasks and compare it to other strategies that they like to apply [5]. The sixth stage is when teachers evaluate students' acquisition of the strategy.

Table 3 shows the stages in CALLA that comprise those of the cognitive model of L2/FL acquisition. Stages 1 and 2 of the former are a subset of stage 1 of the latter; stages 3 and 4 are a subset of stage 2 of the latter; and stage 5 is a subset of stage 3; stage 6 in the former has no equivalence in the latter. We will use the instructional techniques that support students' reading comprehension of science texts in CBI Settings as well as the cognitive model of L2/FL acquisition and CALLA in our study, as explained next.

Table 3. Stages of the cognitive model of L2/FL acquisition (Adapted from [45]) and the corresponding stages of CALLA (Adapted from [1])

Stages of Cognitive Model of L2/FL Acquisition	Stages of Cognitive Academic Language Learning Approach (CALLA) for teaching reading strategy
Stage 1: Input	Stages 1 and 2: Preparation and presentation of strategy
Stage 2: Information processing	Stages 3 and 4: Practice and self-evaluation
Stage 3: Output	Stage 5: Expansion
-	Stage 6: Assessment

3. Methodology

Our study is based on the following two research questions (RQs):

- RQ1: Which of the instructional techniques that support students' reading comprehension of science texts in CBI settings do our subject teachers implement?
- RQ2: Which of the specific reading strategies that the subject teachers use are effective in helping students achieve significantly higher grades on science reading assessment tests than other strategies?

To answer RQ1 and RQ2, we conduct two kinds of studies naturalistic observational and causal comparative. The naturalistic observation study focuses on first hand observation of subject science classes. The causal comparative study focuses on comparing observation results with student assessment test results. Next, we describe the subjects, materials, design, and procedure of each study.

3.1. Subjects

Our research is carried out in five schools, three of which are private and two are public. These schools follow CBI, and are located in the Northern Governorate of the country of Lebanon. There are two kinds of populations: teachers; and students. The teacher population consists of thirteen science teachers of Grades 4, 5, and 6 in the subject schools. We consider the teacher population as our subject teachers. The student population consists of all students of all classroom sections taught by our subject teachers. Our student sample is half the student population, that is, half the number of classroom sections taught by each subject teacher. The group of students in the sections taught by the same science teacher in the same grade is called a student 'sample group'. All our subject students have started learning science in English in Grade 1 and their ages range from nine to eleven. The majority of students in public schools come from low-class families who do not have either the time or the resources to expose their children to English at home. Private school students, on the other hand, come from middle-class families with both educational skills and financial capabilities that are adequate for supporting their children's English learning. The three private schools are referred to hereafter as $PrSch_{(a)}$, $PrSch_{(b)}$ and $PrSch_{(c)}$. The codes *G5.1* and *G5.2* refer to two different student sample groups of Grade 5 in $PrSch_{(a)}$. The two public schools are referred to hereafter as $PuSch_{(d)}$ and $PuSch_{(e)}$.

3.2. Materials

In the naturalistic observation study, an observation checklist and interview with teachers are used. In the causal comparative study, science reading assessment tests are designed. In the naturalistic observation study, a checklist consisting of a list of the four instructional techniques that support students' reading comprehension in the science subject in Grades 4, 5 and 6 in CBI settings, and which appears in the literature review, is used (See Table 4 below). In addition, an interview with each science teacher is conducted after classroom observations to find out whether these teachers use any strategies that are not captured by our observation sessions.

In the causal comparative study, we use science reading comprehension assessment tests. These tests are administered to student sample groups of Grades 4, 5 and 6. Each test is comprised of a science text with reading comprehension questions. The science texts in the reading comprehension tests are new; that is, students have not read them before. Students are familiar with the topic of the texts but not with the content.

Table 4. Observation checklist of the four main instructional techniques that support students' science reading comprehension in CBI settings

Observation checklist
I. Use of L2/FL, with, when necessary, a limited and systematic use of L1
II. Teaching of reading strategies A. Detailed textual genre analysis B. General textual genre analysis C. General reading strategies 1. Directed reading/thinking 2. Question/answer relationship a. First level b. Second level c. Third level d. Fourth level 3. KWL chart 4. Anticipation guide 5. Context clues
III. Use of cognitively engaging tasks A. Experiential tasks B. Collaborative tasks
IV. Provision of student output opportunities A. Peer explanations B. Students' choice of activities C. Metatalk D. Debates

To answer the questions, students need to use the reading strategies they have acquired in class; namely, question/answer relationship of first and second levels, and context clue analysis. The questions match students' cognitive and linguistic levels, as they have been approved by science teachers and coordinators of the subject schools. The tests have been corrected twice to ensure reliability of marks.

