# A STUDY TO DETERMINE INSTRUCTORS
# SELF-REPORTED INSTRUCTIONAL STRATEGIES
# WHICH FOSTER SCIENCE LITERACY IN AN EFL
# (ENGLISH AS A FOREIGN LANGUAGE) ENVIRONMENT
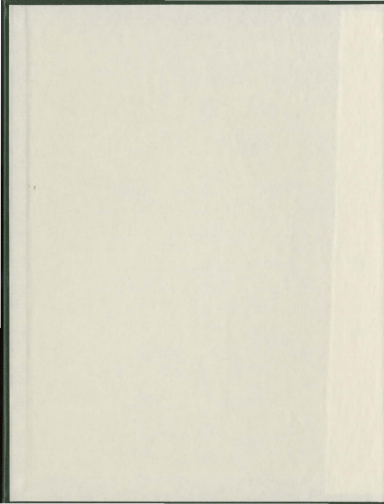
MARK JOSEPH NOSEWORTHY

A Study To Determine Instructors Self–Reported Instructional Strategies Which Foster

Science Literacy In An EFL (English as a Foreign Language) Environment.

by

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A thesis submitted in conformity with the requirements for the

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Abstract

This research titled 'A Study to Determine Instructors Self-Reported Instructional
Strategies Which Foster Science Literacy in an EFL (English as a Foreign Language)
Environment' is an ethnographic study based on grounded theory principles and
research design. The essence of the research was to answer five research questions
that would ultimately create a foundation for instructional strategies allowing science
instructors to foster science literacy in an EFL environment. The research attempts to
conceptualize the research participants' instructional strategies that promote strong
science literacy skills. Further to this, consider the complexities that this learning
environment inherently offers, where the learning event is occurring in an English
environment that is a second language for the learner. The research was designed to
generate personal truths that produced common themes as it relates to the five
research questions posed in this thesis; what instructional strategies do current post
secondary science instructors at one College in Qatar believe foster science literacy in
an EFL environment? As well, do science instructors believe that total immersion is the
best approach to science literacy in an EFL environment? Is the North American model
of teaching/learning science appropriate in this Middle Eastern environment? Are the
current modes of teaching/instruction optimizing student's chances of success for
science literacy? What do you feel are the greatest challenges for the EFL learner as it
relates to science?

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*Chapter One. Introduction to the Study*

*1.0 Introduction*

Many times written words reflect individual or collective realities and conscientia.

The following research was written and conducted to reflect those realities that

represent the participants teaching science content in an EFL (English as a Foreign

Language) environment. The research was conducted using grounded theory principles

and therefore attempts to conceptualize the research participant's instructional

strategies that promote strong science literacy skills. Further to this, consider the

complexities that this learning environment inherently offers, where the learning event is

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American model of teaching/learning science appropriate in this Middle Eastern

environment? Are the current modes of teaching/instruction optimizing student's

chances of success for science literacy? What do you feel are the greatest challenges

for the EFL learner as it relates to science?

Chapter One will provide a discussion of the context of the study with a brief

reflection on the State of Qatar's literacy initiatives and its importance to the Arabian

Gulf nation. Secondly, Chapter One will provide some rationale for the conducting of the

research as it relates to the State's literacy initiatives and the concerns that science

literacy create in an English as a Foreign Language (EFL) learning environment. Further to this discussion, the research will focus on the rationale for instructing in English in the context of it being the lingua franca or the operating language in a modern global era (Graddol, 1997). Chapter One will proceed to comment on the complexities of science literacy and the difficulties that arise from the technical language usage. Finally, Chapter One will provide an operational definition of science literacy in the context of this study. The final section in this chapter provides a list of terms that will appear throughout the thesis.

## 1.1 State of Qatar Educational Initiatives

In the State of Qatar's attempt to meet literacy goals and prepare for social and economic renewal, Qatar has invested significant financial resources, from the country's large reserves of oil and natural gas deposits, in the development of their entire educational system. In roughly 30 years, Qatar has been catapulted from a Bedouin society to a modern urban epicentre. The development of such an economy requires a highly skilled workforce that will include a spectrum of trades people, professionals and service industry specialists. This workforce had been provided by expatriates from different countries but now the Qatari government has embarked on a program referred to as Qatarization (Al Attiyah, 2007). The mission of the Qatarization program is to infuse Qataris into key positions within industry and government that in many cases are currently filled with non-Qatari expatriates. The success of such a program can only be accomplished through extensive training. According to Qatar's energy and industry sector (RasGas, 2008): "The development of the Qatari workforce, through proper education and training, is now a primary national objective designed to enhance the

development of the country" (p.1). In response to this manifesto, the Qatari government embarked on the creation of progressive colleges and universities in partnership with institutions from Canada and the United States. The Qatar government is represented by two governing bodies, the Supreme Education Council [SEC] and the Ministry of Education [MOE], that have sanctioned satellite campuses from a host of educational institutions. These institutions are primarily North American and include Carnegie Mellon University, Georgetown University, Texas A&M University, Virginia Commonwealth University, Weill Medical College, from the United States and the College of the North Atlantic and University of Calgary from Canada (UNESCO, 2007, p.11) . It was believed that each institution would fill a niche in Qatar's attempt to train nationals for a wide variety of occupations.  For purposes of this research it was understood that the College of the North Atlantic would fill the needs associated with trades, field technicians and technologists, offering both certificate and diploma programs.

As a science instructor at the College of the North Atlantic working in an English as a foreign language (EFL) environment one tends to lose sight of this bigger picture and focus on the immediacy of the class at hand.  Each and every day students sit before you in class as adult learners learning science in a second language.  On one hand you have a set of course objectives and in the other hand a tool box of experiences and training that you will rely on in the hope that you as the instructor can optimize the learning experience for the learner.

At the end of the semester your greatest desire is for the learner to have gained a greater understanding of science and all its facets. You are fostering greater science

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literacy in the learner. As an instructor teaching for the first time in an EFL environment, many questions come to the forefront. In an attempt to obtain answers a review of the research literature indicates that there is little research that is specific to science learning in an English as a foreign language environment, hence my interest in conducting this research. The research available was largely centered on children or secondary learners in an EFL learning experience. For example, the foundational research by Jim Cummins (Cummins, 1981, Cummins, 1996, Cummins 1997, Cummins, 1999) and Stephen Krashen (Krashen,1993, Krashen,1994, Krashen,1996, Krashen, 2000) provide the theoretical framework for this research was placed in the context of bilingual children. It has only been recently that Cummins work has been extended to a wider global population of adult learners involved in large scale English language teaching programs as evidenced in a recent publication titled International Handbook of English Language Teaching (2007), Okhee Lee (Lee, O. 1999a, Lee, O.,1999b, Lee, O., 2002, Lee, O. & Fradd, S. H., 1996a, Lee, O. & Fradd, S. H., 1996b, Lee, O., & Fradd, S. H., 1998, Lee, O., & Paik, S., 2000, Lee, O. & Avalos, M., 2002, Lee, O., 2003) is another highly influential researcher that has made significant contributions to science education and the educational strategies that English for Speakers of Other Languages (ESOL) or English as a Second Language (ESL). Okhee's research primarily focuses on instruction methods and strategies that instruction could adopt in order to confront the demands of academic learning in a foreign language environment.

These above researchers represent a large body of the leading research with respect to foreign language learners, but again the research is contextual in relation to

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the secondary learner and elementary learner. There may be a number of reasons for this, but the reality is that the largest learning population is proportionately the secondary and lower level learners in Qatar and thus may inherently place a larger focus on this learning population. With respect to the literature that was available for EFL adult learners outside the North American context, the literature focuses on the context of the Far Eastern learner, but tends to lack science and the Middle East context. From this perspective, with little to draw upon in terms of peer reviewed research, it was a natural progression as a topic for this thesis. It is the hope of this thesis that some contribution to the literature would result and the thesis would fulfill personal learning goals that the researcher has set for himself. The personal learning goals of the researcher include developing an understanding of adaptive instructional strategies, and developing a greater awareness of the learning in context to the learner in the Middle East EFL learning environment.

Initially the research focused on the needs of the adult EFL learner, and the EFL language models used for instruction. The literature presented two influential researchers in the area of bilingual education which the research drew upon for the major foundation regarding the EFL dimension of the study. The authors that influenced a large portion of the theoretical underpinnings of the EFL learner, as discussed earlier, were Jim Cummins (Cummins, 1981, Cummins, 1996, Cummins, 1999) and Stephen Krashen (Krashen, 1993, Krashen, 1994, Krashen, 1996, Krashen, 2000). Both researchers are renowned in the EFL field of study and have established themselves as leading authorities in this area. Cummins alone has "authored or edited more than 20 books and 850-plus chapters, articles, foreword and afterword, reviews,

technical reports, abstracts and papers, as well as curriculums for ESL, reading, social studies, science"(STEEL, 2001, p.1). Krashen was a valuable resource with regard to language acquisition. Regarding the science literacy aspect of this study, research was drawn from a variety of researchers and articles, with Okhee Lee's (Lee, O. 1999a, Lee, O.,1999b, Lee, O., 2002, Lee, O. & Fradd, S. H., 1996a, Lee, O. & Fradd, S. H., 1996b, Lee, O., & Fradd, S. H., 1998, Lee, O., & Paik, S., 2000,Lee, O. & Avalos, M., 2002, Lee, O., 2003) research that provided foundational concepts for the research.

*1.2 Issues*

The greater Middle East population presents some challenges to those interested in providing greater social, economic, and educational opportunities for the citizens of this region.  In light of current world events, the eyes of the world have shifted its focus to the Middle East in an attempt to meet and understand these challenges.  A recent report in the 2002 and 2003 United Nations Arab Human Development Reports (AHDR) for the Middle East suggest that "40% of adult Arabs – 65 million people are illiterate, two thirds of whom are women" (Hayat, 2004, para. 2).  Within the geographical region of the Middle East lies the country of Qatar. Qatar, the smallest Middle East nation, was granted independence from Britain in 1971. It has begun investing national resources in an attempt to increase the nation's literacy. As a result of Qatar's abundance in natural gas and oil deposits it has become one of the wealthiest nations in the world (RAND, 2007). Qatar was a country that had won the lottery, as a matter of speaking.  One day the people of Qatar represent a nation living a modest and traditional way of life and the next day the world is at their doorsteps beginning to develop their natural resources.  The problem was that Qatar's infrastructure was not in place.  This included many

aspects from civil engineering concerns to the societal concerns of educating a population. The State of Qatar in its wisdom and knowing that this wealth is unpredictable and insecure, started to infuse stability into the country's economy by channelling some of that new wealth into educational reforms and development, "with emphasis on creating a dynamic private sector and increasing employment opportunities for Qataris" (RAND, 2007, p.1). Qatar's greatest investment has been in the creation of a number of post-secondary learning opportunities that have resulted in world class educational institutions. With such a huge investment, the state will continue to develop "human resources needed to continue Qatar's ambitious goals for social and economic development" (Rand, 2007, p. 2).

In 2006 the Programme for International Student Assessment (PISA) administered the PISA 2006 assessments to more than 400 000 students from 57 countries making up close to 90% of the world economy (PISA, 2006). PISA predominantly asks 15 year olds to "explain and apply scientific knowledge and knowledge about science, in a variety of complex life situations" (PISA, 2006, p.4). Of the 57 countries represented, Qatar ranked 56th in science competencies with 47.6% of those tested below level 1 science competencies (PISA, 2006, p.20). According to PISA (2006);

> Students in PISA 2006 were classified at one of six proficiency levels, according to the difficulty of science tasks that they could perform (see Figure 1.1). Those unable to perform even the easiest PISA tasks reliably were rated as "below Level 1. (p. 19)
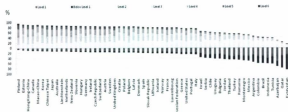
Figure 1.1 Percentage of students at each proficiency level on the science scale

In 2007, the Supreme Education Council (SEC) of Qatar assessed students, from grade 4 to grade 11. The results highlight a general trend of decreasing performance across all grades with respect to mathematics, and science for Qatar independent schools (QCEA, 2007). The study group reviewed included samples from three years; 4,000 students in 2005, 12,000 students in 2006, and 17,000 students in 2007 which represented students from Qatar independent schools. According to the Supreme Education Council of Qatar (SEC, 2010b) an independent school is:

An Independent School is a government-funded school that is granted autonomy to carry out its educational mission and objectives while being held accountable to terms agreed to in an operating contract. All Independent Schools must meet established curriculum standards in Arabic, English, mathematics and science,

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as well as comply with periodic financial audits. Tuition is free for Qataris and others eligible for public education. (para. 1)

Although the results above are reflective of the elementary and secondary school system, the results for post-secondary students may not fare any better. Laidra, Pullman, and Allik (2006) see secondary school performance as a reliable predictor "in impacting students' future opportunities" (p.2). According to Venezia, Kirst, and Antonio (2003) the best predictor of student success is not only the student's academic success but also the pursuit of enrolment in rigorous high school classes. Therefore, extrapolating from the previous discussion and according to Venezia et al. (2003), success in elementary and secondary math and science may be used as indicators of academic success in any post-secondary pursuit. The results portray a potentially disturbing downward trend regarding science literacy levels in Qatar.

The indicators from these assessments represented literacy levels that the State of Qatar was willing to address and commit to overcoming. In her opening remarks in a UNESCO meeting held in Doha 2007, Her Highness Sheikha Mozah bint Nasser al Missned (UNESCO, 2007) identified the emerging attitudes towards education in Qatar.

Cultivating a literate environment in our region is central to progress. A literate culture feeds from knowledge and breeds self confidence and prosperity. When a culture values literacy, the citizens are empowered to be active players in economic and political progress. They take pride in their achievements and so are open to the ideas and values of other people and other societies. Literacy is the very heart of a culture of quality and equality, for when people gain the power to decode their world they gain the power to affect changes to it. It oxygenates

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families, schools, civil society, and all types of institutions and businesses. This is why when we speak of genuine reform in our region and the path to peace, we must keep literacy at the very core of this agenda. (p. 2)

For the Qatari government, education has taken on deep socio-political imperatives that will promote the health of not only the individual but also the health of the community. Qatar, like much of the Middle East, would appear to be at a cross-road, and the movement to increase literacy serves many roles. Greater literacy rates will lead to greater economic opportunities, the creation of a knowledge based society better adapted to meet rapid globalization, and increase governance in the community.

Qatar has ambitious goals for both social and economic development (Rand, 2007). At present, Qatari employers and industry require expatriate workers to fill skilled and unskilled labour positions throughout the energy sector. Such positions would include low-skilled labour positions, high-skilled technicians, managers and professionals (Planning Council, 2005). Most Qataris do not possess the labour skills to meet the labour market needs in Qatar's rapidly expanding economy (Planning Council, 2005). The issue is more complicated by the fact that most Qataris prefer to obtain government positions as opposed to working in the energy sector and related industries (Planning Council, 2005). These are trends that the government of Qatar are ambitiously trying to address, and educating its people is the chief solution.

*1.3 Problem Statement*

Qatar has embarked on a new era of educational reform to meet the challenges of the twenty-first century. The state has exhibited a strong will and determination to create change. The state's motto for education is, "reform's success depends on nothing less than teachers and students transforming themselves" (Supreme Education Council, 2005, p. 2). However, in order for transformation to occur there is a need to identify and understand the many challenges. These challenges can manifest themselves as barriers or create higher non – participation rates and may play a significant role in determining choice of educational pursuits. Concerns that arise can be identified as situational, dispositional and institutional. Such concerns can play a large role in attrition and completion rates. Galusha (1997) with reference to Malcolm Knowles' (1980) work describes the advantages of knowing the learner. Knowles believes "that learner behaviour is influenced by a combination of the learner's needs plus the learner's situation and personal characteristics" (Galusha,1997, para. 9; Knowles, 1980). Galusha (1997) further adds "knowing the participants can help drive program planning and policy formation, factors that are important to participation and success" (para. 8).

Over the last decade English as a Foreign Language [EFL] and English as a Second Language [ESL] training has become an immersive and expanding area in the field of education. A number of factors have clearly precipitated this advance in educational training. These factors include globalization of economies, mass human transport on a global scale, emigration, and refugees from wars. What remains clear is that there has never been such a great need for communication on such a universal

scale, than in the last couple of decades. It would appear that English has become the universal language. According to Crystal (as cited in McKay, 2000) "there are approximately 570 million people in the world today who have a native or native-like command of English" (p. 7). According to a report titled, "English Next" authored by the language researcher David Graddol (2007) roughly two billion people will be speaking or learning English within a decade. What has become the norm is to introduce the learner to English immersion programming as a result of the belief that language skill acquisition can be attained with a high degree of competence. For many EFL or ESL learners this would represent an acquisition of the language and as suggested by Mangubhai (2006) represents a "subconscious way of picking up a second language through exposure to it. It therefore refers to implicit knowledge, rather than explicit knowledge" (para. 7).

The College of the North Atlantic, Qatar Campus, in an attempt to train Qataris in an English environment, has been contracted to train a segment of the Qatari population. The hope is that the training will meet the educational needs in the technology, trades and technician field of their economy. The concern that arises is that the training involves more than implicit knowledge. Training the learner for modern technical fields requires the understanding of science knowledge that permeates with science principles throughout much of the learner's coursework therefore representing explicit knowledge. One aspect of the research will be to examine the realities within which the EFL learner is confronted, while enrolled in an English immersion environment and the resulting instructional strategies and modes of instruction that are used to meet these educational realities. It will focus on the learning of science by EFL

learners wherein English skills and competencies may be obtained concurrently with a full offering of courses that have a repertoire of English, Latin, and Greek word derivatives that science literacy entails. Lee and Avalos (2002) suggest that "although science learning is demanding for most students, it is particularly challenging for students learning English" (p. 7). What makes the task of learning difficult is learning how to master general literacy skills to interact in a meaningful way for 'mainstay' communications, while mastering the complexities and nuances of science literacy. For the EFL learner the technical science 'jargon' is outside the normal realm of conversational English which the EFL programs are designed to facilitate. The task of learning English is further complicated by scientific terminology that could represent another language. Kossack and Vigilante (1983) as cited in Kossack (2007) suggest that "learning of these subject-unique words can be compared to learning a foreign language" (p. 199). Hadaway, Sylvia, and Young (2001) suggested that "the gap between ESL students' language facility in everyday settings and their verbal skills in content areas such as science poses a big problem...especially technical terminology" (p. 31) which for many is almost paralyzing.

The depth of science terminology would represent a language with many complexities in addition to those posed by English language itself. In essence, the EFL learner is required to become not only a bilingual learner, but with science added to the mix, a trilingual learner. Kossack (2007) further adds that "each content area's subject-specific vocabulary becomes an obstacle to students because of its unique, encapsulated nature"(p. 199). Thus the acquisition of core academic themes and

content becomes a nightmare for many EFL learners and a pedagogical challenge for English speaking instructors of science who work in the Middle East.

The purpose of this research after reviewing the five research questions poised earlier, in a general sense, is to examine what strategies and modes of instruction the science instructors have developed which facilitate greater levels of science literacy in the EFL learning environment. The research will look at the English as a second language and the ramifications that a full English immersion learning environment has while a student is learning science in the second language. The research will also take a holistic approach.

In a traditional EFL environment, there is a strong focus on the appropriate usage and structure of the English language. Language acquisition skills acquired from a typical EFL program will fill the need for conversational English; the usage of the language that would allow for the everyday communication for native and non-native English people. However, the EFL learner can be overwhelmed by technical language inherently associated with the science fields. Further to this is the lack of contextual learning. Context was secondary, and at best from an Anglo-Saxon perspective. However, Canagarajah (2006) suggested "that we are compelled to orient ourselves to our learners in more specific ways, taking into account their diverse learning contexts and needs" (p. 14). Lee and Avalos (2002) agree, suggesting "ELLs (English Language Learners) bring their own cultural and linguistic experiences to the learning process" (p. 7).

