European Journal of English Language and Literature Studies

Vol.2, No.4, pp. 54-80, December 2014

Published by European Centre for Research Training and Development UK (www.eajournals.org)

DETERMINANTS OF STUDENTS' COMMUNICATION STRATEGIES IN SCIENCE CLASSES

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ABSTRACT *This study is addressed to the science teachers as they play a big part in the acquisition of the target language (L2) which is English. In as much as the Ministry of Education in Bahrain believes that for their students to maximize learning and in the end to compete globally and boost their economy, they have to make some reforms in the teaching of languages like English and Arabic not to discount the importance of content subjects like Science and Mathematics. Certainly, there is the need for an advanced knowledge in technology which will make everything possible in all areas of discipline. English teachers should coordinate with Science teachers so that the latter may be helped in the learning of the contents they teach in Science. This just proves that content subject teachers are so vital in the acquisition of the English language*.

KEYWORDS: Communication Strategies; Content Classes; Content-Based instruction; Language Acquisition; Comprehensible Input Strategies, Students' Written Output.

INTRODUCTION

The Ministry of Education, Bahrain in its I.T. Future and Vision, has resulted in the improvement and development of the education system in Bahrain and this has been one of the priority areas for reform. Studies have been made of the most successful reforms undertaken worldwide and found out that knowledge of technology, science, English, Arabic and Mathematics are critical in the era of globalization (http://www.bahrainembassy.org).Hence, this study was based and conceptualized. The limited exposure to English has been cited as one of the reasons for the lack of proficiency in English of Bahraini students since most schools use Arabic as the medium of instruction. On the other hand, the use of English as medium of instruction in cognitively demanding subjects such as science and mathematics can make the students acquire the English language that they need in order to understand the concepts to be learned especially in science, which is the focus of this research. Students in Content-Based Instruction (CBI) classes often lack the cognitive academic language proficiency needed to process and express content area concepts (Cummins 1992). The task of the CBI teacher is to expose students to appropriate content designed to further their

ISSN 2055-0138(Print), ISSN 2055-0146(Online)

linguistic skills and to render the core concepts of the CBI lesson accessible through language enrichment activities.

Krashen's theory of Second Language Acquisition

Underlying this study is Krashen's theory of second language acquisition, which has five hypothesis - the acquisition-learning dichotomy, the natural order of acquisition, the monitor hypothesis, comprehensible input and affective filter. This study adopted the acquisition-learning hypothesis, comprehensible input hypothesis, the natural order hypothesis and Donna M. Brinton's Content-Based Instruction.

The Acquisition - Learning Hypothesis. The acquisition-learning hypothesis proposes two independent ways of developing ability in a second language. Language acquisition refers to the sub-conscious process identical to the process children utilize in acquiring their first language. This usually takes place in an informal setting and is unstructured. An individual may be exposed to the target language in any number of settings (the movies, in a telephone conversation, while listening to a radio). He gets a lot of unstructured input in these informal speech events and it is he who decides which items in the input he will transform into intake. Hence, acquisition is learner- directed.

Language learning on the other hand is a conscious process known to most people as 'grammar' or 'rules' that result in 'knowing about' a language. (Krashen, 1987). This usually takes place in a formal setting with the teacher usually deciding which learning items to present in a structured manner.It is acquisition, not learning that is emphasized in this study. Data was obtained from a content area class and not from a language classroom. The focus of the interaction, which served as database was Science and not Language.

Input-Intake Hypothesis. Classroom instruction, whatever the lesson be at hand provides opportunities for students to acquire the language. However, input is transformed into intake only if it is not more than one level higher than the learner's level of proficiency. The input hypothesis says that meaning is first acquired and in the process, the student acquires structure (Krashen, 1982). The learner acquires an understanding of language that contains structure a bit beyond his/her current level of competence. This is done with the help of context or extra-linguistic information.

The teacher's language in the classroom especially the characteristic features to accommodate and facilitate learning in the students, was considered in formulating this study. It is believed that teacher-talk displays a variety of structural modifications, depending on the nature of the learning task and the learner's level of competence.

ISSN 2055-0138(Print), ISSN 2055-0146(Online)

Krashen's comprehensible input hypothesis underlies content-based language instruction models specifically the sheltered class model where students acquire the language just through exposure to input made comprehensible by the content area teacher. Where meaning not form is the focus, the learner will nonetheless pick up the language. In this study, the source of data is the science class interaction with attention given to strategies to make input comprehensible.

The Natural Order Hypothesis. According to Krashen, learners acquire parts of language in a predictable order. For any given language, certain grammatical structures are acquired early while others are acquired later in the process. This hypothesis suggests that this natural order of acquisition occurs independently of deliberate teaching and therefore teachers cannot change the order of a grammatical teaching sequence. According to this hypothesis, teachers should be aware that certain structures of a language are easier to acquire than others and therefore language structures should be taught in an order that is conducive to learning. Teachers should start by introducing language concepts that are relatively easy for learners to acquire and then use scaffolding to introduce more difficult concepts.

There are basically two ways in which the teacher can aid comprehension, linguistic and non-linguistic. Studies have shown that there are many things speakers do linguistically to make their speech more comprehensible to less competent speakers. Hatch (1979) has summarized the linguistic aspects of simplified input which appear to promote comprehension.