3.3. Design

Private schools and public schools are compared separately, since the student population in the private school sector is different from that in the public school one with respect to culture and L2/FL exposure. In the causal comparative study, the independent variable is associated with the kind of reading strategy that each subject teacher uses in each grade. The controlled variables are associated with the three instructional techniques (I, III, and IV in Table 4) that support students' reading comprehension in the science subject. The dependent variables are associated with the means of scores on the assessment tests of student sample groups. Table 5 provides a summary for each variable association.

Table 5. Dependent and independent variables

Causal Comparative Study	
Independent variable	Reading strategy kinds used by each subject teacher in each grade
Controlled variables	Instructional techniques (I, III, and IV in Table 4)
Dependent variables	The means of scores on the assessment tests of student sample groups

The student sample groups that are exposed to different reading strategies, but have the other three instructional techniques (I, III, and IV in Table 4) controlled, are compared using science reading assessment tests. If the mean of test scores of a student sample group on these assessment tests is significantly higher than that of another sample group, then the implication is that the reading strategy that the former group applies is more effective in supporting students' reading comprehension of science texts than the latter.

3.4. Procedure

The procedure consists of receiving official permission to carry out research in subject schools, setting a schedule with each teacher, observing classes using the checklist of instructional techniques, conducting an interview with teachers, and administering tests to students. Permission to attend classes was taken from school administrations. The schedule for attending the four science periods was aligned with the start and finish of the science lesson so as to allow us to record all the strategies that teachers use. Class observations were done within the same time frame in all schools, in the month of April; that is, two months before the end of the school year. Four science periods were attended in the chosen classroom sections, where the applied reading practices were closely observed. Subsequently, interviews with subject teachers were performed. The final step was administering reading assessment tests to students and calculating the mean of test scores for each student sample group. The differences between the means of scores were discerned as being significant or not based on statistical tests of significance, such as simple ANOVA and t-Tests for independent samples. The student sample groups that had a significant difference in means of test scores were scrutinized in terms of their exposure to the instructional techniques that support students' science reading comprehension in CBI settings. Such analysis allowed for the identification of the reading strategies that are most effective in producing significantly high averages among student sample groups.

4. Results

This section consists of a description of the subject teachers' application of the four instructional techniques that improve students' reading comprehension, with a special focus on the applied reading strategies. Since the public and private school population differ, as previously mentioned in Section 3.1, the results from public schools are not compared with those of the private schools. As such, the results of each of the Grades 4, 5 and 6 in $PrSch_{(a)}$, $PrSch_{(b)}$, and $PrSch_{(c)}$, will be compared separately from those in $PuSch_{(d)}$ and $PuSch_{(e)}$.

4.1. Grade 4 Results - Private and Public Schools

The private school subject teachers of Grade 4 only use the English language in class (See Table 6). The cognitively engaging tasks in these schools are limited to few experiential tasks conducted in class, such as observing attraction and repulsion of magnets, but no collaborative tasks are practiced. Student output opportunities in English are limited to answering teachers' questions. Peer explanations, students' choice of activities, metatalk, and debates are not practiced.

Table 6. Results of Observation Checklist for Grade 4

Techniques	Private Schools				Public Schools	
	a	b	c		d	e
I. Languages used:						
A. L2/FL Only	✓	✓	✓			
B. L2/FL more than L1					✓	
C. L1 more than L2/FL						✓
II. Cognitively Engaging Tasks						
A. Limited Experimental Tasks	✓	✓	✓			
B. Collaborative Tasks						
III. Students' Output Opportunities						
A. Peer explanation	✓	✓	✓			
B. Students' choice of activities						
C. Metatalk						
D. Debates						
IV. Reading Strategies						
A. Detailed Textual Genre Analysis						
B. General Textual Genre Analysis						
C. General Reading Strategies						
1. Directed Reading/Thinking						
2. Question/Answer Relationship						
a. First Level	✓	✓	✓			
b. Second Level	✓	✓	✓			
c. Third Level						
d. Fourth Level						
3. KWL Chart						
4. Anticipation Guide						
5. Context Clues	✓	✓	✓			

These schools use the same classroom reading strategies (See Table 6). These strategies are applied during and after teachers' explanation of lesson. The kinds of these classroom strategies are general classroom-reading

strategies, specifically question/answer relationship of the first and second levels that focus on language and SPSs at times and on content and SPSs at other times; as well as context clue analysis to understand meanings of words. Examples of questions that deal with language and SPSs are aimed at understanding adverbs of reason/consequence in relation to the SPS of explaining the cause and effect of the repulsion and attraction of magnets. Examples of questions that deal with content and SPSs are aimed at understanding the forces of magnets and the SPS of inferring regarding the juxtaposition of magnets. In $PrSch_{(b)}$, the teacher instructs students to do home reading, which is not applied in $PrSch_{(a)}$ and $PrSch_{(c)}$. As such, in $PrSch_{(b)}$, the teacher assigns home-reading of a specific section of a new lesson, students read the assigned section at home, then the teacher begins explaining the assigned section in class the next period.