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*1.4 Science Literacy*

The research is designed to fill a contextual void based on the Middle Eastern context. The research is of some importance considering recent educational initiatives by the regional governments. There may be some research regarding contextual learning, but the context is predominantly from a Far Eastern perspective, where there can be a host of varying educational motivators, socio-political climates, historical contexts and so on that are inconsistent with the Middle Eastern context. For the purpose of this research an operational definition of science literacy has to be provided considering the variance that can occur in discussing science literacy. Generally speaking, science literacy can mean different things to different people. Roberts (2007) suggests that scientific literacy, and the notion therein, represents a diverse spectrum of interpretations and as a result of this consideration can create a diversity of instructional strategies that foster science literacy. According to Liu (2009), Shamos (1995) defines science literacy as three levels;

(a) cultural science literacy: a grasp of certain background information underlying basic communication, (b) functional science literacy: not only know the science terms, but also be able to converse, read, and write coherently using these terms in non-technical contexts, and (c) true science literacy: understand the overall scientific enterprise and the major conceptual schemes of science, in addition to specific elements of scientific investigation. (Liu, 2009, p. 302)

Sadler (2007) suggests that science literacy can be viewed from two 'senses'; a 'fundamental sense' and a 'derived sense'. Sadler (2007) believes that science literacy

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in the 'fundamental sense' represents the usage of language as in writing or reading in science context. From a 'derived sense', Sadler (2007) states that science literacy deals with the understanding and abilities as it relates to science. The derived sense can have two domains; the cognitive and the socio-cultural, with each representing a distinct variation. Roberts (2007) describes science literacy as two visions; Vision I and Vision II. Vision I is about looking inwards at the science, the foundational core of science, the laws, theories, the processes that are inherent in science such as hypothesizing and experimentation. Vision I is about the business of being a scientist with the fundamentals of science concepts and notions. Vision II is about looking outwardly at the world around you and the role that science plays. Decisions that would arise from Vision II would be related to scientific considerations related to socio-cultural issues. Science literacy from the perspective of the research will take on a more holistic approach as defined in accordance with the Programme for International Student Assessment [PISA] (2003);

> Scientific literacy involves the use of key scientific concepts in order to understand and help make decisions about the natural world. It also involves being able to recognize scientific questions, use evidence, draw scientific conclusions and communicate these conclusions. Scientific concepts relevant to the students' world both now and in the near future will be used. (para. 1)

The definition provided by PISA represents three dimensions of science literacy; scientific concepts, scientific processes and scientific situations. Scientific concepts according to PISA is the understanding of the natural world and the interaction of human activity as it relates to true comprehension of science principles, rather than just

simple science recall or superficial knowledge. Scientific processes are about a methodological approach to seeking science knowledge. It is about "the ability to acquire, interpret and act upon evidence" (PISA, 2003, para. 3). Finally, Scientific situations, relates to science in context to socio-cultural science issues in a community or globally.

The Instructor's primary role in the pursuit of science literacy then is to not only "introduce a new concept, present any prior knowledge needed to promote understanding, introduce the materials and procedures, address any unfamiliar vocabulary words, and act as a knowledge facilitator" as posited by Devick-Fry & LeSage (2010, p. 37). The science instructors role is to also include science and its contextual relation to the world in which we live. Science and its relevance in our world, is an important consideration for the adult learner.

### 1.5 Summary

In reviewing section 1.3 and section 1.4 the research has identified learners engaged in learning on two different domains; on one hand the learner is developing English language skills while learning highly specific scientific [academic] language as it relates to their program area of study. Lee (2005) describes the best case scenario and states that "Ideally, subject area instruction should provide a meaningful context for English language and literacy development, while advancing English skills provides the medium for engagement with academic content"(p. 492). What Lee has suggested is that the English language and literacy in conjunction with science literacy should represent a complementary process; where one process furthers the advancement of the second process. The final outcome must be a learner who can speak English as a

second language with a full complement of science literacy skills in order to meet the diverse needs within a modern society. The focus of this thesis is what strategies and possible modes of instruction do instructors employ in order to facilitate science literacy in an English immersion environment. The research questions have been created to focus on this one concern, while allowing the instructor the freedom to expand on issues that they feel is relevant to the research. This is reflected in the choice of grounded theory research design.

*1.6 Terms Defined*

The following terms and definitions are provided to ensure a clear understanding of various terms stated throughout this research paper. The terms and acronyms provide a consistent approach through the research literature reviewed and used in this research paper.

BICS – Basic Interpersonal Communication Skills – the language skills required in social settings. Communications that occur in a social context. (Haynes, 2007)

EAP - English for Academic Purposes – is a program where the students are using academically appropriate language in the preparation for their academic programs. The language used is outside normal conversational language.

EFL – English as a Foreign Language – "A person whose mother tongue is not English learns English as a foreign language if they study the language in a non-English speaking country" (TEFL Acronyms, nd).

ELL – English Language Learner – "a term used to identify heterogeneous populations of students who share a few characteristics. As used here, English language learner refers to a person who have a native language other than English and is in the process of acquiring English" (Brown University, nd).

ESL – English as a Second Language – Instructing learners who are native language is not English but is their second language. ESL is different than EFL in that the learner who is identified as an ESL usually is studying in an English speaking country. (Antimoon, nd)

ESP – English for Specific Purposes – Similar to EAP but "the focus of ESP is on terminology used in specific fields such as law, medicine, technology, finance, etc." (TEFL Acronyms, nd)

CALP – Cognitive Academic Language proficiency – the learning in an academic manner. Skills include reading, writing, listening, comparing, classifying, synthesizing, evaluating, and inferring. (Haynes, 2007)

GCC - Gulf Cooperation Council (Cooperation Council for the Arab States of the Gulf) – A group of six Arabian Gulf states that cooperate on all levels of Gulf matters; economic, political, social, and security. The member states represent countries that share many common ties, especially historical and religious. (Cooperation Council for the Arab States of the Gulf, 2010)

CUP – Cognitive Underlying Proficiency – a term coined by Cummins where he postulates that learning one language, the learner "acquires a set of skills and implicit metalinguistic knowledge that can be drawn upon when working in another language" (Shoebottom, 1996, para. 4).

L1 – First or native language – Learners studying in their native language

L2 – Second or non-native language – Learners studying in a second language.

LIH – Linguistic Interdependence Hypothesis – "developed by Cummins (1978) argues
that certain first language (L1) knowledge can be positively transferred during the
process of second language (L2) acquisition" (Vrooman, 2009, para. 1).

SEC – Supreme Education Council – The Supreme Education Council is responsible for
education policy in Qatar. According to their website SEC "oversees education
reform, helps it grow, and objectively monitors its progress" (SEC, 2010a).

UNESCO – United Nations Educational, Scientific and Cultural Organization – a United
Nations organization promoting dialogue between member states in the hope of
creating "sustainable development encompassing observance of human rights,
mutual respect and the alleviation of poverty" (UNESCO, 2010).

*2.0 Introduction*

Two of the research questions of this thesis are to understand what strategies and modes of instruction may facilitate the acquisition of scientific literacy in an EFL environment? A third research question explored whether total immersion is the best approach to science literacy in an EFL environment? Of the five questions, these three provided the richest data sets and consequently the literature review will focus on these core questions in Chapter Two and represent the main body of Chapter Two discussion. Of the two remaining questions that deal with identifying the EFL learner challenges and whether the North American model of teaching/learning science is appropriate in this Middle Eastern environment; The latter question whether the North American model of teaching/learning science is appropriate in this Middle Eastern environment will be discussed in section 2.6. Additional discussion will follow in Chapter Four and Chapter Five with further literature analysis and synthesis.

In Chapter Two the literature review looks at the core research questions; what strategies and modes of instruction may facilitate the acquisition of scientific literacy in an EFL environment? Is total immersion the best approach to science literacy in an EFL environment? To better understand best strategies and modes of instruction in an EFL environment the literature review concentrates on the work of Cummins in an attempt to present the cognitive framework that he theoretically proposes. It is the view within this research that these cognitive processes and an understanding of the processes in which the EFL learner functions will provide a better awareness of effective strategies and modes of instruction in an EFL learning environment. In Chapter Five the strategies

and mode of instruction identified by the research participants will either support or stand in contrast to practices that fit the EFL learner based on Cummins' tenets.

The second half of Chapter Two will address a third research question; Is total immersion the best approach to science literacy in an EFL environment? The literature review drew upon three dominant language models; Transitional Bilingual Model, Two Way Bilingual Model and finally English (L2) Immersion. Again the model of language delivery, as the research will later demonstrate was another core theme that had implications with regards to science literacy and ultimately the planning of future strategies with respect to the EFL learner in this study. The literature review did identify other language models, however, these models were deemed to represent modified models of the three described in the thesis and were not considered. This chapter will explain resistance to models that may allow for dual language usage and the importance that native language holds towards deeper socio-cultural values for the learner. The dual language discussion will bring to the table the resurgence of Arabisation in the Middle East and the sensitivities that this can create in the EFL learning environment. Finally the literature review in Chapter Two will look at the cultural aspects of the learner and will focus on a comparison between learning styles in the Middle Eastern context and the North American [European] context. The final part of Chapter Two is a literature review that will focus on literature that addresses aspects of the research question: is the North American model of teaching/learning science appropriate in this Middle Eastern environment?

Over the last 40 years there have been many philosophies put forth regarding second language acquisition (SLA) (Mangubhai, 2006). This would naturally be a common theme for the EFL learner. One of the considerations that emerged from the research reviewed was the comprehension of language and the parallels as it relates to scientific literacy. One of the earliest proponents of this notion of higher order learning and fluency, was Jim Cummins. One of the outcomes of this research is to determine instructional strategies that facilitate science literacy. One of the aspects of science literacy is the assimilation of scientific language and concepts that can be used to produce self-directed insights related to scientific phenomena.

Second language researchers have provided clear distinctions regarding second language acquisition and second language learning. Mangubhai (2006) identifies acquisition as "a non-formal, subconscious way of picking up a second language through exposure to it" (p. 2). Mangubhai (2006) further suggests that acquisition represents implicit knowledge rather than explicit knowledge. To some degree this presents somewhat of a dichotomy in the post-secondary environment. One of the primary objectives is to transform the EFL learner from being a receiver of implicit knowledge, to being a conveyor of explicit knowledge. This would represent an important consideration within the realm of science literacy. It is important not just to speak the language to convey implicit knowledge, but more important to formulate complex concepts in a cognitive coherent manner. Shoebottom (1996) suggests that;

We should not assume that non-native speakers who have attained a high degree of fluency and accuracy in everyday spoken English have the corresponding academic language proficiency. (para. 3)

Jaing and other researchers highlight the need for fluency in specific language and the need to understand it as it relates to a particular area of study. According to Jaing (2001, p. 417; Saville-Troike, 1984, p. 217; Wagner, 2005, para. 1),

many ESL professionals have realized that general English proficiency is not all that ESL students need in order to succeed in mainstream courses. They also need English academic language development.

Further to this, Jaing (2001, p. 418) quoting Flowerdew (1994) and Wang (1996) states that,

educators and researchers generally agree that low proficiency in academic language and the distinctive type of English used in classrooms and in textbooks are contributing factors to academic failure among language minority and at-risk minority students (as cited in Wright & Kuehn, 1998).

Cummins, one of the world's leading experts in bilingual education and second language acquisition has constructed a language model that attempts to address these same concerns. The relationships that the research identifies between Cummins' works and science literacy will be revealed later in Chapter Five. But first, Cummins' work and the tenets that his work represents is an important consideration that is fundamental for the final conclusions that the research will provide. In light of this reality, Chapter Two will provide a discussion of Cummins' work and the literature reviews around Cummins' work.

Jiang (2001) citing Cummins (1981) suggests that cognitive academic language proficiency is a requirement for the learner to construct meaningful thought processes rather than the basic idiosyncrasies of conversational English communications. Cummins defines (Jiang, 2001) two types of language proficiencies; Basic Interpersonal Communication Skills (BICS) and Cognitive Academic Language Proficiency (CALP). BICS would represent, according to Shoebottom (1996), "surface skills of listening and speaking which are typically acquired quickly by many students" (para. 1). These are the language skills, as suggested by Haynes (2007), that are "needed in social situations. It is the day-to-day language needed to interact socially with other people" (para. 1). Such skills are not cognitively demanding and entail general conveyance of thoughts or emotions. CALP refers to academic language that is all encompassing. The language acquisition at this level is more cognitively demanding. Haynes (1997) suggests that skills acquired at this level include "comparing, classifying, synthesizing, evaluating, and inferring" (para. 1). This clearly involves greater cognitive facilities than superficially understanding academic vocabulary (Hayes, 1997). The learner is required to think scientifically and reflectively at higher levels based on Bloom's Taxonomy (Wright & Kuehn, 1998; Chamot & O'Malley, 1994). Academic language possesses less visible pragmatic and semantic meanings. The language proficiency would account for the conveyance of abstract and obtuse concepts that bear no contextual points of reference. Thus, the learning is less dependent on the context of the learning.

For the science instructor in an EFL/ESL environment, this distinction becomes extremely critical. As a result, the delivery of academic language instruction will require the need to be cognizant of appropriate delivery and assessment methodologies. What

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has clearly been shown in the Cummins research is that basic vocabulary acquisition can be void of conceptual processes. The key then is the transference of learning from BICS to CALP. The transference of learning from BICS to CALP is central to this research. That is, what strategies of instruction and possibly other modes of instruction can better facilitate this transformation in the acquisition of general scientific language to the greater complexities of the scientific language leading to scientific literacy? And is the total immersion bilingual model the best language vehicle for this transformation. What are the challenges that the EFL learner face? Chapter Four and Chapter Five will provide further insights into this very discussion, a discussion that represents the essence of this research. Answers to these research questions will prevent an antagonistic learning environment fraught with learner anxiety. Cummins (1999) suggests that a lack of understanding of the processes of academic language acquisition would be a failing of the institution as a whole, creating greater academic difficulties for the learner. The acquisition of language in the two domains of conversational and academic does not represent distinct concepts. However, the tasks and activities related to the acquisition of language can be thought of as coming from two domains. The two domains are characterized by variation in "cognitive effort/involvement and the conceptual information and clues needed to process tasks" (Paciotto, 2000, p. 46; Cummins, 1997; Collier, 1995). Cummins suggested that language tasks occur over two continuums; "from cognitively undemanding to cognitively demanding; and along the other continuum from context-embedded to context-reduced" (Shoebottom, 1996, para. 8). For Cummins (Shoebottom, 1996) a context – embedded task is language acquisition or cognitive activities with a host of

visual and oral cues. A context-reduced task is language acquisition or cognitive activities such as "listening to a lecture or reading dense text" (Shoebottom, 1996, para. 8), with no other sources of cues but the language itself as the main cognitive stimuli. What Cummins has created is a quadrant of language acquisition as depicted in Figure 2.1 (Paciotto, 2000, p. 47)



Cognitively Undemanding

Context Embedded      A    B      Context Reduced

C    D      (A Continuum)

Cognitively demanding
(Continuum B)

*Figure 2.1 Cummins quadrant of language acquisition*

Figure 2.1 would suggest that a learner in quadrant D would face the most challenging learning experience. Paciotto (2000) believes that the part of the spectrum that includes C and D of the continuum would reflect the realities for many learners in a post secondary learning environment much like that at one College in Qatar. As Cummins (1996) states, "As students progress through the grades, they are increasingly required to manipulate language in cognitively demanding and context-reduced situations that differ significantly from everyday conversational interactions"(p. 58).

There is a sense in academia that BICS and CALP concepts were simplifications and imprecise notions of a larger complexity. Cummins (Wagner, 2005, Baker, 1993)

later addressed these concerns in 1984 with a new theoretical framework which encapsulates CALP and its concepts into the Common Underlying Proficiency, (CUP). The CUP framework suggests that the thoughts and conceptualizations of an individual, regardless of the operating language, are processed from one central cognitive engine (Wagner, 2005, de Felix, 1988). This would suggest that cognitive functioning can be equally fed from many languages, each language representing a channel of stimuli, equally feeding a central processor all merging into one reservoir (Wagner, 2005). This cognitive processing is observed first hand with students who speak Arabic as a first language, listening in class to lectures delivered in English, but writing notes in Arabic. Many times students will write Arabic column notes in their English prepared lecture notes. This is a point of discussion later put forth in Chapter Four and Chapter Five as recounted in the interviews with the instructors. De Felix (1988, p. 3) further adds that "some concepts are not language specific". Many times it is the goal of science literacy to introduce new vocabulary as the result of the need to understand complex science concepts; the learner can access these concepts in either language (de Felix, 1988, Wagner, 2005). Cummins suggests that the multi-language channels must be well developed (Wagner, 2005). What is interesting to note is that Wagner (2005) suggests that if the learner is allowed to function with a poorly developed second language, the processing will not function well. The literature is speaking poignantly to the research question "Is total immersion the best approach to science literacy in an EFL environment?" The literature suggests that there may in fact be room for some alternate instructional models.

There are some schools of thought that suggest that linguistic diversity has been viewed as a barrier to learning. Once the student speaks English the real learning begins (Hampton & Rodriguez, 2001). Recent research suggest that instructional practices that welcome the benefit of multi-language classroom environments leads to success for the learner (Garcia,1991; Hampton & Rodriguez, 2001). This would suggest delivery of science content via a transitional bilingual model or the maintenance of a bilingual model. This is of some importance when one considers the transition required for the ESL/EFL learner gaining competencies in English transitioning into a full- fledged academic science based environment. Such a model would suggest that the instructional practices would play a pivotal role in the success of the student considering the nature of the learning. There are many variables such as "language production, content instruction, and classroom dynamics… suggesting…modification of traditional instructional practices to include the contextualization of language development into content areas, and the sensitizing of heterogeneous student populations to language and culture" (Gardner & Chlup, 2005, para. 8).

One might question the relevance of Cummins framework to the post-secondary environment since most of Cummins work is related to learners at the intermediate levels of school. This would possibly lead to the notion that in an EFL environment, children hold an advantage over the adult learner. However, de Felix (1988, Ervin-Tripp, 1974) suggests that adults are "simply smarter: they have more memory heuristics, more prior experience to draw from, and consequently faster second language acquisition" (p. 4). Cummins work, cited in de Felix (1988), demonstrated that

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"older students with greater metalinguistic awareness were able to perform cognitively demanding tasks in the second language faster than the younger learners" (p. 3).

A second consideration is with the usage of CALP, and the need to measure or find a measure of cognitive abilities or function. Simply put, how can scholars measure cognitive ability or function Cummins believed that such measures could be obtained from standardized achievement tests (de Felix, 1988).

Cummins's model does not recognize the linguistic diversity that may cloud cognitive functions in the interchange between L1 and L2 processes. For example, Arabic is different from English language in terms of semantic and syntactic complexity. However, Johnson (1981) and de Felix (1988) found that the cultural aspects associated with text as written were more critical in text comprehension.

## 2.2 The Transitional Bilingual Model (TBM)

There is a second model that builds upon Cummins' BICS and CALP. This Transitional Bilingual Model (TBM) is a bridge for English language acquisition and instruction for those learners in language transition from their native language (L1) to their second language (L2) (Bruce et al., 1997). The tenets of this model suggest that fluency in the second language (L2) can be obtained if there is fluency in the first language (L1). Fluency is further divided into two constructs: linguistic fluency and literacy. Cummins' BICS and CALP. Hofstetter (2004) suggest that "bilingual education recommend the utilization of the students' native language as a vehicle toward academic and linguistic development in English" (para. 7). Research suggests that learners initially taught in their native language and then allowed to progress to English language learning perform equally well or better than their English only instruction

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counterparts (Hofstetter, 2004, August & Hakuta, 1997). Krashen (2000) suggests that learning content in L1 provides knowledge, and this acts as a conceptual foundation for learning content in a second language. A second consideration posited by Krashen (2000) suggests that becoming literate in L1 will foster literacy in L2. Krashen (2000) is of the belief that reading in one language will lead to reading proficiency in general. These ideas posited by Krashen are supportive of Cummins thoughts regarding a central processor.

The transitional bilingual model is not without criticism. For example, Gomez (2001) suggested that the TBM is a subtractive and deficit model of language learning as it requires the learner to set aside or subtract their native language in favor of learning in the second language. This in many cases may provide for the learner concepts of language inferiority, where the second language has more value than the first or native language.

### 2.3 A Two-Way Bilingual Model

The bilingual Immersion model or two-way bilingual model places a large emphasis on the L1 literacy as well as the L2 literacy and acquisition. This would require maintenance and development of the L1 literacy skills equally with the L2 literacy skill development. This is somewhat of a departure from the TBM philosophy as there is no transition from L1 to L2, but rather a shared learning experience between both languages. According to Gomez (2001) and Lindholm (1992, 1999) acknowledging the strengths in L1 provides a greater opportunity for literacy development in L2. As stated by Gomez (2001): "By giving the L1 equal status with English, it is valued, validated and ensures its role in daily living within and outside the

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school environment" (p. 6).

One of the concerns that the two-way bilingual approach addresses is that the TBM model can rush students from the L1 into mainstream L2 learning environments leaving the learner cognitively ill prepared for the rigors of the L2 learning (Gomez, 2001). This model remains true to the accepted research regarding second language acquisition. A two-way bilingual model ensures that students gain Cognitive Academic Language Proficiency (CALP) skills and strategies in L1 before proceeding to L2 (Bauer, 1997; Gomez, 2001). As well Jiang (2001), suggests that "students with strong academic skills in L1 generally tend to acquire the needed information in L2 more quickly than those without sufficient formal schooling in L1" (p. 420). Walker and Tedrick (2000) suggest that L1 development is "critical for successful development of both L2 competence as well as academic learning" (p. 21). According to Cummins, "Concepts are most readily developed in the first language and, once developed, are accessible through the second language. In other words, what we learn in one language transfers into the new language" (Freeman & Freeman, 1994, p. 176).