1. Slow rate
   - Longer pauses;
   - Exaggerated intonation;
   - Extra Volume
2. Vocabulary
   - High frequency vocabulary (not found in Dale)
   - Definitions will be marked
     - "(This means……)"
   - Form class information (funds or money)
   - Semantic feature information,
   - "A cathedral is a church with high ceilings"
   - Context Information
   - "If you go for a job….. they talk about wage scale"
   - Gestures and pictures
3. Syntax
   - Short MLU
     - (Average T-Unit length)
   - Left dislocation of topics
     - ("Friday, Saturday did you have a nice weekend?")
   - Repetition and restatement
   - Summarizes non-syntactic utterances
   - Fills the blank for incomplete utterances
4. Discourse
   - Gives reply within question (Yes/No or choice question)
   - Offers correction

Figure 1: The Linguistic Aspects of Simplified Input

ISSN 2055-0138(Print), ISSN 2055-0146(Online)

As the teacher is following the comprehensible input strategies, the students on one end are also undergoing communication strategies on their own as they listen to their teachers. Elaine Tarone (1978) presents a typology of communication strategies employed by the students which are manifested in their written communication:

Paraphrase		
Approximation	–	a type of paraphrase using a single target language vocabulary item or structure, which the learner knows is not correct, but which shares enough semantic features in common with the desired item to satisfy the speaker.
Word coinage	–	another type of paraphrase which the learner makes up a new word in order to communicate a desired concept.
Circumlocution	–	another type of paraphrase where the learner describes the characteristics or elements of the object or action instead of using the appropriate target language structure
Transfer		
Literal translation	–	a type of transfer where the learner translates word fro word from the native language
Language switch	–	another type of transfer where the learner uses the native language term without bothering to translate.
Appeal for assistance	–	a type of transfer where the learner asks for the correct term or structure.
Mime	–	a type of transfer where the learner uses nonverbal strategies in place of a meaning structure
Avoidance		
Topic avoidance	–	a type of avoidance which occurs when the learner simply does not talk about concepts for which the vocabulary or other meaning structure is not known.
Message abandonment	–	a type of avoidance which occurs when the learner begins to talk about a concept but is unable to continue due to lack of meaning structure. And stops in mid-utterance

Figure 2. A Typology of Communication Strategies (Tarone, 1978)

This study which investigated the communication strategies employed by high, average and low ability students in science classes made use initially of Krashen's input hypothesis and Tarone's Typology of Communication Strategies. But after the pilot testing of one class meant for the purpose of surfacing other strategies true to a science class, the researcher came up with her own listing of communication strategies. These are the following: (1) Approximation, (2) Word Coinage, (3) Circumlocution, (4) Language Switch, (5) Excessive Coordination/Subordination, (6) Listing, (7) Parallelism, (8) Overgeneralization, (9) Fused Sentences, (10) Use of factual information, (11) Short, choppy sentences, (12) Appeal for assistance, (13) Repetition, (14) Deviant Forms and (15) Use of rhetorical questions.

The Content-based Instruction. Content based instruction (CBI) (Brinton, 1989) is a teaching method that emphasizes learning about something rather than learning about language. The focus of a CBI lesson is on the topic or subject matter. During the lesson students are focused on learning about something. This could be anything that interests them from a serious science subject to their favorite pop star or even a topical news story or film. They learn about this subject using the language they are trying to learn, rather

ISSN 2055-0138(Print), ISSN 2055-0146(Online)

than their native language, as a tool for developing knowledge and so they develop their linguistic ability in the target language. This is thought to be a more natural way of developing language ability and one that corresponds more to the way we originally learn the first language. There are types of Content Based Instructions. For this study, the combination of these three types was used.

The Sheltered Model. Sheltered and adjunct CBI usually occurs at universities in English L1 contexts. The goal of teachers using sheltered and adjunct CBI is to enable their ESL students to study the same content material as regular English L1 students. Sheltered CBI is called "sheltered" because learners are given special assistance to help them understand regular classes. Two teachers can work together to give instruction in a specific subject. One of the teachers is a content specialist and the other an ESL specialist. They may teach the class together or the class time may be divided between the two of them. For example, the content specialist will give a short lecture and then the English teacher will check that the students have understood the important words by reviewing them later. This kind of team teaching requires teachers to work closely together to plan and evaluate classes. It has been used successfully at the bilingual University of Ottawa, where classes are taught in English and French, (Briton, 1989).

The Adjunct Model. Adjunct classes are usually taught by ESL teachers. The aim of these classes is to prepare students for "mainstream" classes where they will join English L1 learners. Adjunct classes may resemble EPA or ESP classes where emphasis is placed on acquiring specific target vocabulary; they may also feature study skills sessions to familiarize the students with listening, note taking and skimming and scanning texts. Some adjunct classes are taught during the summer months before regular college classes begin, while others run concurrently with regular lessons.

The Theme Based Model. Theme based CBI is usually found in EFL contexts. Theme based CBI can be taught by an EFL teacher or team taught with a content specialist. The teacher(s) can create a course of study designed to unlock and build on their own students' interests and the content can be chosen from an enormous number of diverse topics. How Does Theme Based CBI Differ from Sheltered and Adjunct Models? Theme based CBI is taught to students with TEFL scores usually in the range 350 to 500. These scores are lower than the TEFL 500 score which is often the minimum requirement for students who want to study at universities in English L1 contexts. Because of the lower proficiency level of these students, a standard "mainstream" course, such as "Introduction to Economics" will have to be redesigned if it is to be used in a theme based EFL class. For example, complicated concepts can be made easier to understand by using posters and charts, (Mercerize, 2000, p.108).

Figure 3 illustrates what they consider the role of students' output in the curriculum process. The figure shows that language is used to effect learning. Language could be oral or written. The latter, which is the concern of this paper, consists of students' written output and teacher's lesson plan. The focus of this study is the students' written output

ISSN 2055-0138(Print), ISSN 2055-0146(Online)

which was analyzed using Canale and Swain's Communicative Competence. This theory has four components, namely, linguistic, discourse, sociolinguistic and strategic competencies. Grammatical Competence refers to the knowledge of lexical items and of rules of morphology, syntax, sentence- grammar semantics, and phonology. Sociolinguistic Competence refers to the knowledge of the relation of language use to its non-linguistic context. Discourse Competence refers to the knowledge of rules governing cohesion and coherence. Strategic Competence refers to the verbal and non-verbal communication strategies that may be called into action to compensate for break-downs in communication due to performance variables or to insufficient competence.