The public school subject teachers of Grade 4 use English in class at different frequencies (See Table 6). The $PuSch_{(d)}$ teacher uses mostly English in class, whereas the $PuSch_{(e)}$ teacher uses mostly Arabic. Therefore, the efficacy of reading strategies they apply cannot be compared.

4.2. Grade 5 Results – Private and Public Schools

The private school subject teachers of Grade 5 only use the English language in class. The cognitively engaging tasks in these schools are limited to few experiential tasks conducted in class, such as observing kinds of plant seeds, but no collaborative tasks are practiced. Student output opportunities in English are limited to answers to teachers' questions. Peer explanations, students' choice of activities, metatalk, and debates are not practiced.

School $PrSch_{(a)}[G_{5.1}]$, or class-section 1 in Grade 5 of $PrSch_{(a)}$, and $PrSch_{(b)}$ use the same classroom reading strategies (See Table 7). These strategies are used after the lesson has been explained. These classroom strategies are general classroom-reading strategies, specifically question/answer relationship of the first and second levels that focus on language and SPSs at times and content and SPS at other times; as well as context clue analysis to understand meanings of words. Examples of questions on language and SPSs aim at understanding relationship between comparative adjectives and the SPS of classification of sizes and shapes of plant seeds. Examples of questions on content and SPSs activate the SPS of observation by contemplating different shapes and sizes of plant seeds.

In $PrSch_{(a)}[G_{5.2}]$, or class-section 2 in Grade 5 of $PrSch_{(a)}$, before the lesson is explained, students apply classroom reading of lesson from the book, accompanied by application of general reading strategies; specifically, question/answer relationships of the first and second levels that focus on language and SPSs at times and content and SPSs at other times, and accompanied by application of context clue analysis. The same examples of language and SPSs, and of content and SPS, as those of $PrSch_{(a)}[G_{5.1}]$, and $PrSch_{(b)}$ apply. In $PrSch_{(b)}$, the teacher applies home reading, which is not applied in $PrSch_{(a)}[G_{5.1}]$ and $PrSch_{(a)}[G_{5.2}]$. Students do home reading before the teacher begins explaining a new lesson. Therefore, the teacher assigns home-reading of a section of a new lesson, and this section is discussed in class the next period. In $PrSch_{(c)}$, no home or classroom reading practices are applied.

Table 7. Results of Observations Checklist for Grade 5.

Techniques	Private Schools				Public Schools	
	a		b	c	d	e
	$G_{5.1}$	$G_{5.2}$				
I. Languages used:						
A. L2/FL Only	✓	✓	✓	✓	✓	✓
B. L2/FL more than L1						
C. L1 more than L2/FL						
II. Cognitively Engaging Tasks						
A. Limited Experimental Tasks	✓	✓	✓	✓	✓	✓
B. Collaborative Tasks						
III. Students' Output Opportunities						
A. Peer explanation						
B. Students' choice of activities						
C. Metatalk						
D. Debates						
IV. Reading Strategies						
A. Detailed Textual Genre Analysis						
B. General Textual Genre Analysis						
C. General Reading Strategies						
1. Directed Reading/Thinking						
2. Question/Answer Relationship						
a. First Level	✓	✓	✓		✓	✓
b. Second Level	✓	✓	✓		✓	✓
c. Third Level						
d. Fourth Level						
3. KWL Chart						
4. Anticipation Guide						
5. Context Clues	✓	✓	✓		✓	✓

The public school subject teachers of Grade 5 only use English in class. The cognitively engaging tasks in these schools are limited to few experiential tasks conducted in class, such as observing plant seeds, but no collaborative tasks are practiced. Student output opportunities in English are limited to answers to teachers' questions. Peer explanations, students' choice of activities, metatalk, and debates are not practiced.