To some extent these considerations are equally important in both TBM and two-way bilingual models. Additional research findings suggest that a well implemented and well planned two-way bilingual program, can produce greater success for the learner in terms of long-term academic and linguistic skills as opposed to a learning continuum placed in a mono-linguistic environment (Thomas & Collier,1997a; Gomez, 2001). Learning in the L1 language may accelerate acquisition and development of academic skills in the L2 (Nguyen, Shin, & Krashen, 2001; Lopez & Tashakkori, 2004) suggesting a transactional relationship between the L1 and L2. According to Findlow (2006);

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Proponents of educational bilingualism argue that the acquisition of a second 'discourse' can help students to think better in metacognitive, critical and reflective ways. Yet such benefits do not mean it is acceptable to force students to study in a foreign language when so much is at stake competitively. Not only do non-native speakers have an additional workload, but the assessment playing field is hardly equal either. (p. 21)

English-only immersion programs can play an effective role in the acquisition of English at the conversational level at a higher rate than the bilingual program, but supportive programs such as transitional programs support the acquisition of academic language ( Krashen, 1996; Lopez & Tashakkori, 2004). The incorporation of the second language as an equal allows students to identify with their culture and language as valued. The prospect of culture shock is minimized  allowing for greater focus on academic concepts rather than idiosyncrasies of the L2 language; and further aids in the development of the L1 communication skills (Auerbach, 1993; Lucas & Katz, 1993).

## 2.4 English Immersion (L2)

The English immersion approach to learning English provides instruction in its entirety in English only with no support for the L1. L2 is used for instruction in all subject matter and is not taught as a separate subject (Marshal et al., nd). This immersion model has been widely recognized as the Canadian model of language instruction, which has gained world recognition (Peterson, 1997; Marshal et al., nd). This approach can be likened to the sink or swim approach; there is little or no consideration given to

the learner's first language needs or there is no scaffolding learning where the learner can slowly migrate from L1 to L2. Rossell (2004) suggests that there is strong research to support learning in an entirely English immersion environment (Baker & de Kanter,1981,1983; Genesee, 1976,1987; Gersten, Baker, & Otterstedt, 1998; Lambert & Tucker, 1972; Rossell,2002, 2003, 2004; Rossell & Baker, 1996a, 1996b).

The common belief is that L2 language development would occur as the student is exposed to L2 academic language content within the immersion environment (Walker, 2000). The primary concern then becomes the mastery of the academic content in L2, with little support for L1 language development. The development of L1 academic content is not a consideration. But rather a heterogeneous approach is taken to the delivery of academic language in a L2 environment. There is no support for the learner in his/her native language; thereby the linguistic uniqueness of the learner is ignored. With a unilingual delivery of the L2 language even the simplest request in the L1 or native language from students would be misunderstood or ignored (Cohen and Swain, 1976). The instructors are generally native speakers in the L2 with all the linguistic competencies associated with that L2 language. The L2 language is meant to permeate all aspects of the student's life on the campus and L1 usage is discouraged in the classroom environment. Safty (1991) suggests that the instructor should provide "a linguistically rich environment and the provision of a variety of authentic language experiences" (p. 479). The science literacy in conjunction with the L2 delivery would provide an authentic environment for the learner. The L2 acquisition is largely facilitated through imitation and trial and error (Safty, 1991) in the L2 natural environment. This would naturally raise some concern about the literacy achievement levels in both L2 and

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science literacy. Research suggests that there is "no loss in academic achievements" (Safty, 1991, p. 481) with L2 as the instructional medium. The immersion model would hold promise according to Cummins as long as the learner has strong L1 development, in fact with strong L1 development the learner may excel in the L2 environment.

This model is not without its critics. However, there is some concern that the learner with special learning needs in L1 will not be provided the opportunity to address learning needs in an immersion or L2 environment (Marshall, Lieb, DeMorais, & Saavedra, nd). According to Cummins' CUP or what is also referred as the Linguistic Interdependence Hypothesis (LIH), both models claim that academic skills are heavily influenced by the transfer of L1 skills (August, 2006) . According to Hakuta (1990; August, 2006) "one of the most fundamental assumptions underlying the efficiency of bilingual instruction is that skills and knowledge learned in the native language transfer to English" (p. 7). The implication is that not only do good academic skills get transferred from L1 to L2 but poor academic skills get transferred as well. The potential here is to create a disenfranchised learner and the prospect of a diminished self-esteem. The immersion program itself would effectively alienate the learner in this scenario. The problem becomes amplified if the student has few if any science literacy skills in the L1 language. These students are immersed into a full English immersion program that is heavily founded on science fundamentals and skills. According to the CUP and LIH philosophy, the learner could be set up for failure.

## 2.5 Resistance to Dualism in Language

Potentially, there may be resistance to the transmission of knowledge as this may reflect Western cultural norms and idiosyncrasies. These are not new notions.

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Tahtawi, an Arab Muslim warns that learning science concepts that have Western foundation, as necessary as it may be, should be understood using "extreme caution to avoid the danger of falling into a degraded form of imitation that would come by indiscriminately following Western ways, which would cost them their culture and religious identity" (Livingston, 1996, p. 554). These sentiments would appear to reflect and reverberate a view held by a segment within the Arab world, brought to the forefront by recent world events. Interestingly, Tahtawi was an Arab writer from the eighteen hundreds. His view is still shared by many, and in some cases has been reinforced in the modern day Arab world. This would suggest an ethical and philosophical divide between modern science and the corpus of religious traditions and beliefs. According to Findlow (2006), "If language and culture are connected so deeply that different languages embody different ways of seeing the world" (p. 21), then change in a given language, even in terms of a loss of range, logically produces a corresponding change-loss in the culture it embodies.

The two-way model would facilitate a greater sensitivity to the L1 cultural and regional identities. Mourani (2004) suggests there is a new sense of 'Arabisation' within the Arab world; "Arabisation involves the adaptation of concepts, terminology, and approaches to various disciplines. It should be accompanied by an emphasis on both the teaching of foreign languages and on the rapid and efficient translation to and from Arabic" (para. 14). Mourani (2004) further adds that;

> a new approach to public policy is needed throughout the Arab world that will make education a priority. Nothing less than a renaissance - drawing on the dynamism latent to Arabic, and centred on the revitalisation of the language, its

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teaching and its use - is required for Arabic to remain a lingua franca that allows Arabs to take their place confidently in the knowledge society. (para. 15) Findlow (2006) would counter Mourani's arguments suggesting that "Bilingualism itself is generally seen as positive and enabling, a tool through which to negotiate the conflicting demands of external and internal realms" (p. 21). In Chapter Five the ideas around bilingualism will be revisited as it relates to instructional strategies and modes of instruction.

## 2.6 Cultural Paradigms and Learning Styles

The following discussion will make cultural distinctions between Western and Middle Eastern cultures, although this thesis will not focus on this point of discussion in any detail as the debate about what is Western culture and what is Middle Eastern culture can be exhaustive. The discussion of Western culture with reference to the North American Anglo-Saxon perspective without the extensive European influences. The word Middle Eastern is used to refer to a culture that is a sub-group of the Asian culture. This working definition would suggest that the Middle Eastern culture represents an Asian perspective that is inherently the same.

In the Middle Eastern culture, a degree of respect is imparted to elders and leaders in the community and these same values are brought to the classroom. In the learning process, value is placed largely on the opinion of the instructor and little value is placed on their fellow peers (Bodycott & Walker, 2000; Calloway-Thomas, Cooper & Blke, 1999; Cheng, 2008; Holmes, 2004; Jones, 1999; Mooney, 2006; Tani, 2005; Wallach & Metcalf, 1995). The Middle Eastern culture is based on collectivistic principles, expressing harmony in the classroom (Yi, 2002). Harmony is achieved to a

large degree as the result of hierarchical relationships. Hierarchical relationships require roles to be filled and individuals to adapt to fill these roles as expressed by societal norms (Roberts, 2007). With regards to science literacy, "teachers are respected as authority and sources of knowledge, students may be reluctant to raise questions if their culture considers this to be a sign of disrespect" (Lee, 2003, p. 469). According to Lee and Avalos (2002) scientific discovery fosters critical thinking where "natural phenomena" is "based on evidence and logic, not based on the authority of teachers or other adults" (p. 3). Students see their roles as recipients of knowledge as opposed to creators of knowledge; creating a pedagogical dichotomy between western and Middle Eastern educational philosophies.

In addition, Western-Style scientific pursuit encourages individual actions; this may be in contrast to innate social norms that place weight on collective strategies. Western science facilitates 'how to question' learning; this is in contrast to the "passive, teacher-centered learning style of the Middle Eastern students" (Ricardson & Lahlou, 2006, p. 111). Further to this, Ricardson and Lahlou (2006) suggest that "the individual work skills tend not to be…..part of the remit of the learning process and a proactive role in problem solving is perceived as unnecessary" (p. 111). Cultural norms would have an intrinsic role in the constructs for learning and instruction styles. Differences in learning styles are based on geographical cultural differences. The table summarizes the East and West cultural perspectives; however, the Middle Eastern context would reflect an Asian perspective or an Eastern cultural influence.

(Cortazzi and Jin 1996 cited in Wong, 2000, p. 26, and Simpson, 2008, p. 384)

| East | West |
|---|---|
| Knowledge: from teachers and textbooks | Skills: in communicating and learning |
| Collective processes: co-ordination, group support, social and amoral learning | Individual orientation: personal needs, attention, talent, uniqueness |
| Teaching and learning as performance: pace, variety, presentation, virtuosity | Teaching and Learning as organization: pairs, groups, activities, tasks |
| Learning through practice and memorization towards mastery: preparation, repetition, confidence building | Learning through interaction and construction: experience, activities, tasks, initial creativity |
| Contextualized communication: listener/reader responsibility | Verbal explicitness: speaker/writer responsibility |
| Hierarchical relations: agreement, harmony, face, respect | Horizontal relations: discussions, argument, informality |
| Teacher is model, expert, authority, parent, friend teacher-centered | Teacher as organizer, mentor, guide, helper, learner-centered. |

Figure 2.2 East and West educational philosophies.

When a culture accepts instruction based on pedagogical philosophies from another culture, there is an implied willingness to accept the cultural norms that constitute that culture, albeit not necessary in its entirety (Scovel, 1983, Simpson, 2008). Simpson (2008) would further suggest that "pedagogies are often bound up in and are expressions of cultural norms" (p. 382). Modern western science is inherently a reflection of Western notions and schema that reflect liberal, democratic ideals, breeding tolerance and scepticism. For the observer in the Middle East, these tenets can create dilemmas that run counter to traditional cultural and religious attitudes and sensitivities. As a result, a variety of consequences could ensue from possible learning environments that are frustrating for both the native language learner and the Canadian instructor to concerns regarding the misunderstanding of educational intentions that can create issues related to trust and perceived ideological agendas.

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## 2.7 Summary

In summary, Chapter Two has provided a literature review that has addressed the five research questions posed. More importantly the instructional strategies that would be used should be reflective of how learners internalize and synthesize the concepts that have been placed before them. Cummins' work provides critical insights to this internal cognitive process addressing language and literacy attainment. As educators the goal is to facilitate the migration of the learner from a lower cognitive state to a higher cognitive state. However, the EFL learner this transition can become further taxed by foreign language considerations. It is the view of this research to allow this migration as efficiently and effectively as possible. The research has surmised that the language considerations therefore play a pivotal role and necessarily require a closer examination of the three dominant language models as reviewed and reflected upon earlier. The literature review was valuable as it demonstrated alternate language models that the instructors were asked to consider in the interview process. Again, the research data suggested that the language environment and language usage were an element in the learning that could not be ignored. Further discussion of this will occur in Chapter Four and Five.

The research, as well, provided literature regarding the resistance to dualism in language. The context of the study has to be reinforced and the context is an important consideration that must be considered regarding the learners preference for their native language regardless of their motivations. The literature review regarding the resistance to the second language is an important consideration for the

development of instructional strategies as the literature provides further evidence of the value that the native language holds for the learner.

Chapter Four will elude to the importance of the native language for the learner and the rationale for alternate language models that use the native language for facilitating the conveyance of science concepts. The point is that many instructors look to the dual language model of learning as a real and viable alternative. The literature review provided further evidence for native language considerations. The research participants discussed the need for cultural considerations in the learning environment.

Finally, Chapter Two provides a literature review that relates to the research question "Is the North American model of teaching/learning science appropriate in this Middle Eastern environment?" The literature review suggests that there is evidence that there are learning style variances between learners in the North American frame of reference and the Middle East frame of reference. These differences are brought to the forefront in the interviews with the instructors as discussed in Chapter Four and later in Chapter Five. Again the needs to understand learning differences reflect concerns required for the appropriate formulation of instructional strategies for the EFL learner in the context of the Middle East.

Chapter Three. The Research Approach and Design

*3.0 Introduction*

The focus of the thesis is to determine instructors' self-reported instructional strategies which foster science literacy in an EFL (English as a Foreign Language) environment. This chapter will focus on the research design that will provide insights into strategies that instructors at the College of the North Atlantic use to deal with the science literacy in an EFL environment. The specific research questions addressed in this study are presented in Chapter One of the thesis. The questions posed are

- What instructional strategies do current post secondary science instructors at one College in Qatar believe foster science literacy in an EFL environment?

- Do current post secondary science instructors at one College in Qatar believe that total immersion is the best approach to science literacy in an EFL environment?

- Is the North American model of teaching science appropriate in this Middle Eastern environment?

- Are the current modes of teaching/instructing optimizing students' chances of success for science literacy?

- What do science instructors at one college in Qatar feel are the greatest challenges for the EFL learner as it relates to science literacy in this foreign language learning environment?

In this chapter, I will describe in detail the research approach and design for the study. Using grounded theory research design methods and interviews as the main

data collection tool, the thesis will provide insight into the strategies employed by instructors to effectively convey science concepts in varying disciplines of science. The study was motivated by concerns and questions arising from experiences in teaching that the researcher and his fellow colleagues share. The hope of this research is to plant the seed for further discussion and ultimately additional research creating the most effective learning strategies for a science learner in an English foreign language learning environment. It is understood that this research, using only a small sample population, may not be able to conclusively answer the questions posed but will provide research upon which to base further studies.

The study is about gaining insights from the perspective of science instructors about their understanding, intuitions, and emotions related to science literacy in the foreign language environment. The importance of science literacy cannot be overstated. Instructional strategies that are effective in the transmission of science knowledge will ensure the success of the student in a technological society like Qatar. The science knowledge obtained by the learners at the college will permeate throughout their culture and daily lives. Science literacy from this perspective becomes important.

The chapter begins with a rationale for the research design supported by research in grounded theory methodologies and is followed with criticisms of such a design. A review of the sampling, data collection, data analysis and ethical considerations is then presented.

### 3.1 Research Approach and Design

The rationale for selecting one research design over another should originate from the nature of the research question(s) posed and one's own epistemology or world

view. As different questions may be more suited for variance in methodology, some theoretical orientations stimulate more appropriate research and design approaches. Two research directions, qualitative and quantitative, are useful to investigate phenomena and the complexities of natural events. A third approach would be the mixed method approach. The essence of the research question(s) will guide the most appropriate methodology. The choice for a research topic for the researcher is based on more pragmatic considerations. As an Instructor working in an environment where you observe Arabic learners totally immersed in an English environment learning competencies in English that serve both conversational and academic needs, many cognitive demands can be created. These cognitive demands would test the fortitude of even the most prepared of learners. Coupled with this reality is the fact that these same learners are engaged in course work filled with academic language highly specific to a particular science or mathematics discipline. For example, chemistry and biology introduce a host of derived words and concepts that in their own right represent a language onto itself – the language of science. Meanwhile, there is the science instructor, whose primary goal is to engage the learner using academic language to instruct the learner, who may have only fifteen minutes prior to this just finished a class in learning English.

The challenge for the post secondary instructor is how to best engage the Arabic learner, who at best is a limited user of English operationally. Students entering the college based on the Canadian Academic English Language (CAEL) Assessment Test are at a band score of 30 (see Appendix A). The Canadian Academic English Language (CAEL) Assessment Test Score is an English language performance assessment based

on criteria in four areas; listening, writing, reading, and speaking. The band scores for the overall result are indicated in Appendix A accompanied with a description of the meaning of each result. According to the CAEL Assessment Testing Office (2010), based at Carleton University in Canada, a band 30 demonstrates;

> Constrained competency in academic English use. Noticeable problems in fluency accuracy, and not sufficiently flexible in the academic setting. (para. 8)

This study examines the strategies and modes of instruction that instructors at the College of the North Atlantic, Qatar campus adopt in light of the above realities. Discussion will focus on the research questions previously posed. One of the research methods used asks for the instructors to engage in self-reflection of their personal experiences in the hope that their perspectives can come to the forefront. Researchers like Strauss and Corbin (1998) would suggest research that would require getting out into the field to investigate "complexity and variability of phenomena and of human action" (p. 9). Human action, according to Strauss and Corbin (1998, p. 9), where the participants are actively "responding to problematic situations" based on personal meanings and perceptions would represent criteria foundational for grounded theory methodologies. Smith (2008) would further suggest that the researcher adopt grounded theory methodologies when the researcher is developing theory "related to motivation, personal experience, emotions, identity...and interpersonal cooperation" (p. 83). What Smith has described would represent a core set of criteria or attributes indicative of the subjects in this study.

Grounded theory is an ethnographic approach that is an inductive approach to learning "where theory should emerge from immersion in collected data" (Taber, 2000,

p. 470). Grounded theory is rooted in a social constructivist approach. Using the epistemological approach of social constructivism, knowledge and meaning will be generated from the subject's life experiences placing value on the context in which the learning occurs. Creswell (2009) suggests that it is through social constructivism that "individuals seek understanding of the world in which they live and work" (p. 8), reflecting the tone of this research.

Douglas (2003) and Van Maanen (1979) would suggest using grounded theory methodologies where the research question is based on the participants' perceptions of a naturalistic setting. According to Douglas (2003) and Van Maanen (1979) grounded theory is a valuable methodological approach since the participants in the research represent a collection of relationships and interrelationships that convey an understanding of conceptual issues in their immediate or natural world. This research is highly contextual reflecting immediate concerns in an institutional environment set in the Middle East. The institution acts as a stage for the interplay between the Arabic learner and the science instructor and all the dynamic learning that this may represent. Mintzberg (1979) suggest that the qualitative research is a necessary methodology considering the nature of an organization and its inherent setting:

> Measuring in real organizational terms means first of all getting out, into the real organizations. Questionnaires often won't do. Nor will laboratory simulations... The qualitative research designs, on the other hand, permit the researcher to get close to the data, to know well all the individuals involved and observe and record what they do and say. (p. 586)

According to Strauss and Corbin (as cited in Thomson, 2004), "If the research is attempting to find the meaning of or understand the experience of a given situation to a group of individuals then qualitative methodologies would be appropriate" (p. 2). Since the nature of the research question will in essence ask the participants to reflect on their personal experiences and beliefs, a qualitative approach would be well suited to this end, Pajares (1992) noted that beliefs pose challenges for the empirical measure. The primary source of data collection will occur through semi-structured interviews. Pajares (1992) drew on Rokeach (1968) who suggested that understanding beliefs requires inferences to be made by the researcher, as the subjects may not be able or willing to reflect on their beliefs in a truly accurate way. Kalaja (1995) after some review of her studies on beliefs suggest that a naturalistic approach and an analysis of respondent's text (talk or writing) reflecting inherent beliefs is a more appropriate research methodology.

Over the past year during the research of the literature review, it has become obvious that there is not a large corpus of research regarding science literacy and the English Foreign Language Learner. Researcher and lecturer Christina Goulding (1999, p. 6) would suggest that "areas where little is already known" or the need to "provide a fresh slant on existing knowledge" regarding a particular social phenomena is again well suited for grounded theory methodologies. Along the same rationale considering the uniqueness of the study, one could determine that the sample population is not a representative population within the post secondary learning environment. As a result, purposeful and theoretical sampling would be a useful sampling strategy which grounded theory methods could afford (Glaser, 1992; Glaser & Strauss, 1967). The

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research method chosen that best suits the research question and theme would gravitate towards grounded theory methodologies. Grounded theory study methodology is an appropriate approach since the data will construct new theory without any preconceived notions of a previous theory. As a result, grounded theory frees the researcher from the constraints of earlier theories that may prove incomplete or inappropriate. The research will provide perspectives from participants teaching in a highly contextual Middle Eastern perspective thus providing some degree of clarity regarding the topic. The multiple perspectives that the EFL science teacher can provide in context to the Middle Eastern learner will play an important role in the construction of a theory that will better facilitate the learner in their native environment. According to Glaser (2002)

> participants have multiple perspectives that are varyingly fateful to their action.
> Multiple perspectives among participants is often the case and then the grounded
> theory researcher comes along and raises these perspectives to the abstract
> level of conceptualization hoping to see the underlying or latent pattern, another
> perspective. (p. 2)

According to Wilmot (2005), "qualitative research aims to provide an in-depth understanding of the world as seen through the eyes of the people being studied" (p. 1). More importantly there is a tremendous opportunity to study instructors in their natural environment, where latent patterns are uninhibited.