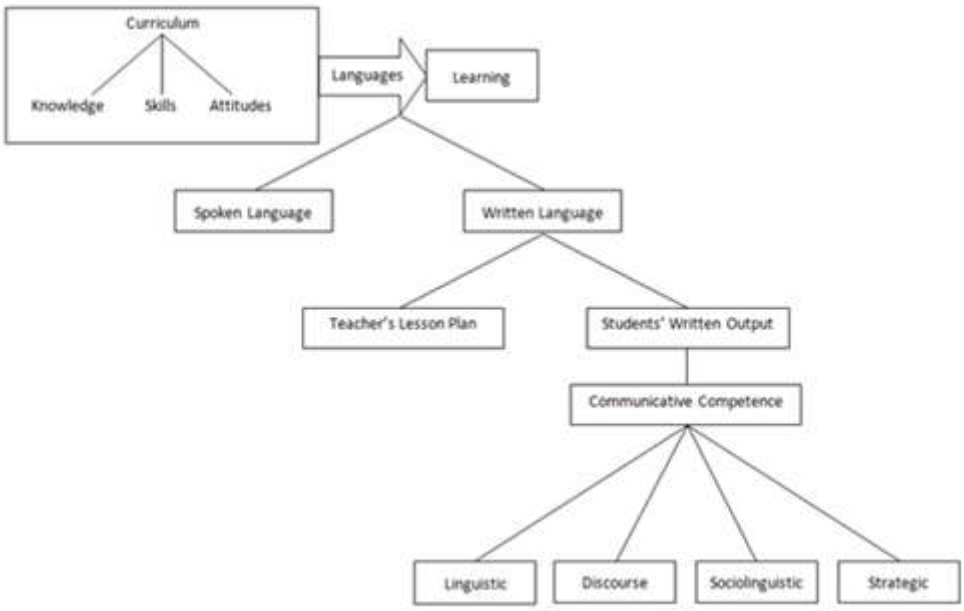

Figure 3: Student Written Output in the Curricular Process

It is acquisition, not learning that is emphasized in this study. Data was obtained from a content area class and not from a language classroom. The focus is the written output of the students in Environmental Management classes, and that the database was Science and not Language.

Classroom instruction, whatever the lesson be at hand provides opportunities for students to acquire the language. However, input is transformed into intake only if it is not more than one level higher than the learner's level of proficiency. The input hypothesis says that meaning is first acquired and in the process, the student acquires structure (Krashen, 1982). The learner acquires an understanding of language that contains structure a bit beyond his/her current level of competence. This is done with the help of context or extra-linguistic information.

ISSN 2055-0138(Print), ISSN 2055-0146(Online)

The teacher's language in the classroom especially the characteristic features to accommodate and facilitate learning in the students, plays significant role in the teaching-learning process. The success of the lesson in Science depends largely on the teachers' comprehensible input. However, this study is focused on the students understanding the concepts taught in Science classes. Krashen's comprehensible input hypothesis underlies content-based language instruction models specifically the sheltered class model where students acquire the language just through exposure to input made comprehensible by the content area teacher. Where meaning not form is the focus, the learner will nonetheless pick up the language. In this study, the source of data is the science classes written output with attention given to communication strategies used by the students in comprehending the lessons taken up in their Environmental Management classes. .

Objectives of the Study

This study attempted to identify and analyze the communication strategies employed by the students in science classes in the tertiary level. It sought to answer the following questions:

1. What are the communication strategies used by the three levels of the students in Science classes?
2. Is there a difference in the communication strategies used by high, average and low ability students in science classes?
3. Does the ability level of students affect the choice of communication strategies in understanding the concepts taught in science classes?

Conceptual Framework

The conceptual framework of this study is based on Tarone's typology of communication strategies and Canale and Swain's written communicative competence: grammatical competence, discourse competence, sociolinguistic competence and strategic competence. Figure 4 which follows presents the communication strategies considered in this research.

Tarone's communication strategies (Figure 4) served initially as basis for analysis of the data obtained but these were reduced after a pilot testing of the instrument conducted mainly to familiarize the researcher and the subjects with the method and to determine which strategies are likely to surface in a science class.

The schematic diagram also shows how Swain and Canale's written communicative competence was adopted in this study. For them, students' written composition can be evaluated into four competencies namely: the linguistic, discourse, strategic and sociolinguistic. Canale and Swain's model of communicative competence was primarily developed for the purposes of spoken language analysis and teaching. For written communicative competence, mastery of each component needs to reflect the grammatical competence for writing. This includes mastery spelling, and punctuation; for discourse

ISSN 2055-0138(Print), ISSN 2055-0146(Online)

competence, cohesion and coherence are considered. To indicate sociolinguistic competence in writing, appropriacy, reader's awareness and appeals to readers, pertinence of claim and tone are considered. The fourth component which is the strategic competence deals with the interpersonal factors between the reader and the writer such as transitions, and other metatextual markers.

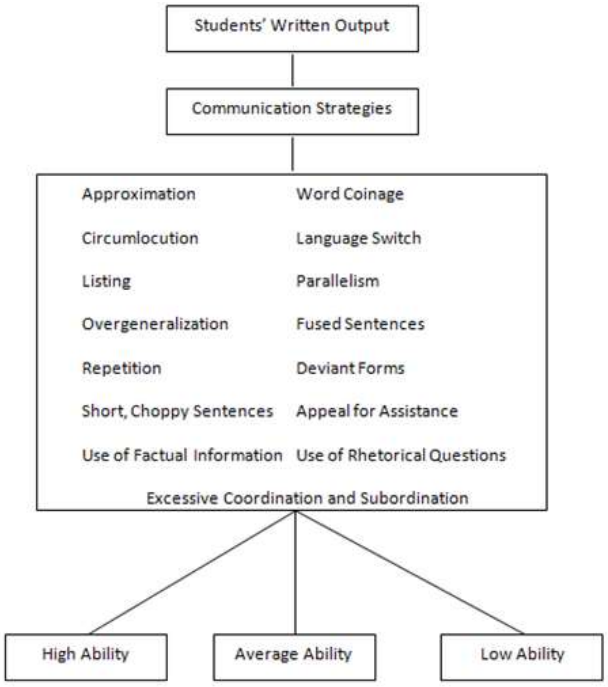

Figure 4: The Communication Strategies in the Students' Output

II. RESEARCH METHODOLOGY

This descriptive study of classroom interaction drew mainly from Krashen's comprehensible input strategies and Elaine Tarone's communication strategies and Strategies in Learning by Andrew Cohen. For analysis however, Canale and Swain's communicative competence in writing was utilized to analyze the compositions of students about their science lessons. It looked specifically at the communication strategies employed by the students in understanding the lessons at hand.