In Grade 5 of $PuSch_{(d)}$, during and after teachers' explanation of the lesson, students apply general classroom reading strategies; specifically, question/answer relationships of the first and second levels, with focus on language and SPSs at times, and on content and SPSs at other times; and students apply context clue analysis. Examples of language and SPSs, and of content and SPS are the same as those that $PrSch_{(a)}[G_{5.1}]$ and $PrSch_{(b)}$ apply. These students apply home-reading accompanied by note-taking of the ideas they understand before the teacher begins explaining a new lesson. Therefore, the teacher assigns home-reading of a section of a new lesson. In Grade 5 of $PuSch_{(e)}$, students do not do home reading. During and after teachers' explanation of the lesson, general classroom reading strategies are used. These reading strategies are question/answer relationships of the first and second levels, with focus on language and SPSs at times, and on content and SPSs at other times, and context clue analysis.

4.3. Grade 6 Results – Private and Public

The private school subject teachers of Grade 6 only use English in class. The cognitively engaging tasks in these schools are limited to few experiential tasks conducted in class, such as observing tree leaves, but no collaborative tasks are practiced. Student output opportunities in English are limited to answers to teachers' questions. Peer explanations, students' choice of activities, metatalk, and debates are not practiced.

Reading strategies are used after teachers' explanation of the lesson. The kinds of these strategies are general classroom-reading strategies, specifically question/answer relationship of the first and second levels that focus on language and SPSs at times and content and SPSs at other times; as well as context clue analysis to understand meanings of words (See Table 8). Examples of questions on language and SPSs are aimed at understanding appositive phrases in relation to the SPS of explaining the process of photosynthesis. Examples of questions on content and SPSs are aimed at understanding the process of photosynthesis to use the SPS of prediction regarding the outcome of an experiment on plant leaves with variable degrees of exposure to the sun. The Grade 6 subject teachers of School b apply home reading, which is not applied in $PrSch_{(a)}$ and $PrSch_{(c)}$. Students do home reading before teachers begin explaining a new lesson. Therefore, teachers assign home-reading of a section of a new lesson, and this section is discussed in class the next period.

The public school subject teachers of Grade 6 use the English language in class at different frequencies (See Table 8). The School d teacher uses mostly Arabic in explanations, whereas the teacher in $PuSch_{(e)}$ uses mostly English. Therefore, the efficacy of reading strategies they apply cannot be compared.

Table 8. Results of Observation Checklist for Grade 6

Techniques	Private Schools			Public Schools	
	a	b	c	d	e
I. Languages used:					
A. L2/FL Only	✓	✓	✓		
B. L2/FL more than L1				✓	
C. L1 more than L2/FL					✓
II. Cognitively Engaging Tasks					
A. Limited Experimental Tasks	✓	✓	✓		
B. Collaborative Tasks					
III. Students' Output Opportunities					
A. Peer explanation	✓	✓	✓		
B. Students' choice of activities					
C. Metatalk					
D. Debates					
IV. Reading Strategies					
A. Detailed Textual Genre Analysis					
B. General Textual Genre Analysis					
C. General Reading Strategies					
1. Directed Reading/Thinking					
2. Question/Answer Relationship					
a. First Level	✓	✓	✓		
b. Second Level	✓	✓	✓		
c. Third Level					
d. Fourth Level					
3. KWL Chart					
4. Anticipation Guide					
5. Context Clues	✓	✓	✓		

5. Data Analysis

This part uses means of students' test scores to apply statistical tests of significance to comparable student sample groups. First, a rationale is given for using the particular tests of significance; then these tests are applied to the averages.

5.1. Rationale for Using Simple ANOVA and t-Tests for Independent Samples in Causal-Comparative Study

The most commonly used inferential statistical analyses are *t-Test*; ANOVA (analysis of variance); and *chi square test* [47]. The *t-Test* analysis is used to discover the significant difference between the means of two groups. ANOVA is analogous to *t-Test*; however, ANOVA is normally used for three or more groups. The *chi square test* is used to discover if an event occurs more frequently in one group than in another. In our causal-comparative study, we want to measure the performance of different groups rather than the events' frequencies; as such, we use the *t-Test* for independent samples for two groups, and *simple* ANOVA for three or more groups. The *t-Test* for independent samples is used since the sample groups are randomly formed without any type of matching [47]. *Simple* ANOVA is also applied because there is one independent variable, not more. We use the *Scheffe Test* in conjunction with the *simple* ANOVA to specify the sample groups between which the difference of means is significant.

5.2. Statistics

Table 9, Table 10, Table 11, Table 12, Table 13, Table 15, and Table 16) represent the *simple ANOVA* statistics of the assessment tests, and Table 14 represents *t-Test* for independent sample results. For each Table, we provide data analysis of statistics.