It is hoped that many of the researchers' personal queries will be answered by this research. For example, what instructional strategies do current post secondary science instructors at one College in Qatar believe foster science literacy in an EFL

environment? Do current post secondary science instructors at one College in Qatar believe that total immersion is the best approach to science literacy in an EFL environment? Is the North American model of teaching science appropriate in this Middle Eastern environment? Are the current modes of teaching/instructing optimizing students' chances of success for science literacy? What do science instructors at one college in Qatar feel are the greatest challenges for the EFL learner as it relates to science literacy in this foreign language learning environment?

### 3.2 Grounded Theory Criticisms

There are, naturally, weaknesses with qualitative research. The result is less easily generalised than with quantitative methods. The criticisms of grounded theory methodologies arise from the treatment of data. Some suggestions include researcher bias that cannot be ignored, regardless of grounded theory assumptions. This may be true in some interviews, but Glaser (2002) suggests;

> It probably applies to lengthy, in-depth interviews where mutuality can grow based on forcing type interview guides (see Kathy Charmaz, 2000). But this type of interviewing is a small piece of grounded theory interviewing, although it happens and one can do grounded theory from it. Much grounded theory interviewing is a very passive listening and then later during theoretical sampling focused questions to other participants during site spreading and based on emergent categories. (p. 2)

The possibility that bias can influence future codification and thereby cause the researcher to miss underlying themes or concepts would represent a significant concern. However, using the constant comparative method of analysis along with note-

taking and direct observation, possible bias introduction can be minimized. Glaser

(2002) further suggests that "...bias is just another variable and a social product. If the

researcher is exerting bias, then this is a part of the research, in which bias is a vital

variable to weave into the constant comparative analysis" (p. 3). According to Alkaissi

(nd) grounded theory begins with a research situation. Within that situation, your task

as researcher is to understand what is happening there, and how the players manage

their roles. You will do this mostly through observation, conversation and interview.

According to Allan (2003), another possible criticism of grounded theory "is a lack

of rigour due to careless interview techniques and the introduction of bias" (p. 8). Allan

(2003) further adds that

a working awareness of bias is imperative in all interview research.

Transcriptions were checked for context and content accuracy before analysis

began. These procedures and the fact that conclusions drawn are grounded in

actual data help minimise the risk of bias. (p. 8)

Glaser (2002) suggests that a real advantage of grounded theory is that analysis

starts as soon as data collection begins in the first interview.

### 3.3 Sampling

According to Strauss and Corbin (as cited in Thomson, 2004), "the key to

grounded theory is to generate enough in-depth data that can illuminate patterns,

concepts, categories, properties, and dimensions of the given phenomena" (p. 2).

Therefore a sample size that can generate meaningful data can vary. In either case the

sample can always be expanded at a later date if the data fails to illuminate patterns or

concepts. The participant science instructors to be interviewed will be selected based

on two criteria: purposiveness and accessibility. These criteria support purposeful and theoretical sampling. Purposive sampling is a deliberate attempt to select research subjects because of some characteristic (Patton, 1999). The uniqueness of the sample is the richness of the personal experiences that each research subject possessed as science instructors in a Middle Eastern context.

A general pre-screen open-ended questionnaire was provided to the participants, in preparation for the face to face interviews. This initial questionnaire was probative in the sense that evaluation of this questionnaire identified the possible candidates that provided the greatest insights to the posed research question. The questionnaire was not meant to screen participants out as much as it was designed to allow participants to self identify that they wanted to participate or had the experience to be included in the study. The importance of the pre-screen interview cannot be overstated. The responses provided a richness of experiences and passions that was important in demonstrating that these participants had something to 'say'.

Upon review of the initial questionnaire, approximately nine of fifteen potential participants were self selected. The number of potential participants was not pre-determined. The results of the pre-screen questionnaire dictated the initial number of pre-screen questionnaires that was administered. The number of pre-screen questionnaires that was administered continued until a minimum of five suitable participants was realized; the pre-screen questionnaire, in fact, produced nine subjects as stated earlier. An additional function of the pre-screen questionnaire was to provide an opportunity to analyse the responses, thus allowing for future consideration regarding refinement of the questions in the interview stage. The rationale was to

ensure a greater likelihood of saturation in the emerging development of themes, useful in the creation of theory. According to Strauss & Corbin (1998), saturation occurs when a number of conditions are met. One of these conditions is when there is no new or relevant data emerging regarding a category. Thomson (2004) further suggests "the category is well developed in terms of its properties and dimensions demonstrating variation, and the relationships among categories are well established and validated"(p. 2). Because the research design will center around grounded theory concepts, theoretical sampling can be used as "an iterative process of choosing additional cases: an initial sample is chosen, the data analysed and theories developed" (National School of Government, 2008, para. 11). Appendix D will demonstrate the nature of the questionnaire. Upon review of the initial questionnaire, nine participants, who represented all respondents, were identified as purposive candidates for the study. At the College of the North Atlantic – Qatar the participants will become English teachers instructing in an EFL environment. The participants will be Canadians who reflect rich traditions, standards, ideologies and perspectives that represent western norms, a perspective that will be predisposed to the democratic frames of reference. Socially the participants will possess a center of consciousness that fosters self-determination and individualism.

The rationale for the Canadian study group is the result of contract obligations between the College and the State of Qatar. According to the State of Qatar the instructional team must be Canadian. These considerations are of some importance because the suggestion that the EFL classroom is apolitical or value-free was an issue discussed. In fact, according to Kubota (2006), "TESOL classrooms are embedded in

and thereby seen to reflect important institutional, societal, and global discourses in subtle and nuanced ways" (p. 615). These embedded frames of reference become even more complicated considering dichotomies between learner and instructor (research subject).

### 3.4 Data Collection

In an attempt to gain meaningful data, the method of data collection must show rigor and appropriateness. The collection of data focused on triangulation techniques that ensured both reliability and validity, internally and externally. The methodology that was employed to collect data included the administration of a questionnaire to pre – screen subjects in the hope of maximizing their participation in a subsequent interview process. The participants were then asked to participate in a semi-structured interview. The interview process was further followed with a Philosophy of Adult Education Inventory (PAEI). The purpose of the administration of the inventory was to determine teaching style and what was their underlying educational philosophy. Finally, the last method of data collection involved a classroom observation. It is important to note that before data was collected approval was obtained from the Interdisciplinary Committee on Ethics in Human Research at Memorial University of Newfoundland (ICEHR #2008/09-094-ED) and the approval by the administrator at the College of the North Atlantic – Qatar.

### 3.4.1 Questionnaire

The questions for both the questionnaire and the interview were formulated to create a line of inquiry that was sensitive and unbiased. The preliminary data from the pre – screened questionnaire addressed a host of concerns. First, the questionnaire

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was used to determine the appropriateness of the subjects for the 5 question semi – structured interview. Secondly, the questionnaire allowed for finer adjustments to the 5 questions that were asked in the semi – structured interview. Finally, the preliminary data from the questionnaire was used as a subset for initial categorization for the purpose of coding. The categories were later expanded to reflect the new themes that emerged. The questionnaire was provided to a number of research subject candidates. Upon review of the answers to the questionnaire, by the researcher, the selection of candidates were identified. Once the selection process was completed the interviews began in earnest.

*3.4.2 Semi-structured Interviews*

The interviews were conducted using face-to-face interviewing and direct observational techniques. The interview subjects were assured that the interviews were anonymous. The interview process was conducted with, as Cohen, Manion, and Morrison (2000) would describe, a deliberate naiveté where the interviewer was open to new and unexpected themes. At this point issues related to power and risk was addressed in order to conform to ethical concerns. Approval was given by the Interdisciplinary Committee on Ethics in Human Research at Memorial University of Newfoundland (ICEHR reference No. 2008/09-094-ED) and the approval by the administrator at the College of the North Atlantic – Qatar. Each subject was given a consent form prior to the interview process (see Appendix E). All efforts were pursued to ensure the comfort and peace of mind of the subject. Anonymity of the subjects was ensured with the assignment of a letter and a number, H for female and R for male. The number represented the sequencing in the interview process. The College of the

North Atlantic-Qatar will be referred to as simply the college. The interview process, as Allan (2003) suggests, can produce "greater reliability... over that gathered by a list of self-completion questions in a survey" (p. 8). Allan (2003) further suggests that "in a face-to-face situation an experienced interviewer can tell whether the respondent is the appropriate person to answer the questions" (p. 8). A large amount of care was used to prevent what Allan (2003) describes as "a lack of rigour due to careless interview techniques and the introduction of bias" (p. 8). In this research the interviews were conducted in a semi-structured way "to avoid leading questions and the introduction of bias" (Allan, 2003, p. 8).

Sakui and Gates (1999) argued that interviews "allow learners to reveal beliefs which are not addressed in the questionnaire" (p. 486). Gutierrez, Hoyos, Barrios and Van der Meulen (1999) in their study of the use of semi-structured interviews suggested that the aim of the semi-structured interviews is "to capture as much as possible the subject's thinking about a particular topic or a practical task, the interviewer follows in depth the process of thinking and posing new questions after the first answers given by the subject" (para. 4). Chambers and Bax (2006) demonstrated the importance of conducting in-depth qualitative investigation and identifying factors in their context. The strategy of semi- structured interviews is widely used in language teacher research according to Mangubhai et al (2004, p. 294) as cited in Borg;

> First, this method has a long and successful tradition in teacher thinking research dating back two decades....It gives teachers the opportunities and time to detail fully and freely the bases for their approaches to teaching, without the constraints of a set schedule of invariant questions. (Borg, 2006, p. 204)

Mangubhai et al (2004, p. 294) as cited in Borg (2006, p. 204) elaborate further suggesting that the semi-structured interview allows the participants to take some ownership of the research in the sense that they develop a voice that is unrestricted and uncoerced. The discussion is largely implicit with the instructors acting as a perceptual filter. For example, Mangubhai et al (2004, p. 294) as cited in Borg state;

> Moreover, this approach allows prominence to be given to the voice of teachers rather than that of researchers, an important consideration for ensuring fidelity of accounts of practice and their rationales...Second, practical theories are considered to be largely implicit (Clark and Peterson, 1986; Gage, 1977) because they tend to build up in teachers minds in the absence of a formal process of theory construction and because teachers are rarely invited to make them explicit. (Borg, 2006, p. 204)

Even more importantly, Mangubhai et al (2004, p. 294) as cited in Borg (2006) imply that the semi-structured interview allows for a climate that fosters instructor reflection that can be enhanced with the presence of the "empathetic, supportive and nonevaluative interviewer" (p. 204).

An additional consideration is that the semi-structured interviews combine the flexibility of the unstructured, open-ended interview with the directionality of a structured interview (Schensul, Schensul, & LeCompte,1999). The semi-structured interview can play an important role in the exploratory nature of Grounded Theory (Schensul et al., 1999). Goulding (1999) suggests that totally unstructured interviews cause "confusion, incoherence, and result in meaningless data" (p. 8). The notion of totally structured interviews according to Goulding (1999) "may be merely an extension of the

researcher's expectations" (p. 8). For Goulding (1999) "the art lies therefore in finding a balance which allows the informant to feel comfortable enough to expand on their experiences, without the interviewer telling them what to say" (p. 8). This balance can be easily obtained in the semi-structured interview format. Interview guidelines have been provided in Appendix F, and have been used as framework for the interview questions constructed for this research.

To enhance construct validity and reliability, a second data source, memos from the interview and the classroom observations, as discuss later, will be used. The memos will be prepared using "active listening". The memos facilitate reorienting the researcher at a later date (Goulding, 1999). As noted in Cohen et al. (2000):

> the interview and interviewee communicate nonverbally, by facial and bodily
> expression. Something as slight as a shift in position in a chair might convey
> whether the interviewee is interested, angry, bored, agreeing, disagreeing, and so
> on... (p. 279)

Appendix G includes a sample Interview protocol document.

The interviews were digitally recorded and transcribed verbatim by the researcher. The interviews ranged from the shortest at thirty-three minutes and thirty-eight seconds to one hour and twenty-nine minutes, for a total of eight hours and twenty-six minutes of audio recordings. The transcription process produced 210 pages of transcribed interviews with a total of 73277 words. After each interview, the transcript and interview summary was sent to the instructor to check for agreement with the researcher's interpretations. When statements made in the interview appear to be unclear or a further line of inquiry was needed to be pursued, then the subject was

asked either to clarify or participate in an extended interview. If a second interview was required to enrich or saturate data sets, then all the pre-conditions from the first interview would be applied. None of the nine subjects were requested to participate in a second interview.

### 3.4.3 Philosophical Adult Education Inventory

After the semi-structured interview each instructor was provided with a modified Lorraine Zinn's Philosophy of Adult Education Inventory [PAEI]. The purpose of the inventory was to gain insight into the instructor's predispositions regarding their philosophy of adult education. Zinn (1991) proposed that adult educators teach according to educational philosophies that are deeply rooted and are generally steadfast, their teaching styles are normally closely aligned with their educational philosophies. According to Herod (2002) with reference to Zinn suggests

> educators will have one or perhaps two dominant philosophies. What is important for adult educators to recognize is that a mismatch between teaching philosophy and educational objectives can be a significant barrier to learning. For example, if an educator holds a strong humanist or progressive philosophy of education, s/he will not be comfortable in a highly pedagogical environment, nor will his/her preferred techniques suit the educational objectives. This educator may be able to use directed learning techniques when the situation calls for it, but to teach fully this way on an ongoing basis would be difficult if not impossible. (para. 5)

This third method of data collection proved useful as Chapter Five will reveal an instructor dilemma when a comparative analysis is performed between the classroom analysis, semi-structured interview and the inventory itself. Chapter Four will provide a

greater discussion regarding the nature of PAEI and resulting data and analysis. The use of the comparative from the perspective of the research was to enhance the internal validity within the research.

### 3.4.4 Classroom Observation

To increase the validity and the credibility of the data from the interview collected, and the PAEI, a follow-up classroom observation occurred in the classroom. As a result of these observations, triangulation of the collected data provided a richness of the data. The observation was designed to be non-intrusive and passive. The rationale, besides the need to enhance internal validity, was to reflect upon the accuracy of the subjects verbal statements from the interview and observe sustainability of their previous statements in the learning environment. The observational protocol entailed note taking, with both descriptive and reflective notes (i.e. notes that encapsulated the feelings experienced at the time of the observations). The data collected from the observations provided further data or reinforced previous themes that were assimilated with the previous data.

### 3.4.5 Observing and Recording Procedures

The following are suggestions provided by Sawhney and Gomez (2000) for consideration regarding interview protocol. For example, the participants were debriefed about what will happen with their interview. For example, the participants were told that the interview would be transcribed and common themes would be developed based on their responses. The participants were told that they can contact the interviewer at any time if they wished to learn more or choose to have their interview

withdrawn from the study. Contact information in the form of a business card was left with the participants.

### 3.5 Data Analysis

All of the interview sessions were recorded via digital recorder and were transcribed, as stated earlier. Along with the transcribed notes, memos field data (i.e. notes taken during the interview) were analysed for the purposes of coding. The analysis of the data was performed with some care as the researcher was flooded with textually rich data). As Douglas (2003) stated "coding for emerging concepts (from those data) is done by close scrutiny, with the intention of developing core categories that account for most of the variance in the data" (p. 48). The coding and ultimate category development allowed the researcher to generate theory. Finally, conclusions and recommendations were formulated based on the interpretation of the interviews in conjunction with data analysis. The total time frame for the research occurred within a 6 month to 12 month time frame. Within this time frame due diligence was practised. There was continuous monitoring of research methods and analyses of feedback from participants that allowed for possible revisions to the research plan.

### 3.6 Coding of Data

At the heart of grounded theory analysis is the coding process (Babchuk, 1997). It was the analysis of that data that had been obtained from the interview process and memos or notes taken during the interview that provided the necessary building block laden with themes and grounded theory analysis used a variant grounded theory approach regarding data collection codification according to Strauss and Corbin (1990). The first step included open coding, where the coding was open and unfocused.

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Spiggle (1994) describes it, as the initial stages of concept development which consists of "identifying a chunk or unit of data (a passage of text of any length) as belonging to, representing, or being an example of some more general phenomenon" (p. 493). Moghaddam, (2006) suggests "once categories are built in concept coding, they are expanded in terms of their given properties and dimensions" (p. 54). This would lead into what Strauss and Corbin (1990) defined as axial coding. Salinger, Plonka, and Precheit (2008) suggest that "relationships can be identified between the concepts described by these codes" (p. 11). Once these relationships have been identified, then selective coding can be used to create a "subset of the concepts and relationships found and formulate them into a coherent theory" (Salinger et al., 2008, p. 11).

### 3.7 Ethical Considerations

According to Cohen et al. (2000), "whatever the specific nature of their work, social researchers must take into account the effects of the research on the participants, and act in such a way to preserve their dignity as human beings" (p. 56). Sound research requires strong ethical foundations. The need to ensure that instructors who contributed data to this study did so willingly and without coercion, and that they would remain anonymous in the study was of the utmost importance. Cohen et al. (2000) suggest that "if a researcher intends to probe into the private aspects or affairs of individuals, his intentions should be made clear and explicit and informed consent should be sought from those who will be scrutinized in private contexts"(p. 61). A trusting relationship between the interviewer and the interviewee must transcend the research (Cohen et al., 2000). Facilitating a trusting relationship can be the product of informed dialogue. For example, the interviewer explained a little about themselves,

their relationship to the research and attempted to find common ground with the interviewee. As a science instructor with the college and the cohort consisting of co-workers, issues related to trust should not present a barrier to reliable and accurate data.

A number of considerations have to be reviewed. These include the notions of informed consent, risk of harm, confidentiality, and anonymity. There were explicit statements that suggested safeguards against the individual in the form of conveyed anonymity and confidentiality. Therefore, the subjects were provided with an informed consent form (Appendix C), a summary of their rights to disengage, statements of confidentiality and anonymity. There was a brief statement of risk or harm. Harm was defined as both physical and psychological. There was no harm in the physical manner as the research subject was not asked to engage in any physical actions. Emotional harm could result if there is a contravention of the subject's confidentiality. Other emotional risks were minimized as the pre-screening and interview questions were semi-structured, allowing the research subject to have a balance in power in the interviewer-interviewee relationship. If for whatever reason the research subject deemed an interview question to be high risk, they had the right to decline a response. Again this represented a degree of disengagement which the subject was fully within their right to exercise without prejudice.

It was the hope of the research that the mere nature of questions did not force the subjects, as Silverman (2005) would state, to display "ethical correctness" (p. 31). Silverman (2005) further suggests that while interviewing research subjects "there were some occasions when members overtly displayed their moral adequacy as a

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consequence of being observed" (p. 31). Again the interviewee was not faced with moral dilemmas that might foster such behaviour.

The research subjects contributed precious time in the participation of the research; conveying personal emotional data, shedding their "instructional skin" if you will. The research, as Creswell (2007) describes, should provide a return on investment. With questions asked and the participants engaged in reflective thought, reciprocity occurred. The subjects should take something away from the study, as we so often do when allowed to put ourselves in a reflective state of mind.

*3.7.1 Data Storage*

The data was electronically recorded using a digital audio recorder. The digital recordings were catalogued according to date and alphanumeric code representing the research subject and burned onto a cd audio disk as a compilation with the other recordings. All identifiable information was stored in a locked safe if in electronic form. The data was stored in a locked filing cabinet. The data was held in this secure location and will be destroyed after publication and appropriate peer review process has occurred. The written thesis does not include any names or other identifying information.

*3.7.2 Institutional Consent*

The College of the North Atlantic Qatar campus was the institution where the research took place. The institution does not have an independent ethics review committee, and accepted the recommendations of the Memorial University of Newfoundland Ethics committee. A letter of informed consent was provided by the President for approval (Appendix H).

*3.8 Summary*

This chapter has focused on the construction of knowledge using the grounded theory methodology. Within this chapter there was discussion around grounded theory principles and a rationale for the appropriateness of such a methodology and the research at hand. The chapter, as well, provided strategies for sampling, data collection, data analysis and codification required to support sound grounded theory principles and approaches.

*4.0 Introduction*

Chapter Four will include the presentation of the data of nine science instructors teaching and living in the Middle East. The following discussion will present data from participants whose personal experiences present some unique insights into the study of the EFL learner learning science. The data was collected from a number of data sets including a pre-screen questionnaire, a semi-structured open ended interview session, the completion of an adult educator philosophical inventory, and an in-class observation. The number of data sets allowed the researcher to collect rich encompassing data for the final analysis that provided strong parameters for validity and reliability.