It is hypothesized that the ability level of students serves as the independent variable in this study which will have an effect on the dependent variable namely, the choice of

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communication strategies used by the students to express the concepts learned in the science lessons.

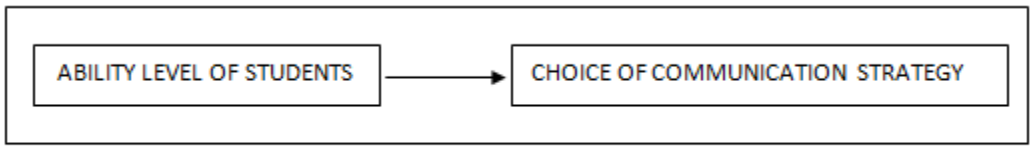

Figure 5: Research Design

Data were obtained from AMAIUB Science Classes. Science classes were chosen because they are supposed to be conducted in the English language. Neither English nor Mathematics classes were considered for a number of reasons. Instead, the study concentrated on communication strategies used in Science classes. Since the study focused on language acquisition where meaning instead of language forms was underscored, data was not obtained from the English class. And since mathematics was equally concerned with computations and concepts, data was not taken from it either. Moreover, the concepts in a science class are less abstract than those in the mathematics class and so the communication strategies employed by the students were more obvious and easier to describe. Then, too, science lessons make use of more rhetorical processes than either the English or the mathematics classes.

A total of five (5) classes was involved in this study with the number of students per class ranging from 10 to 30 and their ages ranging from 16 to 25 years old. It was hypothesized that varied communication strategies would be used in those lessons.

Orientation of the Teachers. Before data gathering, the teachers involved in the study were briefed on the study's rationale and the nature of data collection. To ensure spontaneity and naturalness of writing in the content classrooms, a preliminary writing of a paragraph about the lesson at hand was done so that the students and the teacher would be familiar of what is going to be done on a scheduled data gathering. The data obtained in the preliminary writing was not included as a part of the data analyzed.

Observation and Writing. For data collection, the researcher made a short interview of the teachers concerned about the data gathering and explained to them that the focus of the research was on the students but their role was to facilitate the lesson very well so communication strategies used by the students could be deduced. Complete lessons were held so students can be tested by making them write a composition or a paragraph as answers to the essay questions formulated by the teachers. Analysis concentrated on the communication strategies employed by the students in writing answers to the essay questions prepared by the teachers.

Data Analysis. Data analysis focused on the communication strategies employed by the students to comprehend the lesson at hand. Although Tarone's communication strategies served initially as a means of identifying the ones used by the students in the pilot study,

ISSN 2055-0138(Print), ISSN 2055-0146(Online)

the final list was made up of strategies evident in the data obtained during the pilot study: Approximation, Word coinage, Circumlocution, Language Switch, Appeal for assistance, Excessive coordination/subordination, Listing, Parallelism, Fused Sentences, Use of factual information, Over-generalization, Short, choppy sentences, Deviant Form, Use of rhetorical question and Repetition.

The attempts of the student to express concepts/ ideas in writing were then categorized in accordance with the aforementioned communication strategies. In addition, a comparison was made of the strategies employed by the high, average and low ability classes to determine differences and to account for them qualitatively. A frequency count was likewise made of the strategies employed. It was subjected to statistical treatment using Two-tailed Test to find out if there was any significant difference in the choice of strategies of high, average and low ability students. This served as the quantitative analysis of the data. Another table was made in order to see the ranking of the different communication strategies employed by the students in understanding lessons in Environmental Management classes.

RESULTS

Presented first are the topics discussed and the science concepts taught to Environmental Management students in the classes involved. The high and low ability students were determined by classifying the students according to the grades of students gotten in the preliminary period. The table below shows the distribution of grades which was used for this purpose. The classification of students as to high ability has the grades ranging from 80-99 over 100. (80-99/100) For the average classification, the grades range from 60—79 (60-79/100). For the low ability students, the grades range from 50-59 (50-59/100), where 50 is the passing mark.

Table 1 shows the distribution of grades used for this purpose. The high ability students got the grade range from 80-99% in the preliminary period; the average students got the grade range from 79-69% and the low ability students got the grade range from 50-59% both in the preliminary period.

Table 1: Distribution of Grades

Grade Range	Description
90 - 99	High
80 - 89	
70 - 79	Average
60 - 69	
50- 59	Low

ISSN 2055-0138(Print), ISSN 2055-0146(Online)

The topics that were discussed in the duration of data gathering are "Effects of Population to Pollution Issues" and "Energy Sources". Each of these lessons was taken for three sessions and the fourth session was the writing of the composition about the lessons. The questions asked are as follows:

Effects of Population to Pollution Issues

What can you say about the population of Bahrain? Is it growing fast or slow. Give reasons for your answer.

Energy Sources

1. What are the advantages and disadvantages of nuclear energy?
2. What alternative energy sources are most useful in Bahrain? Explain your answer.

There were five (5) sections of Environmental Management classes participated in the data gathering. The total number of the students was 151. Using the Slovin's formula, the subjects were lowered to 75 students. There were only nine (9) students who were found to be under high ability and the remaining 66 students were divided into average and low ability students.

Samples of Extracts

Extract 1

CS **: Listing**

Topic **: Pollution**

Written Output **:** *Easy ways to conserve the environment:*

a. Change light bulb to one compact fluorescent bulb
b. Stop junk mail
c. Turn off our computer
d. Bring your own cup
e. Wash with warm water
f. Use less water

Listing is a communication strategy of the students when students simply enumerate details or elements through simple recall or memorization. Students can easily remember concepts in words or phrases but not the larger grammatical structure, in general. In the extract above, the student enumerates the easy ways to conserve the environment. There are 6 ways which the student was able to write as answers to the essay question because the answers that they thought about were just memory-call, a support to the essay question that they answered.