Table 9. Simple ANOVA Statistics for $PrSch_{(a)}$, $PrSch_{(b)}$, and $PrSch_{(c)}$ of Grade 4

#	Statistics	Value
1	n_a	71
2	$\sum X_a$	381.5
3	$\bar{X}_a$	5.37
4	$(\sum a)^2$	2831.75
5	n_b	18
6	$\sum X_b$	113
7	$\bar{X}_b$	5.95
8	$(\sum Xb)^2$	748.25
9	n_c	31
10	$\sum X_c$	184.5
11	$\bar{X}_c$	5.95
12	$(\sum X_c)^2$	1159.5

We use the following terminology in our statistical presentation: n = number of scores; $\sum X$ = sum of scores; and $\bar{X}$= mean of scores. For the sake of simplicity, when the letters *a, b, c, d or e* appear in Table 9, Table 11, Table 14, and Table 15, they refer to $PrSch_{(a)}$, $PrSch_{(b)}$, $PrSch_{(c)}$, $PuSch_{(d)}$, and $PuSch_{(e)}$, respectively. In addition, and also for the sake of simplicity, when a[G5.1] and a[G5.2] appear in Table 11, and Table 13 they refer to $PrSch_{(a)}[G_{5.1}]$, and $PrSch_{(a)}[G_{5.2}]$, respectively.

Table 10. ANOVA Statistics summary for PrSch(a), PrSch(b), and PrSch(c) of Grade 4.

Source of Variation	Source of Squares	Df	Mean Square	F Ratio
Between	SS_B = 15.34	K-1 = 2	MS_B = 7.67	F = 1.03
Within	SS_W = 882.55 .93	N-K = 118	MS_W = 7.48	
Total	897.89	N-1= 119		

The required F for a significant difference is 3.07. The calculated value of *F* is smaller than the required value for significant difference. Computation of an ANOVA test (α = 0.05) has shown that there is an insignificant difference among the means of scores of $PrSch_{(a)}$, $PrSch_{(b)}$, and $PrSch_{(c)}$ of Grade 4.

Table 11. ANOVA Statistics for PrSch(a)[G5.1], PrSch(a)[G5.2], and PrSch(b) of Grade 5

#	Statistics	Value
1	$n_{a[G5.1]}$	23
2	$\sum X_{a[G5.1]}$	130.5
3	$\bar{X}_{a[G5.1]}$	5.67
4	$(\sum X_{a[G5.1]})^2$	937.75
5	$n_{a[G5.2]}$	48
6	$\sum X_{a[G5.2]}$	185.5
7	$\bar{X}_{a[G5.2]}$	3.86
8	$(\sum X_{a[G5.2]})^2$	1066.75
9	n_b	18
10	$\sum X_b$	118
11	$\bar{X}_b$	6.56
12	$(\sum X_b)^2$	876.5

Since α = 0.05 and the calculated *df* (within) is 86, two *dfs* (within) will be considered. The first is 60 and the second is 120 because 86 is between 60 and 120. The required *F* for a significant difference among test results is 3.15 or 3.07. The actual calculated value of F is 7.57 which is > 3.15 and > 3.07. What is left to find out is where this significant difference is. Is it between $PrSch_{(a)}[G_{5.1}]$ and $PrSch_{(a)}[G_{5.2}]$, $PrSch_{(a)}[G_{5.1}]$ and $PrSch_{(b)}$, or $PrSch_{(a)}[G_{5.2}]$ and $PrSch_{(b)}$? Or is it between more than one of the mentioned school pairs? To answer this question we apply the Scheffe test as explained in Table 13. Note that the terminologies used in the t-Test are: *t* = t-Value; and *df*= Degree of Freedom.

Table 12. ANOVA Summary of Results for $PrSch_{(a)}[G_{5.1}]$, $PrSch_{(a)}[G_{5.2}]$, and $PrSch_{(b)}$ of Grade 5

Source of Variation	Source of Squares	*Df*	Mean Square	F Ratio
Between	SS_B = 114.52	K-1 = 2	MS_B = 57.26	F = 7.57
Within	SS_W = 650.12 .93	N-K = 86	MS_W = 7.56	
Total	764.64	N-1= 88		

***PrSch*$_{(a)}$[G$_{5.1}$] and *PrSch*$_{(a)}$[G$_{5.2}$]:**

- The value of F required for significance if α =0.05 is 3.15 for dfw= 60 or 3.07 for dfw= 120. The calculated F (3.38) is greater than the required F (3.15 or 3.07). Consequently, there is a significant difference between the two means, $\overline{X}$a[G5.1] and $\overline{X}$a[G5.2]. Please note that a[G5.1] and a[G5.2] refer to PrSch(a)[G5.1] and PrSch(a)[G5.2], respectively.