Initially sixteen science instructors were selected to participate in the research study, based on their general experiences as science instructors in an EFL environment. An email was sent to all the potential participants (see Appendix B). The email contained two attachments a request for support from science instructors, detailing the nature of the study with full disclosure (see Appendix C), and pre-screen interview questions (see Appendix D). From these letters, nine participants expressed a willingness to participate and completed the pre-screen interview questions. Formal consent was provided with the signing of the request for support letter. The participants represent a host of perspectives with educational experiences ranging from junior adult educators with five years teaching experience to well-seasoned adult educators re-entering the teaching profession after full service of forty-two years. Collectively the

participants represent decades of teaching styles and countless hours of facilitating varied learning styles from a plenitude of learners.

The data was clustered based on data collection methods and the themes that each method evokes via a codification process. The collection methods provided a reasonable division of this chapter into three sections with particular attention to the semi-structured interview and the responses that were provided. Initially the data from the pre-screen interview will be put forth allowing a general profile of the participants to be revealed. Characterizations by the participants themselves will act as a mirror reflecting individual self perceptions.

### 4.1 The Research Setting

The College of the North Atlantic was the setting for the research. The College offers Canadian curriculum with expertise from industry experts educating within four program areas: Engineering, Health Science, Information Technology and Business Studies. A requirement for the hiring of instructional staff was that the instructors would be Canadian citizens, and therefore referred to as Canadian hires. Research data was collected from instructors that were primarily associated with the program areas of engineering and health sciences. The interviews and classroom observations were conducted from two of the college's twenty buildings, buildings 5 and 12.

### 4.2 The Pre-screen Interview Questionnaire

The Pre-screen Interview questionnaire (Appendix D) was an opportunity to determine the background of each research subject in an attempt to saturate the sample, since the sample size was small. The questions on the pre-screen interview questionnaire were an opportunity to profile the research subject in the context of the

EFL environment. There were four questions asked in the pre-screen questionnaire; briefly describe your role as a science instructor in an EFL learning environment. Consider what stage your students were at, upon entry into the program. Briefly describe the learner's profile for your courses. The second question of the pre-screen questionnaire was supplemented with a student profile checklist that allowed the research subjects to respond in a concise manner (Appendix D). Do you think conversational English language or small talk represents a comprehensive grasp of the language? How do you make learning comprehensible?

The pre-screen questionnaire was an opportunity for the researcher to gain some awareness of the research subject's understanding about the learning environment, learner's needs and the relationship to the learner in a science rich language environment. But most importantly the pre-screen interview was an opportunity to gain some insights into the science instructors teaching strategies.

### 4.3 The Semi-structured Interview

#### 4.3.1 Question One

*Is total immersion the best approach to science literacy in an EFL environment?*

The first question that was posed to the nine participants related to the instructional language of the learner and the implication for science literacy in an EFL environment. The importance of such a question can truly be appreciated with some reflection on the interview transcripts. For example, if one considers as one mode of instruction as that from the didactical perspective and the average class representing 50 minutes of discussion, based on the word count from the interview transcripts an equivalent amount of elapsed time, the word count averaged 6738 words. Arguably this

textbooks, instructor's notes and institutional media is written or communicated in English.

After analysis of the nine transcripts for each response to this question, a pattern of common themes came to the forefront. The themes included; merits of the three language acquisition models, Arabic language usage as a strategy for learning science concepts in English, validation concerns when Arabic is used in the classroom, and finally English as a global language and the implication for the Arabic learner. The responses to question one will be examined from these four themes and section 4.3.1 will be divided into four subsections to reflect this.

*4.3.1.1 the merits of the three language acquisition models.*

Chapter Two has provided the merits of all three language acquisition models; therefore the following discussion will focus on the instructors' perspective. Initially when question one was asked, *Is total immersion the best approach to science literacy in an EFL environment?* Six out of the nine instructors felt that total immersion in the context implied from this research was not the best model for language acquisition in conjunction with science concept acquisition. The one instructor (R2) who supported the total immersion model did so, because he felt that he "had no experience with the other two". The notion that the other two models would work provided that "all teachers were completely bilingual" and in his opinion he doesn't "think that is a practical" was the strongest reason for rejecting the other two models and accepting the total immersion model.

A second instructor (R3) suggested that total immersion is best considering the "purity of the language." This was a significant concern for R3 considering the precise nature of the science language. R3 drew parallels to the Quran in that:

> The Quran is always in Arabic, it is never translated into other languages. Why? Because there is a certain purity of the language. They want the meaning not to be changed when it goes into other languages. I think there something like that in scientific terms. Scientific terms are defined usually pretty precisely and learning the language is probably the best way to do it.

Such thoughts would express concerns about concepts and specific language usage being lost in translation, concepts that are core to a particular realm of science. Al-Hassnawi (2007) and Nida (1964, p. 223) suggest that "while coinage, borrowing, transliteration and other means of transfer made for a bulk of English scientific terminology, translating of full technical texts from English into Arabic still poses a major intellectual challenge" (para.1).

Another instructor [H1] further provided evidence that language translation is problematic in that as an exercise she will frequently ask the students to go to Google and translate English to Arabic and then get them to translate back what Google has provided in Arabic as a translation to English. She recounts that the 'translation has lost the plot by the time I get the second translation'. Swan and Smith (2001) indicate that there are large differences between English and Arabic and suggests 'the acquisition of vocabulary is particularly difficult for Arab learners. They have virtually no positive transfer: only a minimal number of words in English are borrowed from Arabic" (p. 209).

Odin (1989) suggests that "language distance or the degree of similarity between two languages" (p. 32) can play an important role in the success transference of language meaning in one language to another language. The closer the language distance the more likely the ability to transfer ideas and meaning to the other language. The language difference between Arabic and English can be considered substantial from a number of perspectives. Catford (1965, p. 20) and Ordudari (2008, para. 3) suggest that, "translation is the replacement of textual material in one language by equivalent textual material in another language". This statement by Catford (2008) would suggest that the requirement for equivalent textual material, although the notion of 'equivalent' is not completely qualified, would to some degree necessitate or suggest similar language. The notion of similar languages can be seen in the Latin languages and the daughter languages attributed to Latin. For example, French and Spanish would have equivalent text in that there are many cognates or the two languages have a small language differences. H1 further contends that the total immersion model is problematic considering that the Arabic and English do not even have a shared alphabet.

R3 further clarified his position on the total immersion with the suggestion that such a placement would be better facilitated if suitable learners were placed in English immersion "provided that the students have a working knowledge of English before they get there [Academic classroom]."

With the above considerations this may lend support to the suggestion by another instructor (R6), an Arabic instructor, that thinking in Arabic and thinking in English can represent two distinct processes. This instructor suggests that:

I think in the social models, I think in Arabic, but in the science I think only in English...If I read a translated book on chemistry in Arabic, I don't understand.

Other instructors, like H2, suggest that total immersion places the students at a disadvantage considering the specific nature of the words that are being communicated to the students, terminology that is scientifically based. For instance, H2 recounts a classroom experience where the discussion was centered around gravity. Some of the students were aware of this term, however, a significant number were not sure what this word represented in terms of a concept. It was only through the suggestion of another knowledgeable student acting as an intermediary for his fellow classmates, and acting as a translator, who when he spoke in Arabic the equivalent for gravity became clear for the other students. H2 suggested that if the concept became instantly understandable as a result of the intervention of the stronger bilingual student, then this presented further evidence that total immersion does not work well with all types of students. Experts in the field, such as Ovando and Collier (1985), who have written extensively regarding this same topic and seem to hold similar views regarding students using native language to communicate complex ideas and to clarify misunderstandings and promote science comprehension. Luke (2006; Brooks, McGlone, & Donato, 1997; Donato, 1994; Platt & Brooks, 1994) would suggest "learners often use their native language to manage difficult tasks, direct and monitor their learning efforts, and interact with peers in collaborative ventures" (p. 74). Luke (2006) further submits that use of the native language allows the students to understand complex, and at times abstract principles and concepts.

Finally, Luke (2006) warns that "by mandating and providing only the target language, instructors might inadvertently deprive their students of valuable linguistic resources and tools" (p. 74). Zehler (1994) learning is a constructive process that "involves building meaning not only from the words on the page but also from one's related background knowledge" (p. 3). In fact, Zehler (1994) suggests that the learner's experiences are considered uncommon or not in the mainstream and "will often need additional explanations and examples to draw the connection between new material and their existing knowledge bases" (p. 3). The learners represented in this study reflect non-mainstream learners of a curriculum designed and created for the native English learner in Canada, and may be using their native language to create the connections or relevance that makes the learning contextual. Allowing and respecting the usage student's native language is a vital element to responsive instruction (Cummins, 1999; De Houwer, 1999; Echevarria & Graves, 2003). But this may even go further than just simple clarification and relevance. Goodlad (1999) when discussing school children, makes a valid point that transcends the immediate context of his discussion and pertains to the adult learner in any environment: "Why is it that children can't talk to other children, except in the playground or outside? Why is it that the teacher out-talks children in the classroom? Why is the dialogue teacher-to-child or child-to-teacher never child-to-child-to-child?" (p. 9). His questions are very much relevant for this research because they speak to the desirability of learner-centered learning environments that allow learners to personalize their learning and create individual relevancies.

Further to this point Jin and Wang (2008) encapsulate the importance of learner interactions in learning environments as expressed in the following quote:

> Interaction is an important word for language teachers. In the era of communicative language teaching, interaction is, in fact, the heart of communication; it is what communication is all about. We send messages; we receive them; we interpret them in a context; we negotiate meanings; and we collaborate to accomplish certain purposes. And after several decades of research on teaching and learning languages, we have discovered that the best way to learn to interact is through interaction itself. (p. 16)

Jin and Wang (2008) contend that these principles are the "stones for structuring a theory of interaction in the language classroom" (p. 16).

When H3 reflected on question #1, she suggested that while the total immersion was acceptable for very high achieving students, the college's use of the immersion model has created negative consequences for the EFL learner: "We lose that bulk of students that do not have good backgrounds, do not have strong language skills, and are a little bit fearful and shy." H3 likened the EFL learner to the non-traditional learner, who, if placed in an environment that is antagonistic could experience frustration, avoidance strategies, and resentment. Therefore, H3 suggested that the two-way bilingual model would provide an environment that would 'ease them into' a transition from Arabic to English while allowing them to obtain important science competencies. However, to ensure that the final outcome for the Arabic learner is to be proficient in English language, there should be a greater inculcation into the English language.

When H3 was asked if there should be equal co-instruction between Arabic and English, the following response was elicited:

I mean we are supposed to inculcate them into the English language. So the instruction, they do have to do English speaking exams, they do and have to graduate and be capable of working in an English environment. So we need to prepare them for that path. But I think the path that gets them there should not be total English immersion because I think it really does miss out on a large proportion of students whose language skills are not strong, whose science skills are not strong, whose study skills are not strong and what we are doing is catering to the students who come in with good science backgrounds, good language skills…

Further to this, H3 suggests that allowing the second language to be a part of the learning can accomplish many learning goals including:

• the flexible usage of native language and English allows for linguistic bridges; to be created, allowing for quicker science concept acquisition;

• a safer learning environment that lowers the anxiety associated with linguistic challenges while allowing for the transmission of science concepts. A language 'safety zone';

• acknowledges the value of their native language and signifies a respect for their language; and lastly,

• the ability to cater to the weaker learner where the pressure created as a result of linguistic challenges can alleviate science concept acquisition stressors.

R3 endorses H3 beliefs suggesting that "there has to be some understanding that it [English] is a foreign language for the students and should allow for some flexibility". He [R3] suggests that this flexibility in native language usage would be a pre-cursor to the total immersion model. R4 further reiterated the notion of quicker science acquisition through the usage of native language and suggests that Arabic could be used to 'grease the wheel' when a topic seems impassable, Arabic could be used to overcome the impasse. R4, concurs with H3 in believing that, as the impasse is overcome, the instruction should revert back to English Instruction. R1 expresses a similar sentiment regarding the Arabic learner and the use of Arabic as a bridging strategy in the clarification of science concepts. However, R1 is clear in that out of necessity in this culture and in the institution, instruction must be in English as mandated by the College and the State of Qatar. R1 sees his role as being dual in nature, fostering science literacy in English and as a result fostering in the student a good command of the English language in its context. But again R1 qualifies his comments with the following statement;

> I think there are times within the classroom where it is necessary for an exchange in the Arabic language. If in fact you are trying to teach a particular concept and because of limits of our language, we find it difficult to explain a particular concept to the students, sometimes I think it is necessary for students to interact amongst themselves as a way of explaining a particular concept to their classmates.

The response provided by R5 suggested that he was in favour of total immersion, but that this model ideally would be suited to an institution that was primarily focused on

the learning of language. However, R5 felt it was important to allow cooperative learning among students with Arabic as the language that would facilitate science learning.

Finally, R6 suggested a more structured transitional bilingual approach would be more appropriate. For example, the first year student would use Arabic instruction in the core science concepts, and the next semester the English to Arabic instruction would be at a ratio of 50:50, in the third year 75:25 English: Arabic language ratio all while learning science. In essence, what R6 was suggesting was a slow migration in the language while maintaining science learning regardless of the language used. R6 further discusses the need for this slow migration with further consideration given to the greater complexities of the learning environment that mitigate such a transition. R6 suggests:

> Between them, you know, bring in students weak in science, weak in math, weak in English, giving them these difficult courses, even in Arabic, it is difficult. So you need some time until they adopt themselves in the environment with language you know, when they feel confident. This slow migration would allow the students to meet the linguistic goal of English fluency with the reinforcement of science learning in both languages while taking a holistic approach to the learning and the learner.

In summary, three instructors felt the total immersion model was considered a logical language model for instruction primarily because of the preciseness of the science language and fears that the usage of Arabic would create imprecise science concepts learning. However, the remaining instructors felt that the use of native

language [Arabic] was important and in some cases a necessity for complex science concepts. The literature appears to support this position of the native language as a bridging mechanism for concept formation between Arabic and English. Many of the instructors felt that the total immersion model was a fit for students with high second language skills, but for learners with lower language proficiencies, the use of Arabic would be a mitigating factor for science literacy to occur. This notion of dual language would support bilingual models of instruction that favours two-way instruction or the transitional bilingual model.

### 4.3.1.2 Arabic language usage as a strategy for learning science concepts in English.

The usage of Arabic or the notion of linguistic duality emerged early as a theme in the interviews, so a secondary question was asked regarding this dual linguistic approach to instruction. How do you feel about co-instruction in both languages?

The responses suggested that this would more than likely create a number of difficulties such as; lack of institutional support as the result of increasing operational costs resulting from the instructional overlap. Three of the instructors suggested that having a bilingual instructor would be one solution. But two of the instructors felt that there would be more emphasis on language instruction and the instruction of science or the technical knowledge would be adversely affected. Similar concerns raised the prospect that depth of science knowledge would be sacrificed as a credential for instruction in favour of the language credentials that would be possessed by a bilingual instructor as a requirement for the instructional position.

Other concerns raised regarding co-instruction was the likelihood of heterogeneous instructional methodologies that could possibly foster more conflict than cooperation. Some reasons cited for such concerns centered on cultural, and socio-political considerations.

Interestingly, of the suggested approaches to a dual linguistic approach, the majority of the instructors felt favourably disposed to having a student(s) acting as the mediator, in effect acting as an Arabic/English translator. What is even more interesting is that this student was typically strong in both language and science knowledge. The majority of instructors stated to varying degrees that Arabic language intervention is a useful learning strategy and in many cases this interaction occurs at the student level, having a strong academic/linguistic student in some sense acting in a cooperative mode with the instructor as an aid would be very well accepted by instructors. The research would go further to suggest that this type of student could be considered the 'silent instructor', filling a large role in the complex EFL learning environment, bridging the conceptual divides resulting from language and the science concepts that are being transmitted.

Of the nine instructors interviewed, five suggested that as the students progress from the lower course offerings in their programs to the higher course offerings, the reliance on Arabic diminishes with the greatest reliance occurring largely in the foundational course offerings within a program area. In many cases students pursuing EFL studies in their last offerings, EFL1080 or EFL1090, may be concurrently engaged in English science courses like biology, chemistry and physics. This holds true for the foundational math offering as well. The native language learner's reliance on Arabic

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transitioning to reliance on English may seem like a natural progression for the early student program entrants, to the point where, regardless of the language acquisition model formally engaged, some learners will pursue a transitional language approach to their own learning. Initially this would be a realistic learning goal for the EFL learner. It would perhaps be more about a coping strategy to create a comfort zone in a foreign environment. All the instructors agreed that the final outcome has to be a greater than functional usage of English, which would include full science literacy entailing appropriate usage of science terminology.

In summary, the instructors interviewed felt that the dual instruction to facilitate a bilingual language model would be problematic. Instead the role of filling language needs in the classroom could be adequately filled with students that have strong language and science skills, acting as 'silent instructors'. The research findings suggest that the learner, regardless of the language model used, will revert back to Arabic in an attempt to navigate a host of science concept difficulties. As well, this reversion to the native language [Arabic] is encountered less often as learners advance in their program of studies.

*4.3.1.3 validation concerns when Arabic is used in the classroom.*

Throughout the nine interviews, a recurrent theme within the interviews was the benefit of stronger students, bridging both language and science concept gaps while active instruction was being engaged. As a result of this emerging theme, one probative question became apparent; if this activity is critical for some students in the EFL program, especially early in their programs, then how does the instructor ensure the validity and reliability of the information being conveyed from one student to another

student? Keeping in mind the precise nature of some of the science concepts being conveyed, the usage of inaccurate language may not suffice. So the question is how does the instructor ensure what is being transmitted is accurate? R3, when asked how you would validate information conveyed in Arabic, suggests that this could be difficult. However, one method would be the direct approach in that the instructor would simply ask the recipient student to explain back in English to the instructor what had been conveyed in Arabic. R1 suggests that validation can result from "body language, the expression in the face" as well as asking the students poignant questions such as "do you really understand this", and "would you mind explaining it to me now". R1 feels quite often that the responses provided will determine the effectiveness of the translation in a particular learning exchange. Validation of concepts as reflected by R1 and R3 was agreed by all the instructors to occur as a result of the usage of probative questions that would produce points of clarification or the observance of the learner's body language.

*4.3.1.4 English a global language and the implication for the Arabic learner.*

This research has provided some rationale for the importance of English and its role as a global language. This theme emerged with many of the research subjects. For example; H1 when asked if we should focus energy ensuring that students speak science in English and not science in Arabic. She commented on the fact that it is fine in the educational institutional environment to use Arabic as a bridging language, however in the real world, English is the dominant language, especially in a multilingual country like Qatar. H1 further discusses the predominance of English by stating;

Once you move beyond the classroom, when they get into the workplace,

They're not just working with Qataris speaking Arabic, they are working with

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Westerners, they're working with Indians, they're working with Asians, in fact they are working with multiple nationalities. So for me it is a no go, you have to have English somewhere in the equation.

H3 suggests that "they have to be capable of working in an English environment". According to Redmann (2002), "English spans the divide between people and cultures. It is not owned by Britain and America: now it belongs to everyone" (p. 45) and in fact Redmann (2002), quoting Lord Alan Watson, further surmises that 'English has become the working language of the global village' ( p. 45). The notion of English as a global language resonates with R3 as he describes the modern reality of English as the lingua franca. According to the Department for General Assembly and Conference Management (DGACM, 2010), the need to avoid becoming the 'Tower of Babel' requires common languages to be used for the ease of communication. Two languages; French and English are used as working languages in the Secretariat. Global Envision (2004) suggests that;

> The English language has unmistakably achieved status as the world's lingua franca through globalization. English is now the official or dominant language for two billion people in at least 75 countries. According to the British Council, speakers of English as a second language probably outnumber those who speak it as a first language, and around 750 million people are believed to speak English as a foreign language. English is the most common language to communicate scientific, technological, academic, and international trade information, English is clearly the world's lingua franca. (para. 3)

R6, when asked if the science should be taught in Arabic, replied,

No, no because you see here, the market is or, is to think in English. And in this day, in education, health and everything is in English. They are not, I mean, I don't think they will be productive in Arabic, you know just learning Arabic. The development and everything most of the workers here ex-pats non-Arabic.

The significance of the previous discussion is that a number of instructors in the support of a bilingual model have unequivocally stated that, the final outcome of the learning must be to learn English while learning science. The suggestion is that even though the Arab language can be used to facilitate the transition of the learning from Arabic to English, in the end considering the global significance of the English and the science collectively, H1 further adds that English is an international language, in fact, to a large extent the language of science is moving towards English. Therefore, "English has to be in the equation". R1 reminds us of the mandate of the college: to provide the skills of science and the students have to develop a good command of the English language.

In summary, all the instructors feel strongly that the ultimate outcome for the learner is the attainment of high English language competencies with strong science literacy skills. The instructors belief that the Arabic language can act as an intermediary strategy or bridging strategy for fulfilling science conceptualization, however in the end, both science literacy and English as the functional outcome of the learning.