Extract 2

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CS : Parallelism

Topic : Pollution

Written Output : *Climate in Bahrain is hot and humid in summer and mild in winter.*

Parallelism refers to balance and equality. In order for the reader to understand what the writer means, the words must make sense in time and space. Extract 2 is an example of the communication strategy which manifests the use of parallelism, the use of balanced construction, in this case, "humid in summer" and mild in winter". These two elements function as complements of the sentence.

Extract 3

CS : Approximation

Topic : Pollution

Written Output : *There are a lot of hotels and restaurants. The piece (peace) which is felt in the islands and castles*

Approximation is a type of paraphrase which uses a single target language vocabulary item or a structure, which the learner knows is not correct, but which shares enough semantic features in common with the desired item to satisfy the writer. In this extract, "piece" is what is not meant in the above extract but "peace" which has similar pronunciation.

Extract 4

CS : Use of factual information

Topic : Population

Written Output : *The people in Bahrain are 60% Bahraini and 40% are foreigners.*

The use of factual information including numbers and figures is a communication strategy where cardinal, ordinal or percentage and other facts in is used in order to make the understanding of science concepts more reliable or authentic. In the above extract, 60% and 40% were used in order to prove that the population of Bahrain is composed of not only locals but a big percentage of it are foreigners. The quotation of facts to support statements is a proof that the ideas presented are not hearsays but are documented and therefore more credible.

Extract 5

CS : Excessive Coordination/Subordination

Topic : Pollution

Written Output *: Beachese in Bahrain is very nice. But we don't have a lot of it because its owend by the king family and because of that the people go to another countries to enjoy being in the beach.*

ISSN 2055-0138(Print), ISSN 2055-0146(Online)

Excessive coordination as a communication strategy is the most used by high, average and low ability students. Ideas about the lessons at hand were expressed in long, run on sentences by joining them by either coordinator or subordinator. It is a sentence violation but it was found to be a common error of the students in expressing the concepts learned in Science. These sentences that they used to express their ideas did not show correct relationships; yet in many instances they connect them simply because that is the way their minds work and automatically transferred it into writing.

Extract 6

CS **: Word Coinage**

Topic **: Sources of Energy**

Written Output *: Solar energy would be best fro Bahrain because the sun sends an incredible amount of energy to earth and has been doing so since the dawn of time and is capable of supplying Bahrain with enough JUICE to fulfill its needs.*

Word coinage is a type of paraphrase where the learner uses a new word in order to communicate a desired concept. In the extract above, the use of the word, "juice" is used to refer to something liquid a more common drink for the mass apart from water. Juice is nothing but water in this context.

Extract 7

CS **: Fused Sentence**

Topic **: Sources of Energy**

Written Output *: Of the most serious drawbacks leakage radiation as the Chernobyl reactor disaster months It is also the negative aspects of nuclear waste that are difficult to get rid of them.*

Fused sentence is a sentence violation but is used as a communication strategy in this context. Two complete ideas that are put together without punctuation will certainly result to fused sentence, just like the extract above. The first sentence should have been a full stop after months, but it appeared as a continuation of the first sentence, so that they become fused.

Extract 8

CS **: Use of rhetorical questions**

Topic **: Sources of energy**

Written Output *: What if terrorists got their hands on nuclear weapons? Or what if nuclear weapons were launched by accidents?*

The use of rhetorical question is another strategy that was used by one of the high ability students. It just shows that the lesson at hand is very well understood that it provoked

ISSN 2055-0138(Print), ISSN 2055-0146(Online)

questions in his mind. These are questions which need no answers at all but good questions to ponder upon, not only for him but more so to the readers. The students fully understand the consequences of nuclear power handled improperly and incorrectly.

Extract 9

CS : Repetition

Topic : Sources of Energy

Written Output *: Nuclear fuel stays where we put it, and we can put it somewhere and we can watch it. Keep it safe with relatively little effort.*

Repetition is the act of repeating words and phrases until the intended meaning is conveyed. While it may seem that repetition per se would not help make an utterance comprehensible since no change was made on the original text, nonetheless, repetition enables the reader to focus on what was written and provides him with the intended meaning of the word that is repeated. In this extract, the phrase, "we put it" was repeated because nuclear fuels must be kept in a safe place for possible damage or contamination if improperly placed or disposed.

Extract 10

CS : Deviant Form (predicate)

Topic : Sources of Energy

Written Output *: And helpful to transfer the sun energy to solar energy.*

Deviant forms are non-syntactic forms. In many instances, in this study, this is used because of the inability of the students specially the low ability ones to express their ideas correctly and the results prove that ideas were written but in an erroneous way. The extract above is an example of deviant form which is just a predicate without the subject. Nevertheless, the meaning is clear that the sun energy is transformed to a solar energy.

Extract 11

CS : Circumlocution

Topic : Sources of Energy

Written Output *: We have other alternative of source of energy in bahrain we have the sun and it is the best alternative because I'I always sunny in bahrain and we can implement by building all huge places that lake the sun and replace it into energy like the chip in the calculated and also we have the wind but that bad choice because we don't have the wind that I have the power to scours energy other is water solar hydrolical and tidal.*

Extract 12

CS : Language Switch

ISSN 2055-0138(Print), ISSN 2055-0146(Online)

Topic : Sources of Energy

Written Output *: In bahrain is a sun wether I thank we well yous the sun energe …*

Language switch is the effort by the student to use the first language without bothering to translate. For instance, in this extract, the student's first language interfered with the use of the letter "e' which is very prominent in the Arabic language both in oral and in written form. Thus, "wether" for "weather'; "yous" for "use' and "energe" for "energy". As a whole the meaning that is supposed to be imparted is still understood: In Bahrain, the weather is almost sunny the whole year and that they can use solar energy as an alternative source of energy.