Table 13. Scheffe Tests for PrSch(a)[G5.1] and PrSch(a)[G5.2], PrSch(b) of Grade 5

Groups	Calculated F
Group One: *PrSch*$_{(a)}$[G$_{5.1}$] vs. Group Two: *PrSch*$_{(a)}$[G$_{5.2}$]	3.38
Group One: PrSch(a)[G$_{5.1}$] vs Group Three: *PrSch*$_{(b)}$	0.53
Group Two: *PrSch*$_{(a)}$[G$_{5.2}$] vs. Group Three: *PrSch*$_{(b)}$	6.31

***PrSch*$_{(a)}$[G$_{5.1}$] and *PrSch*$_{(b)}$:**

- The value of F required for significance, as shown in Table 13, is *F*=3.15 or 3.07 (same as previous explanation for Schools *PrSch*$_{(a)}$[G$_{5.1}$] and *PrSch*$_{(a)}$[G$_{5.2}$]). The calculated *F* for *PrSch*$_{(a)}$[G$_{5.1}$] and *PrSch*$_{(b)}$ is 0.53, which is smaller than the required *F*. Therefore, there is an insignificant difference between $\overline{X}_{a[G5.1]}$ and $\overline{X}_b$.

Table 14. t-Test Statistics for Schools PuSch(d) and PuSch(e) in Grade 5

#	Statistics	Value
1	n_d	38
2	$\sum X_d$	119.5
3	$\overline{X}_d$	3.14
4	$(\sum X_d)^2$	548.25
5	SS_d	208.45
6	n_e	41
7	$\sum X_e$	112
8	$\overline{X}_e$	2.73
9	$(\sum X_e)^2$	501.5
10	SS_e	195.55
11	T	0.80
12	$df = n_d + n_e - 2$	77

***PrSch*$_{(a)}$[G$_{5.2}$] and *PrSch*$_{(b)}$:**

- The calculated value of F, as shown in Table 13, is 6.31, which is greater than the required value of F (3.15 or 3.07) for significance. As such, there is a significant difference between $\overline{X}$a[G5.2] and $\overline{X}$b.

Table 15. Simple ANOVA Statistics for PrSch(a), PrSch(b), and PrSch(c) of Grade 6

#	Statistics	Value
1	n_a	67
2	$\sum X_a$	261
3	$\overline{X}_a$	3.9
4	$(\sum X_a)^2$	1242.75
5	n_b	18
6	$\sum X_b$	77.5
7	$\overline{X}_b$	4.31
8	$(\sum X_b)^2$	447.25
9	n_c	26
10	$\sum X_c$	89
11	$\overline{X}_c$	3.42
12	$(\sum X_c)^2$	447

The required *t* for a significant difference is 2.00 or 1.98. The calculated *t* is smaller than both. As such, computation of t-Test for independent samples (α = 0.05) has indicated that there is no significant difference between the means of scores of Grade 5 of *PuSch*$_{(d)}$ and *PuSch*$_{(e)}$.

Table 16. ANOVA Summary of Results for PrSch(a), PrSch(b), and PrSch(c) in Grade 6

Source of Variation	Source of Squares	Df	Mean Square	F Ratio
Between	SSB = 8.61	K-1 = 2	MSB = 4.31	F = 0.97
Within	SSW = 481 .93	N-K = 108	MSW = 4.46	
Total	490.54	N-1= 110		

Computation of ANOVA test (α = 0.05) has indicated that there is no significant difference between the means of scores of the sample population of Grade 6 in the three schools. This is due to the fact that F <3.07.