*4.3.2 Question Two*

*Is the North American model of teaching/learning science appropriate in this*

*Middle Eastern environment?*

The question in itself was presumptuous in that an assumption was made that there is a difference in the North American model of teaching as compared to the Middle Eastern model of teaching/learning. The question is open ended in the sense that the researcher was interested in the interpretations and perspectives of instructors regarding their teaching philosophies and whether there had been any consideration given to the teaching environment and the sensitivities that the environment produces. These foundational presumptions could play an important role in the development of teaching strategies that would foster science literacy in an EFL environment. This understanding would place the learning in context considering, possibly, the diversity in learning/teaching environments. It is of the opinion of the researcher that teaching strategy(s) is formulated based on a number of considerations; understanding the learning environment, the nature of the learner, what you understand your role in the broader sense in relation to all extraneous variables.

Once this educational awareness is realized, then one can develop a strategy; a strategy that will encompass and meet the diverse needs of many learners. Franzoni and Assar (2009), Ford and Chen (2001) suggest that educational systems tend to ignore the diversity and the uniqueness of the individual learner where there is variety among learning styles, learning ability, educational backgrounds, and learning goals. Franzoni and Assar (2009) and Rose (1998) further suggest that if the teaching style used closely resembles the student's 'preferred' learning style, then the learning

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becomes more natural, and student performance increases with reduced learning times. Therefore, if careful considerations are not given to the learner characteristics and styles of learning, then teaching strategies will not have the global learning effect. Instead, only a few learners whose unique learning styles closely match the instructional strategies will be benefactors of the attempted learning event.

Instructors were asked to explain or reflect on the concept of North American teaching model as opposed to a Middle Eastern model. To provide some guidance, the instructors were further asked probative questions to initiate their reflection regarding this topic. For example; do we represent the Western Model of education? Is there a difference between Western and Middle Eastern Models? If there is, what would you define as the biggest difference between a Western or North American and Middle Eastern Model? But first the term "Western" should be qualified.

From the North American frame of reference, Western, would embody pedagogies, strategies, practices, adopted to encourage freedom of thoughts and expressions that are many times individualized, it represents critical thinking and reflection emphasizing higher order cognitive skills, rigor and accuracy in statements and thought, facilitation of autonomous learning to varying degrees. The Western model is holistic in that the learning for the student is not all academics but there is an extended focus on life skills such as leadership skills, personal health and wellness, activities that foster self-esteem and personal worth. The Western model, as well, inherently provides for the continuity of culture and societal values reflecting Judaeo-Christian values.

The notion of a Western model resonates within the research. Recent literature has suggested that there is an unequivocal presence of the western model of teaching around the globe. Spring (2004) suggests that "for better or worse, Western models of the nation-state and schooling now dominate global discussions of education" (p. 2). Spring (2004) further states that "Western-style schooling is now so universally accepted that few can imagine alternative models"(p. 2). This point is of some interest as the research participants provide some interesting insights into what constitutes a Western model and a comparative to the prior model that the learners may have been exposed to prior to entering the college.

*4.3.2.1 Orders of Learning.*

In responding to question two; Is the North American model of teaching /learning science appropriate in this Middle Eastern environment? The instructor's responses generated a number of themes. The largest response provided by all nine instructors interviewed related to the application of Bloom's Taxonomy and the implication this has on the educational learning objectives and/or goals. Most instructors suggest that the largest difference between the North American Model and the Middle Eastern model was the attainment of lower ordered objectives in the Middle Eastern learning environment. Seven of the nine instructors felt that the Middle Eastern model for learning would represent the lower orders of learning from Bloom's taxonomy. This would equate to the lower levels of knowledge and comprehension. H1, when asked is there a difference between the Western Model in comparison to the Middle Eastern Model, indicated that there is:

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the North American or Western model, I do think it is very different than the model these students are brought through their lower education grade school or high school here in the Middle East.

Continuing on with this response, H1 suggests that there is a noticeable difference in the method of learning in that learning in the Middle Eastern model is mostly in the lower cognitive tasks, namely rote learning. H1 suggests that they are told to "open a book and you memorize it", adding that all future tested material would be those questions memorized, including sequential problem solving strategies. Sequential problem solving is a method for solving most problems requiring the memorization of steps in a problem as though to create a generic approach to all problems in the future. Solving problems that fit this level of learning has more to do with learning a process than it does with higher levels of learning that require analysis, synthesis, and evaluation. However, the method of learning or the memorization of steps can be exhaustive to the learner if the problem is slightly modified. Nonetheless, H1 would argue that "they have an amazing ability to memorize verbatim something". This sentiment may reflect the traditional Islamic education that teaches children to memorize the Qur'an from ages 7 to 9 (Anderson, nd). Anderson (nd) citing Imam Yusuf states that the practice of memorization "...develops a memory in a child that will surpass others in any other school" (para. 9). The idea according to Imam [religious leader] Yusuf (Anderson, nd) " is to empower a child with the ability to absorb information, as a good deal of reading is based on that ability" (para. 9). The source for this information is not peer reviewed, but nonetheless, these statements would reflect a reality important to understanding the motivations and rationalizations for some

educational philosophies. These are statements that cannot be ignored for they represent articulated statements from an authority on Islamic education.

Again, H1 adds "that does come from the religious aspect of it, you know, memorize the Quran. You know it off by heart and it is typically what are Arab students are used to" and the learner is "told to open a book and you memorize it". R1 suggests that the learning is less systematic than previously discussed, as questions that are discussed throughout the semester are the same questions that are provided to the students on a test or final exam. H3 further adds that the learner comes in with stronger "regurgitation backgrounds, not so much the analytical skills that we need to prepare students for". R2 felt strongly that this was the largest deviation between the North American model and the Middle Eastern model of learning. R2 believes that "the North American method is better for teaching science. You have lecturing and laboratory work". The suggestion is that the labs would extend the comprehension to application.

With regards to memorization, R3 suggested that it has some merit and is, in fact, in some cases a necessity for the delivery of introductory courses. However, R5 expresses some concern or reservations regarding memorization of knowledge, factual information as opposed to inquiry type learning or the application of information, and problem solving. R5 went on to further elaborate that if the previously covered material is not presented in an identical manner on an exam for example, or is not identical to a previous question then the question is perceived by the student as a dissimilar question and in some aspects is unfamiliar. Such statements suggest that if the questions are worded in a different manner to promote critical thinking then the outcome can result in

confusion for the learner. In fact, the need for such visual cues in sentence structure where wording is the same and ideas are expressed in the same manner, as though questions are mirrored from previous worked examples, may result in more language difficulties than the content specific nature of a question. R6 suggests that this mirroring of examples includes the memorization of calculations, even the expressions and becomes more about memorizing a process than a deeper understanding of the content conceptualizations. In fact, Wagie and Fox (2005) have emphasized that given the new global realities and considering the Arab learner, "education needs to change from rote memorization to critical thinking, creativity, and independent learning" (p. 279).

This idea of critical thinking was, naturally a point of discussion among most of the instructors. In fact it was equally discussant within any discussion regarding rote memorization. It was this dichotomy of learning that most instructors felt was the greatest difference between the Middle Eastern model and the North American model. When R3 was asked if he encourages critical thinking or inquiry based learning strategies with the learner, R3 responded that he does not see the students as critical thinkers; "they accept whatever comes from the front", suggesting a didactic learning style. H2 suggested that the teaching is more about "demonstration techniques as opposed to explaining". The explaining is important as this provides theoretical frameworks, but H2 would suggest that the demonstration techniques seem to play a larger role in the Middle Eastern environment. Upon further reflection H1 provided a further commentary in which she suggests that the Middle Eastern to the Western Model, stand in contrast. H1 indicates that;

I think from an earlier age you [the western learner] are asked these probative questions. So that by the time that you get to be an adult learner you have already learned the techniques. You have already started to ask the secondary questions. You have started asking how does this apply to me, how does this apply to my life, where would I see this. And that is very much lacking in our Middle Eastern student. Specifically from those who are taught in the state of Qatar I find.

H1 further adds that "they do not do a lot of inductive and deductive thinking". The points raised by H1 would suggests that the learning in the Western Model would foster the personal reflection and learner relevancy in that the learning has to fit in with the learner's world perspective and the life they live; it has to be real for them fostering lifelong learning. This would make the learning more individualized, suiting the needs of the individual learner. But for many educators trained in Western institutions, this has become a well entrenched tenet of the adult learner.

R5 contended that the North American style of learning is based on an inquiry based learning approach, an understanding of concepts to the point that you take that information to new situations. R5 suggested that when students are asked to take an inquiry based learning approach, and once they embrace this approach, they find the learning becomes more satisfying. In balancing this point H1 suggested that many of the students [Arab learners] have made comments reflecting some of the study's affirmation of a different pedagogy; "you are the first teacher who has ever explained why that happens that way. We were always told that this is how it happens and that is it, no explanation."

H1 reiterates that:

> If there's no explanation students cannot learn to apply and they cannot think of it
> in new and different ways. So for some students they have said that this is the
> first environment where they were given the explanation.

Such learning processes suggest a higher order of critical thinking and analysis in the
learning environment which in some regard reflect a new reality in the 21st century.
Wagie and Fox (2005), with discussion regarding the Arab learner reinforce the
importance of critical thinking and the relevance to the 21st century learner with the
following statement;

> They [the Arab learner] need to be critical thinkers, creative problem solvers, and
> self learners ready to continue a process of lifelong learning, so they can respond
> to rapid changes in technology and business and be competitive in the new
> economy. (p. 283)

Further to this H1 made an interesting comment that the North American learner
is more reliant on relevancy-oriented learning. For example, Lieb (1991) indicates in
context to the North American learner that the adult learner is relevancy-oriented and
they must know why they are learning something. Lieb (1991), further contends that the
learning is more than a rational action, but the "learning has to be applicable to their
work or other responsibilities to be of value to them"(para. 5). The research suggests
that this need for relevancy, if it is there for the Qatari learner, is not being expressed in
an overt way. Unfortunately the data does not shed further light on the topic of
relevancy-oriented learning with respect to the Middle Eastern learner. But undoubtedly,
this would be a future point of discussion and research. Are the learners different or are

their expectations or assumption about learning different than those in the Western learning environment?

In summary the previous discussion would raise some obvious questions regarding the relationship between science literacy and the EFL learning environment within the Middle Eastern context. The instructors interviewed are clear in their agreement that rote memorization is not the preferred learning pathway for the learner. But the challenge is to create an environment that fosters inquiry-based learning instilling critical thinking, while reducing reliance on didactical approaches that in many cases cater to rote memorization dispositions. However, analysis of data collected from other sources provides an interesting comparative to what has been described as the North American model of teaching and learning. Other analysis from the Philosophy of Adult Education Inventory (PAEI) and the subsequent classroom observation would provide evidence in contradiction of the personal interviews. The review of this data will follow in the upcoming section of Chapter Four.

### 4.3.3 Question Three

*Are the current modes of teaching/instruction optimizing students chances of*

*success for science literacy?*

Question three was designed to gain some insights into the instructors' perceptions of the modes of instruction employed in their EFL learning environment. Modes of teaching are probably one of the most visible dimensions of the instructor-learning interactions in the learning environment. The 'hows' of what we do when we instruct is an important piece of the larger picture of meeting the needs of the learner. We need to know whether one mode is more effective than another, or

whether a combination of modes would produce the greatest return from the learning event. Specifically, in context of this study and the nature of the learner; we need to understand if there is a mode that is better suited to increasing chances of science literacy for the EFL learner. The most dominant theme provided by instructors suggested that adaptation and flexibility were key elements in the approach to science literacy in an EFL environment. For example, H2 suggests that being flexible in the mode of instruction is important as long as it is student centered. H3 suggested this,

> I think if you can be flexible as you can in a classroom as best as you can in your timeframe you will reach more students.

H3 adds to this

> I think if you can use multiple number of methods which involves getting the students involved, getting them writing, getting them to draw pictures... Tap into more learning methodologies for the student and also repetition is important with learning. But not repeating it over and over again by saying it over. Repetition by learning it in many different ways is the key to learning.

H3 states that perhaps the best approach to the mode of instruction in the EFL environment requires one to "use every bag of tricks" coupled with a wide range of educational philosophies. R2 suggests that the idea of flexibility in the modes of instruction is important. R5 reaffirmed previous beliefs that flexibility in modes is the best approach stating; "I think the word that comes to mind is simply a variety of approaches". This would reflect similar sentiments expressed by R6, "I don't like one mode, you know I would make a variety, I myself".

The research presented the notion of flexibility and adaptation as a predominant theme. Yet, when asked to identify which mode they would choose if they could choose only one, four of the instructors strongly identified modes that were student-centered and collaborative in nature. H2 suggested that she uses a lot of group learning and states

> I always tell them they will learn more from their friends then they will learn from me...So I think the group dynamics work, really works well just because again of the language. If one person cannot understand the English words, then they have a friend to tell them the translation.

H3 suggests that some modes allow for the native language usage and can facilitate the learning faster. Speaking of student-centered learning and becoming adaptable in the learning environment, H3, discussing a group learning environment, poses the question; "why would I make them speak English when they are discussing amongst themselves". Upon self reflection H3 suggests;

> If I was in a classroom with English speaking people learning something in a different language I would immediately default to my native language. Of course I would. That's my comfort zone. At that point they're not answering a test, they are working with each other. Why wouldn't they speak in their own language, and I would respect that."

R3 further adds that instruction should encourage collaborative learning and that flexibility in the EFL environment is truly important. H3 again suggests that "use whatever tool is necessary in the classroom to get it". H1 points out that some modes can act as learning bridges allowing the students to engage in meaningful discussion

and classroom debate. This would create a learning environment that focuses on learning potentially core science concepts with few inhibitions and feelings of an open and respectful learning environment in which the learner dictates the learning and to some degree makes the learning more personal, more individualized. The learning would take on a more balanced approach allowing native language usage and English to facilitate the learning of science as the student deems appropriate. What this would suggest is that modes of instruction that allow students to express themselves and explore the world around them in a manner they deem suitable should be encouraged and to some extent facilitated by the instructor. The instructor should remember that teacher centered modes of instruction, for example, direct learning modes may not be the most effective ways to optimize student's chances of success for science literacy in an EFL environment.

Modes of teaching may mirror the instructor's teaching and learning philosophies, and represent a window into the core ideals that represent the instructor's teaching/learning environment. In an ideal world this would appear to be an accurate statement. However, the study provides the observer with a snapshot and a reminder of the complex nature and the fluidity of the learning environment. In some respects the research describes the dilemmas and compromises that arise to facilitate a learning event. From the perspective of the research, what impact, if any, does this have in this learning environment and on the science literacy? This question seemed to elicit the greatest challenge for many of the instructors.

The instructors expressed mixed emotions in their responses to this particular question. The researcher generally sensed that there was a learning reality and learning

philosophical divide between "learning reality" and "learning philosophy". In that, many instructors are dealing with the realities that were present in the learning environment and in many cases this would be in conflict with what they themselves deemed as more effective learning practices. The following data will reflect this internal battle and the task of many of the instructors in their attempt to meet the learning needs of the EFL learner in a science context. Therefore, the nature of this question as it relates to modes of instruction is another critical point of discussion as the modes meet the needs of the learner.

Previous discussions suggested that a majority of the instructors feel that student centered learning and modes of instruction like collaborative or problem-based learning for example, would be a desired path in the classroom. However, many instructors also realize that their philosophical point of view and the reality before them are at times in conflict. For example, H1 when asked if she feels that the learning environment forces her to stay with one mode of instruction stated, "Yes sometimes it does" with reference to course outlines. But H1 Further adds that

> I think the other thing that restrains us is time and we are expected to teach the same volume that you would speak or teach to a native speaking English learner. H1 suggests that these external factors in many cases force the instructor to forget different modes and resign themselves to "nope, I just have to get through this."

Countering this point H3 suggests that;

> I think the worst thing to do is the lecture-listening mode. And I think it's done too often, not only too often here, it's done too often in general. And it is a quick and

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easy way to get through the curriculum without being concerned about how the students are learning.

R1, supporting H3, suggests that sometimes it is easier to teach using direct instruction because the communication issues surrounding language in many cases are eliminated in the sense that unidirectional communication does not allow for many language issues to surface. R5 describes his mode of instruction right now as teacher-centered and "it is very difficult to break away from that when you have been used to that sort of method for such a long time". R5 rationalizes that he is "honestly trying to get them more involved" and to some extent distance himself from the direct instruction mode. R4 expresses similar concerns stating;

You know you are given a tremendous course description that assumes you have absolutely no problems in language or culture with the students in front of you. It is a lot of our trying to finish the curriculum so it is put in it every animated mode and you have to keep the ball rolling in terms of that. So, you know, I would love to do other things but you have to for some things, you have to have a little more flexibility in the curriculum.

R4 further extends the discussion to say "modes are dictated by, high stress to finish curriculum, common exams," and "it takes a lot of time to do things a lot differently". The stress of external factors like time and course curriculum again are ideas and concerns that R2 brings to the discussion as well, stating "I'm flexible, but I am straight jacketed by the amount of material and the time constraints". R1 suggests using different modes

requires a greater effort. I do not think that we are being as efficient in terms of the learning here. I find quite frankly that there is not enough time to teach the concepts many ways because we have to move on.

R1 further adds "so that has been a source of frustration quite frankly for me." R3 in describing the factor of time constraints suggest that

There is no doubt that time is a constraint especially when there is a policy of the college, we must cover all the course objectives in the time available.

Again R3 suggests that because of time constraints perhaps the engagement with the students becomes lessened.

In summary, the instructors felt that student centered modes of instruction were the best approach in the EFL learning environment but other extraneous considerations make the student centered mode of instruction difficult. In many cases the understanding that the learning could be optimized through student centered modes of instruction created a dilemma, that resulted from the reality of time constraints and curriculum design that had an overriding effect in the learning environment.

### 4.3.4 Question Four

*What strategies do foreign trained instructors use to enhance science literacy?*

Question four and question three could be identified as closely linked in that modes of instruction could represent an instructional philosophical stance and the strategy would reflect a way of implementing such philosophies. The strategy that instructors hold would be highly contextual dealing with immediate instructional goals. So when question three was asked, it was no surprise to get, in many cases, answers that were blended reflecting concepts, modes and strategies. Strategies of instruction

suggest a plan of implementing instructional goals with the philosophical biases in mind. Shih (1992) suggests that "a central goal of academic purposes for ESL programs is to help students develop reading and thinking strategies needed to read academic text in their classes in order to learn new subject matter" (p. 289). The question asked of all the instructors was; *What strategies do foreign trained instructors use to enhance science literacy?*

For many of the instructors, strategies of instruction reflected the need to bridge the communication barrier that was present as a result of the Arabic language. For other instructors, the strategy was to center instruction around relevancy of the topic being instructed. The research is important from the perspective that the learner is atypical in the sense that the complexities that face the EFL learner are accentuated with learning at multiple levels of cognitive and emotive streams, with language acquisition coupled with science literacy. Some of the complexities that can play a role in the formulation of appropriate strategies could include considerations for the learner's personal cultural and gender backgrounds (Lu & Berg, 2008). The end result is to implement strategies that increase the likelihood of student success in the classroom and to foster greater science literacy. Instructor responses to question four indicate that the learning environment restricts the instructor's ability to ensure the maximum effectiveness of many strategies. Such a sentiment was echoed by Koenig (2010), a physics education researcher whose research on implementation of innovative technologies as a strategy for teaching physics demonstrated that sometimes the best strategies are not considered as the result of the context of the learning environment. "Regrettably, these innovations often go untapped because of the potentially large investment of faculty

time and the additional cost put upon students or departments" (Koenig, 2010, p.1). The instructors in my research express similar concerns about the pressure of time constraints. This was an underlying concern when some of the instructors in the study were discussing mode of instruction earlier. Once again, the issues relative to time were revisited in question 4. For example, R5 when comparing strategies that he may have implemented back in Canada to those used in Qatar states;

> Back home sometimes you would purposely go outside the box, sort of thing and make them go look and so on. But here, it is difficult in the timeframe that we have here particularly this semester, but in any semester. Large amount of material to cover in a relatively short time, I think that is one of the issues. As well, I think we really need to gear down the amount of material that needs to be covered. We are trying to keep it in comparison to what is happening back home, with the system back home, and with the language issue here. I don't think you can do it.

R1 adds that 'the language is the point that is slowing us down'. These quotes illustrate common underlying concerns that affect not only the mode of instruction but also create a backdrop to the formulation of instructional strategies. The two constraints of language and time in the instructional environment would naturally impact the strategies implemented to facilitate the learning. Since the learner has a spectrum of learning styles and needs, a strategy for the instructor is to match the learning styles of the learner with the teaching styles of the instructor.