Extract 13

CS : Appeal for Assistance

Topic : Sources of Energy

Written Output : *The most useful alternative energy source can be used in Baharin is the solar energy. That's right it's so expansive, but it's the best solution to the country To be implemented.*

Appeal for assistance is another communication strategy, more occurring in oral but also happens in written. The learner asks for the correct term or structure for him to express what he wants to say. In this extract, the use of "That's right." implies that somebody was beside him and telling him the correct term or concept to be used for him to continue writing.

Extract 14

CS : Short, choppy sentences

Topic : Sources of Energy

Written Output *: We can use wind power also. since we already have one. And this a alternative energy instead off our oil. Since oil generates lot off pollution.*

Short, choppy sentences can be a sentence violation and can also be a technique to communicate ideas. In this case, it is a communication strategy for him to say what he wants to say about different types of energy. Even if there are connectors, the learner opted to end his sentence in every single idea until he was able to form four short sentences: we can use wind power also. Since we already have one. And this a alternative energy instead off our oil. Since oil generates lot off pollution. Although there are a lot of misspelled words, the meaning is expressed.

Extract 15

CS : Overgeneralization

Topic : Sources of Energy

ISSN 2055-0138(Print), ISSN 2055-0146(Online)

Written Output : *Wind energy is more cheaper than nuclear energy.*

Overgeneralization is a fossilized mistake in grammar. No amount of corrective measure can solve this error because it has always been the error of many second or foreign language speakers of English. The overgeneralization of rules in grammar is always manifested in written composition of students. In the extract above, the comparative degree of ending in "er" is overused because the adjective cheaper has the suffix "er" already.

FINDINGS

1. What are the communication strategies used by the three levels of the students in Science classes?

Table 2: Communication Strategies Used by Students in Science Classes

	High		Average		Low		Average	
strategies	f	Rank	f	rank	f	rank	f	rank
Approximation	**2**	**3.5**					2	11
Word Coinage	1	7					1	13.5
Circumlocution	1	7	3	6	**4**	**4**	**8**	**4.5**
Language Switch			3	6	2	6	5	7.5
Appeal for Assistance			1	9			1	13.5
Repetition			**5**	**3**	**5**	**2.5**	**10**	**2.5**
Excessive Coordination/ Subordination	1	7	**9**	**1**	**10**	**1**	**20**	**1**
Parallelism	**3**	**2**	3	6	1	9	7	6
Fused Sentences	1	7	1	9	1	9	3	10
Short, Choppy sentences			1	9	**3**	**5**	4	9
Deviant Form			**5**	**3**	**5**	**2.5**	**10**	**2.5**
Use of Factual Information	**2**	**3.5**	**5**	**3**	1	9	**8**	**4.5**
Over generalization					1	9	1	13.5
Use of Rhetorical Question	1	7					1	13.5
Listing	**4**	**1**			1	9	5	7.5

ISSN 2055-0138(Print), ISSN 2055-0146(Online)

For the high ability students listing ranked first followed by parallelism. Third in rank is the use of factual information and approximation. Fourth were word coinage, circumlocution, excessive coordination, fused sentences and the use of rhetorical question. Listing appeared to be the most common used communication strategy because the high ability students can easily store in their memories facts which are numbered because these are objective type and are simple recall. This is the most common used objective type question by teachers and is a part of their day-to-day teaching and students have already mastered this type of question. Parallelism can only be used by high ability students because of the manipulation that they can do to the structure of the English language. The use of factual information showed the retention of what was studied before or the diligence of the students in updating themselves about the subject at hand. They must have advanced reading on the subject matter, the reason behind the use of these facts in answering the essay question.

All the other communication strategies were used only once but the use of rhetorical question is a revelation for one of this group of students. This shows that the level of thinking of this student is really high that asking this type of question will ponder more thinking on the part of the reader. Besides, essay type of question tests higher order thinking skills which is really meant for higher ability students. The essay question over other forms of assessment challenge students to create a response rather than to simply create a response. Educators use them because essays have the potential to reveal students' abilities to reason, create, analyze, synthesize, and evaluate.(Reiner, et.al. 2002)

For the average and the low ability students, the same results were seen. Excessive coordination ranked first. In their effort to express their ideas about the lesson, they just put sentences in between, any coordinator or subordinator even if they have done that several times. The results are overused of connectors that lead to a violation of a sentence rule. Second in rank for the average level of students are repetition, deviant form and use of factual information; the same is true for the low ability except for the use of factual information. The third rank went to circumlocution for both the average and the low ability including language switch and parallelism for the average students and short and choppy sentences for the low ability; the fourth rank went to appeal for assistance, fused sentences and short, choppy sentences were placed; all of which were used once by the average students and therefore not really significant.

Over all, excessive coordination ranked first, followed by repetition and deviant forms, third rank is circumlocution, and use of factual information, fourth rank are listing, fused sentences and language switch, followed by short, choppy sentences, fused sentences, approximation and use of rhetorical question, overgeneralization, appeal for assistance and word coinage respectively.

It was followed by deviant forms and repetition. English language in Bahrain is foreign and in the public schools where most of the subjects graduated, Arabic is used as the medium of instruction. Even if English is included in the curriculum of the Basic

ISSN 2055-0138(Print), ISSN 2055-0146(Online)

Elementary and Secondary Schools, the exposure of the students is minimal, so much so that when they were accepted in college their communication in English is very low that the English orientation they got in the university was not enough to make them competent in English, most especially in writing.

2. Is there a difference in the communication strategies used by high, average and low ability students in science classes?

Table 3 presents the test of difference on the usage of communication strategies in science classes. Using the analysis of variance, it was found out that there is a highly significant difference on the usage of Approximation and Listing when the respondents were grouped according to their mental abilities: F-values of 9.194 and 16.914 respectively, and p-values of < 0.001 at 0.05 level of significance. Also, it was found that there is a significant difference on the usage of Word Coinage, Use of Rhetorical Questions and Parallelism with F-values of 4.022, 4.022 and 4.160, and p-values of 0.022, 0.022, and .019, respectively, at 0.05 level of significance. Hence, the null hypothesis is rejected.