6. Discussion

The statistical analysis of the means of test scores of the student sample groups reflects the efficacy of the reading strategies that these sample groups are exposed to with regards to supporting their reading comprehension skills in the science subject. In Grade 4, Computation of an ANOVA test (α = 0.05) shows that there is an insignificant difference among the means of test scores of *PrSch*$_{(a)}$, *PrSch*$_{(b)}$, and *PrSch*$_{(c)}$. Therefore, the home reading strategy that the sample Grade 4 students apply before teachers explain the lesson has no additive effect to that of the general classroom-reading strategies, specifically question/answer relationship of the first and second levels that focus on language and SPSs at times and on content and SPSs at other times, and context clue analysis, which are applied during and after lesson explanation. In Grade 5 of *PrSch*$_{(a)}$ and *PrSch*$_{(b)}$, the ANOVA (α = 0.05) and Scheffe tests show that there is an insignificant difference between the means of scores of *PrSch*$_{(a)}$[G$_{5.1}$] and *PrSch*$_{(b)}$; but that there is a significant difference between the means of scores of *PrSch*$_{(a)}$[G$_{5.1}$] and *PrSch*$_{(a)}$[G$_{5.2}$], and of *PrSch*$_{(a)}$[G$_{5.2}$] and *PrSch*$_{(b)}$, where $\overline{X}_{a[G5.1]} > \overline{X}_{a[G5.2]}$ and $\overline{X}_b > \overline{X}_{a[G5.2]}$. The insignificant difference in means of scores of *PrSch*$_{(a)}$[G$_{5.1}$] and *PrSch*$_{(b)}$ indicates that, in the sample private school students of Grade 5, the home reading strategy that students apply before teachers explain the lesson has no additive effect to that of the general classroom-reading strategies, specifically question/answer relationship of the first and second levels that focus on language and SPSs at times and on content and SPSs at other times, and context clue analysis, which are applied after lesson explanation. The significant difference in means of scores of *PrSch*$_{(a)}$[G$_{5.1}$] and *PrSch*$_{(a)}$[G$_{5.2}$], and of *PrSch*$_{(a)}$[G$_{5.2}$] and *PrSch*$_{(b)}$ gives a positive indication concerning the classroom use of general reading strategies, specifically question/answer relationships of the first and second levels that focus on language and SPSs at times and on content and SPSs at other times, and context clue analysis. The indication is that when such reading strategies are applied before teachers' explanation of the lesson, they are not as

effective as when they are applied after teachers' explanation of the lesson in Grade 5. Computation of t-Test for independent samples ($\alpha = 0.05$) for Grade 5 of $PuSch_{(d)}$ and $PuSch_{(e)}$ shows that there is an insignificant difference between the means of test scores of the two schools. This implies that the home reading strategy that the sample Grade 5 public school students apply before teachers explain the read material has no additive effect to that of the general classroom reading strategies, specifically question/answer relationships of the first and second levels that focus on language and SPSs at times, and on content and SPSs at other times, and context clue analysis, which are applied during and after lesson explanation. In Grade 6, computation of ANOVA test ($\alpha = 0.05$) shows that there is an insignificant difference among the means of test scores of $PrSch_{(a)}$, $PrSch_{(b)}$and $PrSch_{(c)}$. This indicates that the home reading strategy that the sample Grade 6 students apply before teachers explain the read material has no additive effect to that of the general classroom reading strategies, specifically question/answer relationship of the first and second levels that focus on language and SPSs at times and on content and SPSs at other times, and context clue analysis, which are applied after lesson explanation.

7. Conclusion and Recommendations

In this section, we give answers to the two research questions, RQ1 and RQ2, based on the study results, and recommend measures, which, if taken, can support students' reading comprehension in science classes of Grades 4, 5 and 6 in CBI settings, such as Lebanon.

RQ1 is concerned with the types of instructional techniques that support students' reading comprehension of science texts in CBI settings that teachers implement. These types are exclusive use of L2/FL, general reading strategies of question/answer relationships and context-clue analyses, and experiential tasks that are limited to classroom observations of living or non-living things, in all private and some public schools.

Some kinds of reading strategies are not used at all in the subject schools, but others are. The reading strategies that are not implemented are detailed and general textual genre analysis, directed reading/thinking, the KWL chart, and anticipation guide. Those that are implemented are general reading strategies of the types of question/answer relationship of the first and second levels and context clue analysis. Those implemented general classroom reading strategies appear before, during, and/or after lesson explanation. The general reading strategy of the question/answer relationship type in both its first and second levels, focuses on either of the pairs language and SPSs, or content and SPSs; or on both these pairs separately. These focuses of the general reading strategy of the question/answer relationship type are not yet found in the review of related literature; and can henceforth be entered as new categorizations of the general reading strategy of the question/answer relationship type. In addition to these general classroom reading strategies, home reading is applied by some student sample groups. Such home reading strategies are of the following two kinds: with or without notetaking of the ideas that students understand while reading at home; and succeeded or not by classroom discussion, before teacher explanation of lesson.

The efficacy of the above home and general reading strategies in producing significantly higher averages in science reading comprehension tests among student sample groups is examined through RQ2. The statistical results indicate three major facts. First, application of home reading strategies in their two kinds in all Grades 4, 5 and 6 does not induce significantly higher averages between the student sample groups that use the home reading along with general classroom reading strategies and those that only use general classroom reading strategies. This can be attributed to the absence of any kind of instruction in reading strategies when students are doing home reading by themselves. Second, the implementation of the general classroom reading strategies of the types of question/answer relationship of the first and second levels and of context clue analysis during and/or after lesson explanation contributes to producing homogeneous averages for student sample groups that apply these strategies in Grades 4, 5, and 6. This is attributable to the efficacy of such reading practices in supporting students' reading comprehension in the science subject, as clarified in the literature survey. Third, in Grade 5, the general reading strategies, specifically question/answer relationships of the first and second levels and context clue analysis, are more effective when applied after teachers' explanation of the lesson than when they are applied before teachers' explanation of the lesson. This fact can be attributed to one of our observations regarding science lessons that include classroom reading after teacher explanation of the lesson. The observation is explained below.