According to Franzoni and Assar (2009), 'Many researchers agree on the fact that learning materials shouldn't just reflect the teacher's style, but should be designed

for all kinds of students and all kind of learning styles" (p. 15). In the research the instructors interviewed reflected this need as instructors to be adaptive and flexible in meeting what they perceived as the learner's needs or styles. Based on the interview responses, the strategies naturally reflected the understanding of the learner's needs. Interestingly some instructors felt what was central to their instructional strategies development were issues regarding language, in that the language of instruction was English and the native language was Arabic. In the early acquisition of the English, instructors in the study felt that the usage of English in some ways became a barrier. As discussed earlier in the thesis, add to this the learning of highly specific technical language, and learning pressures increase.

Most of the instructors interviewed suggested that it was this context that the EFL learner would be better suited with instructional strategies that support a visual learning environment. The literature review appears to support this philosophical stance. Wellington & Osbourne (2001) suggests that when just considering science alone,

We need to remind ourselves that there is far more to science communication than the verbal language, (i.e, the spoken language and written word). Words are important but in science more than any other subject we rely on a combination and interaction of words, pictures, diagrams, images, animations, graphs, equations, tables and charts. (p. 6)

Haynes (2009) in an article written to everythingesl.net titled 'Teach to Students' Learning Styles' suggests "most English language learners are visual or kinesthetic learners when they first learn English" (para. 1). She further adds that most instructors teach to students with an auditory learning style creating some difficulties for the

learner. Silverman and Freed (1991) suggest that "linear thinking – the norm in American education-is particularly difficult for this person [visual learner] and requires a translation of his or her usual thought processes, which often take more time"( para. 1). This linear sequential thinking, Silverman and Freed (1991) suggest is more in line with auditory learning. Given the nature of science language integrated into this learning, a challenging learning environment can be created considering most science instruction is in the auditory sequential style. Silverman and Freed (1991) feel that this would pose a host of complex issues creating a mismatch in the instructional style with the learner's style.

The interviews with the instructors would support assumptions similarly held about the learner in the EFL environment. But recent research has found that "although English language learners can develop peer-appropriate conversational skills in about two years, developing academic proficiency in English can take much longer" (Druker, 2003, para. 5). In fact, the latest research suggests a far greater period of time is required to become proficient in academic language. The research suggests that a period of five to seven years is required to obtain a similar proficiency as their counterparts speaking native English (Druker, 2003; Collier &Thomas, 1999; Cummins, 1989).

What are the implications? The English language learner relies on environmental cues, body language, facial expressions, cues that for the most part are in the visual domain in the learning process (Druker, 2003). The problem with academic language is that there can be little in the way of visual cues to overcome this; the learner will rely more on context or personal experiences to create what the experimenter would call

'envisioned learning'. Through their own personal experiences, learners will create meaningful linkages or personal relevancies to the academic content being taught. As a result, the difficulties that the English language learners face in a void of visual cues can create their own contextual visual learning. In an environment where the auditory world seems to make little sense at times, the visual world combined with personal experiences would seem like a natural way to learn. The experimenter believes there is a lot to be said in the phrase "seeing is believing". We as organisms put a lot of faith in what we can see, it almost becomes irrefutable in what we see and experience. It becomes real to us.

*4.3.4.1 visual cues and image relevance as a teaching strategy.*

Within the research there were two common themes that emerged from the instructor's interviews and as a result instructional strategies were developed to meet these learning styles. The two themes once again were: that the instructional strategies should plan delivery of academic concepts filled with visual cues and could be further enhanced with visual cues filled with learner relevance in the Middle Eastern environment. Relevancy in learning is a keynote in many educational philosophies but it does seem to play a vital role in the EFL environment.

The instructors throughout the interview process reflect strategies that would support the visual learner and strategies reflecting learner relevance. Palincsar (1998) suggests "there is a legitimate and valued role for depicting understanding through illustrations, oral argument, and computer-generated graphics" (p. 372). Felder and Silverman (1988) state that

most people of college age and older are visual while most college teaching is verbal – the information presented is predominantly auditory or a visual representation of auditory information (words and mathematical symbols written in texts and handouts, on transparencies, or on a chalkboard. (p. 676)

Franzoni and Assar (2009) posit that "powerful encoding and visualization techniques have been shown to enable the creation of lasting memory and improve recall" (p. 15). Oxford (1990) supported by research from Bower (1970), Higbee (1979), Nyikos (1987) posits that "visual imagery is known to help learners package information more efficiently than they could if using just words alone" (p. 17). According to Oxford (1990) with support from Coleman's (1986) research "about 94% of all people are at least moderately good at using visual imagery" (p. 17). For example, when H1 was asked to explain a strategy, she responded that besides the traditional visuals like PowerPoint slides on a projector screen, she should present them with a blank piece of paper at the beginning of class. The intent is to provide a medium that would allow them to transfer their visual constructs of the scientific content under investigation onto paper, by way of drawing. Her role is, at this point, one of a facilitator allowing the students to draw what they believe represents an accurate drawing of what is being described in the class. H1 asks the learner probing questions that create reflective moments for the learner and allows the learners to become active with the direct hands-on technique that drawing would allow. As well, when describing a topic H1 does not stand still but becomes very animated, incorporating herself into the discussion. For instance, when having a discussion of global wind patterns she became an animated earth. What H1 has done in essence then, is to appeal directly to the visual senses of the learner, using objects

that are real for the learner thus incorporating relevance in the learning experience. For H1, she describes the learner as individuals that "need to see action, they need to see it doing something, they need to know why and the only way is to actually sit down or go to the boards and do something with them. H1 has described strategies that appeal to the visual learner, but as well, using active-learning techniques that engage the learner, allowing sometimes abstract science concepts to become a little more concrete. H2 would further provide additional support to the EFL learner in the Middle Eastern context as a visual learner suggesting that she uses a lot of pictures, "because they're such visual learners". The strategy is to use educational aids that will "allow them to see, play with is good".

The reoccurring theme of a visual learner was once again brought to the forefront when R2 was asked what he felt were strategies that foreign instructors use to enhance science literacy? R2's response was unequivocal as seen in the following statement;

Well they like pictures there is no question about that, they like visuals you know in science we have lots of models, whether it is atomic or molecular models or even using things like the periodic table as a big wall chart or there are many things you can use for visuals. You can bring in equipment to the classroom to show. You don't have to, in terms of literacy; you don't always just have to say words. You can use pictures, use puzzles even sometimes. I like using puzzles when you are teaching the names of elements and things like that.

When asked if he felt that incorporating a lot of visuals is a large part of his strategy? R2 responded;

Yes I think in that type of thing, that is why I teach a lot by PowerPoint because we have the technology here in the classrooms. It works very well. However, I am still using the whiteboard above that, so that PowerPoint is on the screen but there is a lot of teaching done on this side of the screen on the board.

R3 discusses adaptation that would increase the likelihood of science literacy for the EFL learner and in R3's words "has not adapted enough" visual techniques or aids as a method of problem-solving. A viable solution for R3 was to employ graphic organizers as an approach to solving problems in his course. R3 referred this as concept organizers, or an alternately induction framework. Mayer (1989) as cited in Burger (2001) describes graphic organizers as "tools which select concepts and display them with links between them which convey the structure or organization of ideas" (p. 78). Egan (1999) suggests that the graphic organizer "make information more apparent, distinct, and more articulate" (p. 641). The benefits of graphic organizers as viable strategies for learning are well established and accepted at all levels of learning (Egan, 1999; Alvermann,1986; Bromley et al.,1995; Friend & Bursuck,1999; Heimlich & Pittelman, 1986; Murray & McGlone, 1997; Pearson & Spiro, 1982; Reutzel & Fawson, 1989). However, not all educators are in agreement regarding the benefits of the graphic organizers. According to recent research the use of graphical organizers have produced mixed empirical results. Jiang and Grabe (2007) is quoted as suggesting:

> Although the suggestions for using various types of GOs [Graphic Organizers] as a technique for facilitating reading comprehension seem intuitively appealing, questions have been raised about whether these claims are supported by specific empirical studies. (p. 35)

Jiang and Grabe (2007) further add that other research has in fact produced findings that would be 'incongruent', raising concerns about the overall effectiveness of graphic organizers. Jiang and Grabe (2007), contrary to these findings, indicate in their research that these conclusions can be misleading, and they tend to lump all graphic organizers into one category, with an ambiguous definition for graphic organizer. Grabe (2002) suggests that text arranged in graphic organizers presents information that is much easier to comprehend. Jiang and Grabe (2007) point out that there is research like that produced by Geva (1983) indicating that particular types of graphic organizers can empirically show 'significant improvements' in standardized testing scores produced with college students. Geva (1983) suggests that written text in the form of paragraphs would be effective if translated into 'node-relation flowcharts'. As an instructor, the researcher used node-relation charts in the classroom with the EFL learner in the 2010 academic year. In a foundational math course, he had written a summary review sheet outlining in brief a strategy for factoring polynomials. The review sheet was written in complete text, using point form structure. After a week using the review as a strategy for factoring, he sensed that the learner was not embracing this review sheet and in some cases appeared to reject this collection of words and phrases. Knowing the value of this review sheet, he thought he would transpose this sheet using what Geva (1983) described as a node-relation flowchart. Within a week his students were using it as a crib sheet, attesting to the value and the ease to which factoring polynomials had become. This was a bit surprising to him as only the format not the information had changed. The lessons learned were invaluable, and provided a wonderful opportunity for his personal growth. For the visual learner, graphic organizers can represent a piece

of the bigger picture allowing the learner to overcome many of the difficulties that arise from poor language comprehension inherent in the auditory experience. The graphic organizers become a part of the scaffolding in the learning process, and can become a means of cognitive support allowing the learner to internalize the science concepts. The graphic organizers can provide an opportunity for the learner to communicate their understanding of concepts that can be internalized in a more meaningful way, in that the learning experience can be personalized based on what the learner takes from the communication.

In the transcript for R4, there was some discussion of the strategies that appeal to the student's processes involved with creating mental images, an extension of the visual aspects of learning. R4 posits that the instructor can make the learning relevant by trying to "bring science to the things that affect their real life", a secondary theme, that is a central focal point for his strategies in the learning environment. An effective method for R4 is to use analogies and is described in the following quote;

So you try always to use analogies and examples and ask of analogies and examples that would be meaningful for them... So one strategy to make the science concepts applicable to the life around them in the Middle East, in terms of what they experience. And that's the way you can turn any student, anytime, anyway. You got to always make it, even in the West, applicable to what the real-life is like. And that is a good thing in science because it's always real-world, all your conclusions are based on measurements in the real world. Right, you just don't artificially say 'this is scientific law, here memorize it'

Gregory and Chapman (2007) suggests;

Using metaphors and analogies is another way to show similarities and differences and to connect new information to more familiar objects or concepts...Having students stretch their thinking through metaphorical connections increases the likelihood of broadening their understanding of a concept or topic and remembering it in the future. (p. 108)

Many times the learner has little or inadequate conceptual structures from previous science learning experiences, therefore the usage of metaphor and analogy becomes an important instructional aide in the formation of science concepts. In fact, the usage of metaphor and analogy allows the learning to become personal as the metaphors or analogies used are personally relevant (Fensham, Gunstone, & White,1994). Analogies provide a sensory stimulus that initially is not possible through abstract and verbal means (Wong,1993; Petrie,1979; Schon, 1979). Comprehension is attributed to the process of generating relationships, formulating connections as a result of the external stimuli that analogies can provide (Grabowski, 2003). Comprehension, according to Grabowski (2003), is not solely the result of transferring information into memory, but rather as a result of the formulation of these connections that the student creates for themselves.

R4 in keeping with an engaged learning approach tries to appeal to the learner's natural curiosities as indicated in the following statement;

> You pose questions of things that they are curious about. And the next thing you know we are talking about "you know how is that working" and you know the way you go. And that is for all students anywhere, but I guess since you are in a different culture you have to make it, twist to fit them.

R4, as well, suggests that one of his major adaptations in instructing in the middle-east is that he is "doing an awful lot more computer work". R4 has taken advantage of the technology so he can as he describes "do a lot more in animation" and takes advantage of the graphical interface to present material such as diagrams and simulations. Once again this is suggestive of the nature of the EFL learner as a visual learner.

Curiously R1 suggests that the strategies that he implements in the Middle Eastern environment are no different than strategies that he would use in a Canadian institution.

> Well you know again, I will say this I have not seen any evidence or I have not found it necessary to implement strategies that are different than what I would be teaching if I was in a college system in Canada. In other words if I am talking about the intangibles, if I am talking about molecular models, if I want a student to better understand hydrogen bonding, then I can construct two molecules of water. Two models of water and I can use that to illustrate hydrogen bonding. If I want students to understand the shape of an alkane. Then I can do that with molecular models. That is what I do in North America, that's what I would do in Canada. And quite frankly I think the strategies that we believe as educators are effective in teaching a particular concept or a particular skill. I think can be used in this particular culture. I have not been able to identify anything that is different in that regard.

Nonetheless, R1's comments are suggestive of the importance that visual learning plays in both the North American context and the Middle Eastern context. R1 when asked to clarify his position: "So what you're saying is that you really haven't had to

change strategies, It is pretty much the same strategies". R1's response was very clear;

> No really because young people learn and we find ways to help them learn.
> The difficulty comes in language. If I were doing this activity involving the
> reactions using molecular models in St. John's, Newfoundland. I would not have
> had the challenge of language. And they would've worked through this very
> quickly, very efficiently. But when I gave them written instructions two days ago
> and they are, they have real language challenges, this group does. When I gave
> them instructions, they could not read the instructions, quite frankly. But
> nonetheless the strategy of using molecular models to better understand the
> nature of esterification or a substitution reaction, I believe that strategy is still
> sound.

R1's comments reiterate concerns with what, R1 appears to represent the challenges associated with communication, but other instructors have developed strategies that attempt to lessen the reliance on the auditory learning and increase the visual domains of the learning environment. However, reflecting on R1's comments in some ways reaffirm that despite not noting any differences between learner characteristics in a direct manner, R1 has made the observation that the usage of molecular models, or props can appeal to the visual and tactile learner.

R5 further posits that a strategy that works well in the Middle Eastern environment is through the use of graphical methods of delivery. For instance R5 when describing 'complicated subject matter' expresses the value of visuals in the following quote;

sometimes there will be diagrams, because I love to use diagrams because I really do believe that in many cases the picture is worth 1000 words especially for the students when words are so difficult to understand. Animations are great, and there are some great websites where I get those.

R5 as well tries to keep the subject relevant to the learner's natural world experiences as indicated in the following quote;

> like anything that relates to their environment and this is something that is really important to, you have to try to relate it to what they are familiar with in their environment. Because as soon as I start talking about things like space shuttle or Hubble telescope and the photographs, they may be totally unfamiliar. They have no idea what the Hubble telescope was, they really didn't know too much about the space shuttle…So you really have to try to relate to, many of my questions start off with 'your Land Cruiser is traveling with a certain velocity'. You really have to relate to something that they are familiar with.

R6, like R5, indicates that the best strategy for the EFL learner is to keep the learning relevant. Relevancy R6 suggests, allows the learner to visualize the learning and to make the learning more personally meaningful. R6 as well supports R1's suggestion that relevancy instruction as a strategy, which is used in this environment, is more of a universal instructional strategy, not merely restricted to the context of the study's learning environment. For R6, R5 and other instructors the learning can be better facilitated by creating concept association, with personal experiences as the foundation for new concept integration and new concept expansion. When introducing new concepts in science, especially those concepts that can have obtuse and abstract

dimensions, the ability of the instructor to create concept linkages for the EFL learner is valuable as an instructional strategy. Considering the foreign nature of the second language and the science terminology, these linkages or associations with the learner's personal experiences can become instrumental in the learning and ultimately lead towards higher literacy in science.

In summary, question four has provided an opportunity to gain a sense of the instructional strategies that these nine instructors highlight as basic elements that should be considered in developing strategies. These strategies provide greater opportunity for science literacy in the EFL environment. The nine instructors to varying degrees have suggested that numerous strategies should be explored in the learning environment in an attempt to match the learning styles of the EFL learner. However, as a result of continuous work with the EFL learner, the instructors through experience believe that strategies containing visual elements should be utilized in order to maximize the learning experience. As a secondary note, four of the instructors also suggested that with the visuals there must be relevant to the instruction. The relevancy in instruction allows the learner to make real connections between the academic world of science and the natural world in which they live. Add to this the visuals and the learning goes from the abstract, vague learning experience to the more concrete, a real world that the learner accepts and is more willing to integrate in their own schema. In plain language it is learning that makes sense to the EFL learner.

### 4.3.5 Question Five

*What do you feel are the greatest challenges for the EFL learner as it relates to science literacy in this foreign language learning environment?*

In the EFL environment a number of concerns arise all creating a dynamism that must be understood by the instructor in order to better understand the nature of the EFL learner. The success of the EFL learner and the successful creation of instructional strategies in the learning environment depend on the knowledge that the instructor has. A good place to start understanding the learner is looking at the challenges that the learner faces day to day. Question five was asked in an attempt to understand this reality and looked at opportunities that could produce optimal instructional strategies.

In answering this question the study provides data that supports other research, which will follow, suggesting a common theme among other EFL learners from other studies. The classroom can create many challenges for the learner. There are different skills that students can use to overcome these challenges. One skill that is used to ensure success is listening skills (Huang, 2005). Listening skills are more important in the academic success of the learner than reading or academic aptitude (Conaway, 1982; Huang, 2005). Huang (2005) posits that the understanding of the academic language in English poses the greatest challenge for the ESL learner. Research from Ferris and Tagg (1996) and Huang (2005) looked at professors' opinions with respect to the difficulties facing ESL learners. Instructors from four institutions all stated that listening comprehension, providing responses to questions, and class engagement were the greatest difficulties facing the learner in an ESL environment. In a recent research article from Song (2006) a couple of the factors had been identified by other researchers as factors that affect the acquisition of advanced literacy by ESL students. Included in these factors were a lack of; strong oral English proficiency upon entry to

school (August & Hakuta, 1997; Snow, Burns, & Griffin, 1998) and basic reading ability (August & Hakuta, 1997; Krashen, 1993 ).

The instructors in this study described, as other research has, that language plays a large role in the instruction of the EFL learner creating the largest challenge in the learning environment. As most of the language concerns that arise from English as a second language and its usage as the instructional language a number of secondary concerns arise. Like the previous questions where a common theme was investigated, question 5 as well, presented the same opportunity within the research. However, many times the secondary concerns were equally important, presenting perspectives from the instructors and expanding the discussion into implications as a result of language challenges that the learner faced. The responses from each instructor with regards to the secondary concerns did not necessarily indicate common themes, but the points raised were of some importance, perhaps for future research. Therefore, unlike previous analysis of the research questions posed, question five will look at the individual instructors' responses in some depth.

For example, H1 describes in her opinion the challenges associated with language and comprehension.  For instance H1 suggests that she

> ends up with students who do not have a basic understanding of the English
> language which is not going to make the understanding and comprehension of
> science literacy any easier. Because let's face it, like I said before scientific
> literacy involves the students being able to read a scientific procedure.

H1 further adds that in the laboratory component they sometimes find it difficult to "understand simple procedural order". H1 suggests that the learner has to be able to do

more than understand the scientific concept and academic language superficially, but that they need to

> be able to discuss things, they need to be able to explain what they're seeing, but if they do not understand simple words such as compare and contrast. How can I expect them to understand larger scientific phenomena, theory using scientific words, terms, using scientific methods, of thought even. We require students to read textbooks; in a lot of cases is way beyond the reach of the students.

The observations have created secondary concerns for H1, more notably the self-esteem of the learner can be at risk. H1 feels that by placing, or as H1 describes the learner as being 'pushed', the linguistically ill-prepared learner in the English science course will do nothing but be destroyed. H1 considers this to have occurred in her personal and past experiences with the learner. When asked to explain the usage of the language 'destroys' H1 explains:

> It destroys them, it demoralizes them, their self-confidence is down and their esteem is nonexistent. Then it is up to the science instructors, and I have had to do this several times, to build them back up.

H2 suggests that there are two challenges besides the language as being a major challenge, a second challenge seems to have a residual role as a result of the learner's prior learning and the preparedness of the learner for the EFL environment. A residual role in that when asked if the enrolled program was degraded in terms of course outcomes in order to facilitate the learner in this environment as a result of some of these challenges, the answer was "yes". As H2 stated;

I wouldn't put a real hard question whereas you might be more inclined to do that teaching North American students who are used to the application of a topic into something that's a stretch to, but it applies and they can make the connections.

But here maybe it is not the best.

When H2 was asked to the degree in which the cognitive domain was affected, H2 responded that learning was more "recognition when learning a new topic and learning how to apply it to something else". The "something else" would refer to a new learning episode that would be somewhat unrelated but would have some fundamental commonalities. This is suggestive of Bloom's taxonomy of orders of learning. This would suggest that the level of learning may occur at a lower level as a result of acknowledged challenges that the learner faces in the EFL environment. This appeared a number of times when the other instructors were questioned about the lowering of expectations in light of EFL learner challenges. Time and time again the response from other instructors was similar. In fact, H2 expressed some anxiety when creating a written evaluation to be performed by the learner, as the following quote would suggest;

I did actually write a question for my next test this morning and that is one they haven't done in class but it is not difficult. It is just one other step past the question. I only made it worth half a mark that particular part of it. So we will see, I don't know, I think, I am nervous about it because I don't know if they will get it or not.