This shows that among the levels of the students, only the high ability group can use the approximation and listing. The Bahraini students generally are poor in spelling. They may be good in class but the spelling of majority of words in their compositions is erroneous. In approximation they want to impart the correct meaning but the spelling is wrong; for instance, "piece" for "peace". Listing needs sharp memory. Average and low ability levels of students can hardly use listing because it needs memory of consecutive concepts: words, phrases and sentences. They can hardly remember many items; if ever they can only write one or two out of many.

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Table 3. Test of Difference on the Usage of Communication Strategies in Science Classes

Strategy		Sum of Squares	df	Mean Square	F	Sig.
Approximation	Between Groups	.392	2	.196	9.194	**.000***
	Within Groups	1.556	73	.021		
	Total	1.947	75			
Word Coinage	Between Groups	.098	2	.049	4.022	**.022***
	Within Groups	.889	73	.012		
	Total	.987	75			
Circumlocution	Between Groups	.019	2	.009	.095	.910
	Within Groups	7.139	73	.098		
	Total	7.158	75			
Language Switch	Between Groups	.057	2	.028	.451	.639
	Within Groups	4.614	73	.063		
	Total	4.671	75			
Appeal for Assistance	Between Groups	.016	2	.008	.611	.545
	Within Groups	.971	73	.013		
	Total	.987	75			
Repetition	Between Groups	.177	2	.089	.760	.471
	Within Groups	8.507	73	.117		
	Total	8.684	75			
Excessive Coordination/Subordination	Between Groups	.261	2	.130	.657	.521
	Within Groups	14.476	73	.198		
	Total	14.737	75			
Parallelism	Between Groups	.650	2	.325	4.160	**.019***
	Within Groups	5.705	73	.078		

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	Total	6.355	75			
Fused Sentences	Between Groups	.052	2	.026	.676	.512
	Within Groups	2.829	73	.039		
	Total	2.882	75			
Short, Choppy sentences	Between Groups	.092	2	.046	.904	.409
	Within Groups	3.698	73	.051		
	Total	3.789	75			
Deviant Form	Between Groups	.177	2	.089	.760	.471
	Within Groups	8.507	73	.117		
	Total	8.684	75			
Use of Factual Information	Between Groups	.358	2	.179	1.897	.158
	Within Groups	6.789	72	.094		
	Total	7.147	74			
Over generalization	Between Groups	.018	2	.009	.666	.517
	Within Groups	.969	72	.013		
	Total	.987	74			
Use of Rhetorical Question	Between Groups	.098	2	.049	4.022	**.022***
	Within Groups	.889	73	.012		
	Total	.987	75			
Listing	Between Groups	1.479	2	.740	16.914	**.000***
	Within Groups	3.192	73	.044		
	Total	4.671	75			

*The mean difference is significant at 0.05 level

The use of word coinage, use of rhetorical questions and parallelism were also found to be significant but not as high as in approximation and listing. This is because these three communication strategies need mastery of the linguistic aspect of the language and this is present only for those who have the communication skills which is one of the qualities of the high ability group. All the other communication strategies were insignificant because they were seldom used or not used at all, as proven by the statistical treatment below.

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On the other hand, no significant difference is observed for Circumlocution, Long Switch, Appeal for Association, Repetition, Excessive Coordination/Subordination, Fused Sentences, Short, Choppy Sentences, Deviant Form, Use of Factual Information, Over generalization and Use of Rhetorical Questions: F-values of 0.095, 0.451, 0.611, 0.760, 0.657, 0.676, 0.904, 0.760, 0.666 and 1.7444, and p-values of .910, 0.639, 0.545, 0.471, 0.521, 0.572, 0.409, 0.471, 0.558, 0.517 and 0.182, respectively at 0.05 level of significance. Hence, the hypothesis is accepted.Therefore, there is a difference in the use of communication strategies among the high, average and low ability levels of science students.

3. Does the ability level of students affect the choice of communication strategies in understanding the concepts taught in science classes?

Table 4: Post-hoc Analysis on the Usage of Communication Strategies in Science Classes

Dependent Variable	respondents		Mean Difference	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Approximation	high	average	**.222***	.055	**.001***	.09	.36
		low	**.222***	.055	**.001***	.09	.36
	average	high	**-.222***	.055	**.001***	-.36	-.09
		low	.000	.036	1.000	-.09	.09
	low	high	**-.222***	.055	**.001***	-.36	-.09
		average	.000	.036	1.000	-.09	.09
Word Coinage	high	average	**.111***	.041	**.032***	.01	.21
		low	**.111***	.041	**.033***	.01	.21
	average	high	**-.111***	.041	**.032***	-.21	.00
		low	.000	.027	1.000	-.07	.07
	low	high	**-.111***	.041	**.033***	-.21	.00
		average	.000	.027	1.000	-.07	.07

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Parallelism	high	average	.245	.105	.072	-.02	.51
		low	**.303***	.105	**.020***	.04	.57
	average	high	-.245	.105	.072	-.51	.02
		low	.058	.068	.699	-.11	.23
	low	high	**-.303***	.105	**.020***	-.57	-.04
		average	-.058	.068	.699	-.23	.11
Use of Rhetorical Questions	high	average	**.111***	.041	**.032***	.01	.21
		low	**.111***	.041	**.033***	.01	.21
	average	high	**.111***	.041	**.032***	-.21	.00
		low	.000	.027	1.000	-.07	.07
	low	high	**.111***	.041	**.033***	-.21	.00
		average	.000	.027	1.000	-.07	.07
Listing	high	average	**.444***	.078	**.000***	.25	.64
		low	**.414***	.079	**.000***	.22	.61
	average	high	**-.444***	.078	**.000***	-.64	-.25
		low	-.030	.051	.839	-.16	.10
	low	high	**-.414***	.079	**.000***	-.61	-.22
		average	.030	.051	.839	-.10	.16

*. The mean difference is significant at the 0.05 level.