The phases of typical science lessons that utilize classroom reading during and/or after teachers' explanation of the lesson are parallel to the phases of typical reading lessons in a L2/FL subject. These phases are pre-reading, reading and post-reading. The pre-reading phase is implicitly applied when teachers explain targeted content and specialized vocabulary. In pre-reading, the main focus is content and concepts, not language. Therefore, students begin to learn the targeted content first, before learning the commensurate language, so as to prevent cognitive overload. In this phase science instructors mediate between students' science understandings on one side and the targeted ones on the other [36,48]. The next phase is the reading phase, in which instructors demonstrate and teach particular reading strategies that accompany texts, focusing this time on the language that is commensurate with the learned content. In executing these reading strategies and skills, science students are supported in simultaneously acquiring the targeted content and the commensurate language and SPSs. By the end of the reading phase, students will have learned the targeted knowledge and skills. The post-reading phase comes to help students solidify their learned knowledge and skills and transfer such knowledge and skills to new science texts, by providing diverse practice in reading comprehension that suits multiple intelligences and learning preferences [49,50].

The pre-reading, reading and post-reading phases that constitute the aforementioned science lessons correspond to steps in the stages of the cognitive model of L2/FL

acquisition and CALLA. The pre-reading phase provides the first step in the input stage of the cognitive model of L2/FL acquisition. This step is input of science content and concepts. The reading phase comprises the following step and stages of the cognitive model: the second step of the input stage, and the information processing stage. The second step of the input stage in the cognitive model is input of reading strategy, which corresponds to the CALLA stages of preparation and presentation of reading strategies. This step makes students aware of the reading strategy and the commensurate content, language and SPSs. The information processing stage corresponds to the CALLA stages of practice in reading strategies and self-evaluation. In this stage, students learn the reading strategy and the accompanying language, content, and SPSs. The post-reading phase comprises the output stage of the cognitive model. This stage corresponds to the expansion stage of CALLA, which provides extended practice in the targeted skills and knowledge, and allows students to transfer such skills and knowledge to other tasks. In CALLA, after the expansion stage comes the assessment stage, in which students' output is evaluated. The assessment stage does not have a cognate in the stages of the cognitive model.

As previously mentioned, the above pre-reading, reading, and post-reading phases are exclusive to science lessons that apply the general classroom reading strategies of question/answer relationship and context clue analysis during and/or after teachers' explanation of the lesson, and not before. If such reading strategies are applied before teachers' explanation of the lesson, students' concentration, at the outset of the new lesson, would not be on one entity at a time, but on all the entities of content, language and SPSs at once. This seems to prevent efficient processing of the required information. In the first phase of the lesson, students' focus should be on new content only. When they understand such content, they can move on to the second phase, in which they can now concentrate on the reading strategies that help them acquire the language and SPSs that are commensurate with the new content. Deep assimilation and transfer of such skills and knowledge to other tasks come in the third phase via extended practice in diverse reading strategies, which meet the requirements of multiple intelligences and learning preferences.

Home reading whether with or without notetaking and whether with or without classroom discussion of the read material does not produce additive positive effects to the exclusive application of general classroom reading strategies of the question/answer relationship of the first and second levels, and context-clue analysis. Such general classroom reading strategies play a role in maintaining homogeneous means of scores among student sample groups that apply these strategies during and/or after teacher explanation of the lesson in Grades 4, 5 and 6.

Science teachers of Grades 4, 5, and 6 in CBI settings should intend to teach reading strategies by using the aforementioned strategies. They can also use the other kinds of reading strategies that are present in the related literature review and that the subject teachers in the present study do not use, such as detailed and general textual genre analysis coupled with Fortune and Tedick's [2] written-text analysis form, to provide more diverse and concentrated practice.

The following is a suggestion for an easy integration of reading into the normal flow of teachers' science lessons of Grades 4, 5, and 6 in CBI settings. Teachers who begin class with explanations then move on to reading could divide lessons into three phases: the first phase is the pre-reading phase or content input, in which the focus is on explaining science concepts and technical terms; the second phase is the reading phase, in which the focus is on teaching reading strategies that trigger students' acquisition of language, content and related SPSs; and the third phase is the post-reading phase, in which students' acquired knowledge and skills are solidified by providing diversified extended practice in the reading strategies.

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