Concomitant to the test of difference on the usage of communication strategies is a post-hoc analysis using the Scheffe Test. It was found out that the use of the high ability group on communication strategies in science classes differs significantly with the average and low abilities in terms of Approximation, Word Coinage, Use of Rhetorical Questions and Listing: F-values of 0.222, 0.111, 0.111 and 0.444, and p-values of 0.001, 0.032, 0.032 and 0.033 and < 0.001, respectively, at 0.05 level of significance. However, the use of the high ability in terms of parallelism only differs significantly with the low ability group: F-value of 0.303 and a p-value of 0.020 at 0.05 level of significance.

The high ability students differ significantly in approximation, word coinage, use of rhetorical questions and listing with the average and the low ability groups because these communication strategies entail a high level of academic abilities (Rogers, 1995). She

ISSN 2055-0138(Print), ISSN 2055-0146(Online)

said that they are able to remember more and retrieve it easily from memory; they are able to give correct feedback to any factual recall question; they can apply learning from one situation to other situations; they are able to retain material with one exposure; they are able to recall material previously presented and may continue to build on that to show understanding. These abilities are manifested as the situation calls for and these happened spontaneously and naturally in science classes.

It is also gleaned from the table that the use of parallelism is significantly different only with the low ability students. Parallelism needs manipulation of the English language and for this group of students parallelism is difficult to do. Low ability students has difficulty following multi-step directions; lives in the present and does not have long range goals; has few internal strategies (i.e. organizational skills, difficulty transferring, and generalizing information.); scores consistently low on achievement tests; works well with "hands-on" material (i.e. labs, manipulative, activities.); has a poor self-image; works on all tasks slowly. (http://www.scribd.com/doc/25376434/Characteristics-of-Slow-Learners)

The average group of students does what they need to get by, get decent grades, will participate in activities and discussions in the classroom, and will probably complete their homework. http://www.brighthub.com/education/k-12/articles/78977.aspx. These students are called the silent majority who are one time high and another time low in academic abilities. This is the reason why this group of students did not really make significant difference in the use of the communication strategies among the three levels of the students.

CONCLUSIONS

1. The three levels of students in science classes use different communication strategies in consideration to the most to the least used:

    a. With the high ability group of students the use of listing is the most used communication strategy, followed by parallelism, then by approximation and use of factual information, then by word coinage, circumlocution, excessive coordination/subordination, fused sentences, and use of rhetorical questions. The remaining communication strategies like language switch, appeal for assistance, repetition, short choppy sentences, deviant form and overgeneralization were not used at all.

    b. With the average group of students excessive coordination/subordination is the most used communication strategy followed by repetition, deviant form and use of factual information, then by repetition, deviant form, use of factual information, and by parallelism, circumlocution, and language switch. Appeal for assistance, fused sentence and short, choppy sentences are the last of the communication strategies used by the average students.

ISSN 2055-0138(Print), ISSN 2055-0146(Online)

c. With the low ability students, excessive coordination is also the most used communication strategy just like the average group. This is followed by repetition and deviant form, then by circumlocution. The fourth most used communication strategy is short choppy sentences, fifth is language switch, and the last are parallelism, fused sentences, use of factual information, overgeneralization and listing.

d. Among all levels, the following communication strategies arranged from the most to the least used communication strategies are the following: excessive coordination/subordination, repetition, deviant form, circumlocution, short, choppy sentences, language switch, parallelism, fused sentence, use of factual information, overgeneralization, and listing, the last five strategies are of the last rank.

2. The ability level of the students affected the students' use of communication strategies. There is a highly significant difference on the usage of Approximation and Listing when the respondents were grouped according to their mental abilities. It was also found out that there is a significant difference on the usage of Word Coinage, Use of Rhetorical Questions and Parallelism.
3. The use of the high ability group on communication strategies in science classes differs significantly with the average and low abilities in terms of Approximation, Word Coinage, Use of Rhetorical Questions and Listing. However, the use of the high ability in terms of parallelism only differs significantly with the low ability group.

Implications to Research and Practice

1. There is a need to review the pre-service curricula of content area majors where English is used as medium of instruction to determine if provision is made for "the language of science" and classroom interaction strategies. Among the observation made was the difficulty of coping not only with the concepts but also with the language in which these concepts are taught, namely, English. Including the language component in the pre-service curricula of content area teachers would equip them with skills to enable students to cope with the content and the language of the discipline.
2. It is recommended that the use of the English language for initial literacy be implemented. Guidelines as to when and how the transition will be made from the use of L1 to the use of L2 in science should be informed by research in that area. As was mentioned earlier, in the lower grades where science is taught as a process, the use of L1 is preferred but a shift has to be made to L2 when science is taught as a discipline.

ISSN 2055-0138(Print), ISSN 2055-0146(Online)

3. Instructional materials in science should consider not only the content but also communication strategies to make sense of the language used to express that content. This is in line with the emphasis placed on strategy training were the development of strategies are underscored to enable the students to be autonomous and to ultimately develop cognitive academic language proficiency.
4. Finally, the English curriculum of the basic education in Bahrain could include sessions on English for Science and Technology to help science teachers develop their own linguistic capacities in their discipline. The skills they develop can then be applied in the handling of their subjects.

Future Research

1. A study on the common errors found in the written composition of the students in science classes is recommended to better address the communication needs of the students for the curriculum enhancement of the Department of English.
2. With the current emphasis on learner-centered approaches, suggestions have been made to take into consideration the learning preferences of students. Since the focus in this study is the communication strategies in the students written output, another study could be undertaken to determine student preferences using the audio-taped speaking interaction of the students in science classes.
3. Other research could be conducted to determine if equipping content area teachers with an awareness of comprehensible input strategies and the role they play in providing an acquisition-rich setting will result not only in a clearer grasp of content but also in the acquisition of language skills on the part of the students.
4. A study of comprehensible input strategies on the tertiary level can also be undertaken.

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ISSN 2055-0138(Print), ISSN 2055-0146(Online)

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ISSN 2055-0138(Print), ISSN 2055-0146(Online)