H2 felt that the language issues are of equal concern and as H3 describes is a "huge barrier" to the learning. For H3 the topic of the English language was a difficult challenge for the EFL learner, and as H3 suggests, "So I have some students that try to

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read the textbook and they had a dictionary and they were constantly translating the English words". This statement reflects the nature of the EFL learner in the sense that basic communicational language intertwined with the academic language can be difficult for the EFL learner. H3 reflected that the students were more burdened with the communicational language almost to a point of a distraction that in learning words would be a fundamental requirement to obtain an understanding of the scientific words and context. Without the foundational conversational English, as H3 suggests 'forget the scientific words'. H3 suggests that 'those books [science books] are written in a different style language and conversational language, so it difficult to understand them'. For H3 it was the language challenges that she felt would necessitate greater time allowance for the learning episode. H3 stated that 'most language learners or cultural learners will learn the amount of material but you must provide more time for them'. H3 suggests that because of the language challenges the instructor must be more accommodating, and that might mean giving the students more time to write a written evaluation, since the EFL learner can take a considerable amount of time to read and process individual questions. H3 suggests that 'they need to read it, they need to read it again, it takes a long time to read a question'. H3 comments that 'The time, I think is a difficult one here. We are throwing lots of courses at them, at an incredibly fast pace. It is the antithesis of how to teach the language learner'. H3 points out that the pace and the need to cover curriculum is compounded with the time constraints. A recent year-long qualitative study by Mei-Hui (2009) suggests EFL instructors find increasingly that "keeping pace with tight curriculum schedule was the priority" (p. 521). H3 was asked much like H2 if she felt that the course outcomes in terms of expectations had been

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affected because of the time constraints she indicated that "people [instructors] are sticking to the curriculum, they make sure they get through the course content, as quickly as they can". H3 does raise concerns that these challenges act to some degree as detractors from the true essence of science teaching. When looking at the transcripts I get a sense that the instruction requirements to successfully reach the course outcomes but these challenges are limiting the breath of the instructional strategies in the sense that, as H3 would describe, as "missing out on the big aspect of scientific and math learning which is analytical thinking". H3 suggests that the instructor is so tied up in the basics of science literacy that there ends up being little time to dig deeper into the heart of science literacy. As H3 would describe:

> But I think we are missing out on a big aspect of scientific and math learning
> which is analytical thinking. You know getting them to learn how to solve
> problems. Real world problems are what they are going to be doing when they
> graduate. Like I try to bring in things that are not in the curriculum, things that
> are current. Scientific problems that are current, newspaper articles, things that
> are new in science research.

The language challenges H3 suggests can be consuming making the transmission of basic scientific knowledge time intensive. H3 explains that she is always 'self-editing' her English language and quite often explaining words as she says them, and as a result slowing the pace of the lecture delivery. H3 feels that the instruction language therefore becomes restrictive and she does not have the freedom to use whatever English word she can. To overcome some of these challenges she will use etymology,

thereby allowing the learner to see the word as smaller fragments rather than an overwhelming collection of letters.

R1 is in agreement that the biggest challenge like the previous instructors is the language concerns as indicated in the following quote; "I think the language will always be a challenge, there is no question about that in my own view". However secondary to the language R1 felt that the next challenge is in the values area. R1 expands on the notion of values as indicated in the following quote from the interview;

> I think what I am talking about largely of course is the need for proper use of technology, the need for the preservation of the environment, the need for the wise use of resources, conservation of resources and so on. I think a lot of the values that we associate with scientific literacy needs significant work done on it and these are cultural in nature and as we all know, of course, to change a culture requires a very long time.

What R1 is advocating is the adjustment of the learner's value system, or ultimately the nature of the learner. The discussion has more to do with affective learning/instruction and changing the learner's attitudes towards the world they are in and interact with. What R1 is describing could be as Gee (1996) describes as discourses. Gee (1996) and Souto-Manning (2006) suggest that discourse can best be described as;

> ...ways of displaying (through words, actions, values, and beliefs) membership in a particular social group or network...Discourse, then, is composed of ways of talking, listening, (often, too, reading and writing), acting, interacting, believing, valuing, and using tools and objects, in particular settings at specific times, so as to display and recognize a particular social identity. Discourses create "social

positions" (perspectives) from which people are "invited" ("summoned") to speak, listen, act, read and write, think, feel, believe and value in certain characteristic, historically recognizable ways, combined with their own styles and creativity. (p. 128)

However, R1 suggests as indicated in the previous quote that the greatest challenge lies in the inherent difficulty in affected cultural domains of the learner. In some regards, this raises some issues with the instructor's role in relation to the EFL learner. How affective can the instructor be in terms of the cultural differences that inherently arise while teaching in an EFL environment? The dilemma for R1 is that changing the learner's attitudes as it relates to the real world around them can be very much a part of science literacy. For example, issues that affect the environment are clearly areas that a science instructor might wish to engage the learner. But if the learner's perceived cultural beliefs are counter to any affective instruction with regards to the environment, for example, the instructor now has to develop a strategy to overcome these challenges. One could argue that the instructor should instruct based on 'safe' scientific facts thereby avoiding any issues that would raise potential conflicts and run the risk of offending the learner's cultural sensitivities or devaluing the culture. Students entering into a multicultural learning event where there is a misalignment of their cultural beliefs with those in their learning environment can experience significant conflict (Pincas,2001; Parrish, & Linder-Van Berschot,2010). This would lead most students to demand a culturally adaptive learning environment, allowing for the full development of the learner (Visser, 2007; Parrish, & Linder-Van Berschot, 2010). On the other side of the coin; is science or should science be 'acultural'? Are the two separatable?

R2, similar to the previous instructors suggests that the 'language is a critical part' of what constitutes the greatest challenge for the learner. R2 suggests that the EFL learner is receiving a broken message because the sentence that is being read or spoken by the instructor and the information is being processed in a fragmented manner. R2 suggests that 'they read just a little bit and they get part of what they are supposed to get'. This would indicate that the concept formation is partial and highly inferred. R2 indicates that the EFL learner is using cues to try and formulate what they believe the question is rather than reading the question in its entire context. Inferences are drawn from their observational cues. R2 suggests that the heavy reliance on these cues is problematic, in many times leading to conceptual errors. Difficulty with the basic language skills, according to R2, or skills that are 'not up to the standard' will have an accumulative effect on the science literacy. The learning will be superficial, with a mix of accurate concept understandings mixed in with inaccurate concept formation. R2 suggests a strategy that would address this concern is to restate or repeat what the instructor is teaching several ways. R2 feels that there has to be a deliberate and self-reminded effort on the part of the instructor to say something several different ways using several different words. R2 indicates that this would be no different than a "literacy gunshot approach", in that if you provide the learner with a number of thoughts all representing the same learning goal, then the likelihood of the learning concept being processed in a desired manner is highly probable. R2 states that 'if there are three words that you could use to explain something the EFL student is likely to catch one of those three as opposed to all three. So it is important that you reiterate what you're saying'. R2 adds that this is meant by no means to complicate the learning but is an

opportunity for the EFL learner to maximize the learning in light of the language barrier. In fact, R2 suggests that 'If you are teaching science, the object is to try to make it as simple as you can but they need to have the understanding. You cannot oversimplify, there is still a happy medium." Interesting enough R2 does feel that the nature and context of the learning lowers the course expectations, and with further reflection on other college course offerings, R2 states that the courses have been 'dumbed down'.

Another instructor [R3] stated that one of the biggest challenges was in the motivation of the EFL learner. The research regarding motivation and the second language learner has become increasingly more important in an attempt to understand the complex nature of the EFL learner ( Hsing-Fu & Dornyei, 2007). Hsing-Fu and Dornyei (2007) suggest that one of the key factors for determining success in foreign/second language learning is motivation of the learner. A recent research project carried out at the Beijing Foreign Studies University on Chinese investigated factors that affect learning achievement with a sample size of 250 students from six foreign language institutes in China (Lui et al., 1989; Wu et al. 1993, 1996; Zhang, 2003). The research showed that out of a possible set of 13 factors, there were six factors that had the greatest contribution in improving learner proficiency, one of which was motivation (Zhang, 2003). R3 felt that a secondary concern was the language concern and during the interview reflected on a recent event stating:

> I had a test just the other day and there was something about, name the least active of the metal or something like that. They did not know the word least and, but I don't mind if there is language, that is on a test, I will try to phrase it differently use simpler language and it is a learning experience I think for

instructors as well, teaching in a foreign language environment. Just because you are teaching at the college level doesn't mean you could or should use college level English.

Further to this, instructor R3 was asked if he felt simplification of the language was a necessity responded as follows;

> I think it is a necessity and I don't think it's impossible, I think it takes some thought and I think we as instructors always have to be aware of when we are using words that are not necessary. There are some scientific words that have to be used and they are big long words and they look funny phenolphthalein is a funny looking word. It has five consonants in the middle of it but it may be necessary. Where are there other words that we use in everyday speech that are more difficult than they need to be in this environment?

Like H1, H3 and R3, suggest that the spoken language is not the only problem, but as well the written language in the form of textbooks are problematics as well. For example,

> Finding a text which is not a suitable level for their English skills. That needs a lot of attention I think. I think the text that we are using now for instance, in chemistry, the Cheng text is better than some that I have seen but it is still not readable for these students.

H3, as well as R3 posit that presenting the written language as one long paragraph may not be the best way or solution to transmitting the lecture information. R3 suggests that:

> It might be better visually for them if it is broken down into a series of sub paragraphs or maybe headings put with it or something like that. I know I don't

know enough about all these things and I think our EFL colleagues could help us out here.

Once again R3, like other instructors before, acknowledge the visual domain of the EFL learning and the usage of language fragments as a way of conveying central scientific themes. This was a point of discussion in Question 4 regarding the strategies that instructors would use.

R4 when interviewed and in response to the challenges facing the EFL learner, suggested the need for greater consideration for the EFL learning in terms of the learning environment. The need for an adaptable learning environment was what he saw was the greatest challenge for the EFL and the difficulties that he/she face in the foreign learning environment. R4 provided a number of considerations that constitute challenges associated with the learning environment as a whole. R4 made points of discussion regarding the rigorous time constraints placed on the EFL learner and the added stresses that this creates for the learner. R4 posits that the academic terms should be spread out 'over slightly longer terms' and greater allowances given to the learner in recognition of the language challenges. R4 feels that the learning environment not only places stress as a result of the academic life but also the stress of dealing with an institution that represents a culture that is foreign to the student. R4 indicates that the learning environment therefore represents a cultural shock that requires learner adjustment. R4, after some discussion about the institutional challenges, expanded the discussion to discuss the more common theme related to the challenge of language for the EFL learner. For instance R4 providing a comparison between the North American experience to the experience in the Middle-East stated 'In

the West I would be able to give complicated problems in wordy paragraphs…' however when referring to the learning environment in the Middle-East, R4 indicated that he probably would not word a question in as complicated wordy fashion as he would in a college level student in Canada. R4 recognizing the challenges of the language states, 'Now and again you have to do it a slightly different way because of the language, language problem, written language problem for some students'. The language that R4 uses is words that are consistent and contextual with the learner and their environment.

Looking at the response from R5, the research brings to light the notion that language provides the greatest challenge for the EFL learner. R5 suggests that the challenges associated with language poise a very large concern. Generally, speaking R5 indicates that as the learner progresses to the later stages of their program the difficulties encountered with language become less over time. This was not the first interviewee, who has made this observation. However, R5 states:

> Some students I've had, had been here for a very short time, they are very, very weak in English and it poses a tremendous problem to them. The textbook is virtually useless because it is written in a very high vocabulary level for the United States and Canada. In countries such as this one, it is virtually useless to them and I have to take the textbook and I have to condense and summarize it and just take the main points and put in the simplest language that can and then try to use several different versions to get it across.

R5 does indicate like previous instructors that the idea of reiteration of concepts and language is an important consideration with the EFL learner. For instance, when asked if R5 would use an alternate term that would explain a concept in simpler term, R5

responded; 'Not necessarily an alternate term but certainly a variety of ways to explain what this term means". R5 suggests that a strategy to bridge language challenges is to augment the terms with qualifiers. The reality for R5 is "to try and keep the language there because I know that those students who leave here and go out into the workforce in the same field are going to be confused when exposed to this language". R5 indicated that the exposure to the language is equally important along with other language considerations. Other considerations for the EFL learning is the relevance in topic and example. For example, when describing problems related to physics instead of using an example that has a North American frame of reference like baseball, use golf. R5 states that this aspect of relevance 'is the most serious problem, it is not that they don't know the math or the physics. It is that they don't understand what the question is saying or what it is asking'. R5 indicates that this literally requires the instructor to be adaptable as is indicated in the following quote; 'the notes, for example, I adapt them and continuously in that process trying to make changes to make it more understandable'. R5, echoes similar concerns raised earlier from other instructors and points out that he feels that he is 'lowering expectations' and the proof is in the type of questions R5 is asking. For simplicity the questions are being written using simple language. R5 adds that he 'thinks the language itself limits the type of question that can be asked sometimes'. Interestingly enough, R5 suggests that some students in dealing with the language issues exhibit avoidance strategies as a 'mechanism for them to cope with what they are having so much difficulty with'. R5 states 'instead of focusing on the physics which is causing them so much grief they would rather simply focus on something else, and talk about something else...it is like they get overwhelmed fairly

quickly and suddenly, they show up but they just kinda tune out the difficult stuff". R5 believes that this not a matter that is related to cognitive abilities but more challenges related to language.

Finally, R6 again reflects the language challenges as an important priority in terms of dealing with the EFL learner's challenges. R6 feels strongly enough about the challenges related to language that he would suggest creating an academic bridge program. R6 echoes sentiment amongst all the instructors that suggests that a bridge program or other variant transitional program, in the initial stages of the EFL program, would act to facilitate a transitional period for the learner.

In summary, all instructors feel that the primary challenges reiterated a number of times is English language usage in the learning environment. However, many instructors further indicated that secondary challenges for the learner were:

1.     Inappropriate text material, for example, using prescribed textbooks with language designed for learners where English is the first language.

2.     Stress created on the learner with weak language skills resulting in negative self-esteem concerns.

3.     The transmission of science concepts in a weak English environment require considerable amount of time with 'self-editing' and reiteration of concepts.

4.     A realization that science concepts conveyed in large blocks of information poorly suits the EFL learner and require fragmentation of concepts into more manageable information blocks.

5.     Language challenges resulted in lower learner outcomes or expectations.

6.      The difficulties of creating an effective learning environment that allows for learner socio-cultural discourse reflection.

### 4.4 Additional Findings from the Interview Process

The use of the semi-structured interview and the nature of the research founded on grounded theory principles provided a great opportunity to delve deeper, bringing to the forefront thoughts that initially were not anticipated. The Grounded Theory approach acts as a wonderful exploration tool in that the new revelation that came forth from the research can produce insights that at first were not apparent. A couple of these issues that were discussed included the use of approximate language and science instructors as language instructors.

#### 4.4.1 Approximate Language Usage

At the beginning of the interview process some of the instructors provided the researcher with a sense that the language challenges were at times becoming large enough concerns that maybe the instructors were allowing 'approximate language' in an attempt to minimize this language challenge. Within the context of the research the researcher used the words 'approximate language' as a way of using language that is not entirely accurate but can suffice in order to convey scientific concepts. It is a way of deemphasizing the language so as to gain complex science concepts. Such strategies can be useful in scaffolding strategies whereby, once the learner grasps science concepts in terms of creating personal meaning in their own cognitive sense, then the accuracy of the language can become a priority in the learning. It is a way of trying to keep the language simple as a way of facilitating foundational science .The notion of approximate language was only a consideration after the researcher had spoken to H1,

H2, and H3. It was then that the researcher thought that this topic should be pursued with the remaining interviewees. The question was asked because the usage of 'approximate language' is a starting point in the learning, but if there is no progression to the usage of accurate language then science literacy will be affected. The best way to liken this is in chemistry, the EFL learner might forget the word atom, but describe the atom as a ball and use this word as a substitute for any discussion that initially involves the atom.

So the question was asked of the instructors; "In terms of using correct language to explain something, but if it is approximate language would that fine?", or "approximate language in my opinion would allow a student to write water 'W-A-T-E-R' rather than $H_2O$". R1 response to this was

Yeah I think so. I think so. Yeah now I realize again one would like to have well explanations given good English language, but my concern in this particular points is do they understand why ethanol rather than ethane? As opposed to whether or not they can do that in very good language. Because all of us are of course are limited in our ability to express ourselves as well, theirs is less so. R2 when asked if he would allow approximate language for evaluations in the sense that the EFL learner does not use specific language but instead uses language that is providing answers in a 'roundabout way' felt that this would be acceptable. The question was posed to R3 "do you allow the learner to engage in approximate language?". R3 responded:

Yup. For instance, the definition of a solution. At best, solution is two words, a homogeneous mixture. But if they get this concept across to me that is made up

of more than one thing, this mix together you cannot see any parts to it. Then I will accept that. They've got the concepts there.

The responses that R1, R2 and R3 provide are suggestive of two things; the instructor is allowing the learning environment to remain flexible and learner centered with the usage of approximate language but this creates a new dilemma. A dilemma where the very nature of science literacy is suggestive of science language proficiency and not just the proficiency in science concepts. Again the same question was posed to R4 with a similar response. However, R4 provided a more comprehensive approach in an attempt to re-enforce the proficiencies for science literacy and allowing the learner to overcome the language challenges. R4 suggests that it is fine to allow the approximate use of language, but one should ensure that every opportunity is taken to correct the usage, using specific scientific language. R4 felt that the continual modification of the learner's answer with the more appropriate response was within his obligation to correct evaluations as opposed to mark an evaluation. The following quote from the interview in response to whether R4 would allow approximate language usage highlights this approach;

> You know. If they are getting the idea to me, yeah. And you know what you always do is make a correction on it, and you make annotation to it; "I understand what you mean but....." that kinda thing. And hopefully next evaluation it would be a little bit better and all that kind idea. Everything that you do, then I find that is different for different faculties, you do it and the purpose of doing this assignment is to learn from doing so you just don't mark it, you correct it. And you say improve it and this is what you should do next time....

Interesting enough when the same question about the allowance of approximate language was asked of R6, the response was 'No. I don't allow'. R6 suggests that there has to be preciseness in the discussion or responses that the learner may provide because many times the language is precise. R6 suggests that in chemistry, for example, there exist two compounds that vary in one letter and the pronunciation of each is slightly varied. Take the words alkane and alkene, as indicated by R6, stating that an alkane is an alkene is problematic. R6 suggests that accepting one word for the other is 'wrong' and there is 'no in the middle' response.

The notion of approximate language would then appear to compliment the instructor's strategies in an attempt to achieve science literacy. All the instructors who were asked if this was acceptable, except one instructor, suggested that it was a way of building science literacy. Using the approximate language as a transitional strategy in an attempt to ultimately obtain true science literacy. In some ways, the process can be likened to scaffolding where basic concepts and language can be used as a foundation and building upon this foundation with more precise language that would lead to full proficiency in language and concepts. R6 reminds us that within the learning environment the margins for approximate language usage are small and limited at times, considering the precise nature of the science language. There is no doubt that the learner will at some point be required to have a high degree of proficiency in the usage of science and technical language, it is the role of the instructor to find that balance and transitional point between the approximate language usage and the more precise language usage.

*4.4.2 Science Instructors as Language Instructors*

After interviewing H1 and H2 language appeared to be an issue that was a concern for possibly future interviews. There was a sense that the instructor was getting slowed down with the language concerns in the instruction, and would in some ways end up focusing more on language then the instruction. In response to this the research wanted to see if this was a general feeling among other instructors so the question was posed; "Some would say that we [Science instructors] are language teachers in that every science lesson is a language lesson". The question allowed the instructors to reflect on their role, a new dimension in their instruction, which perhaps was not a consideration in their previous teaching experiences. This would focus on the uniqueness of the teaching experience in the Middle-East. For example, H3 in response to this question stated;

> Well what I would agree with is that when I am talking to the students here I will not talk to them in the same manner that I would speak to students at home. I'm self editing my English language and quite often explaining words as I say them because you can kind of see, kind of tap into the classroom and look for those blank stares. I think that is partly true because I'm not teaching science the way I would teach it at home. I don't have the freedom to use whatever English word I want. If I want to use a word that I feel they may not know I am going to explain that word and I also use etymology even the PowerPoints to explain words to help them understand words. So I think that is partly true. You have to be aware. You are speaking a language which is not their native language and you have a

variety of English language skills in the classroom, from very rudimentary to almost fluent and so you cannot cater to the fluent English speaker.

H3 was then asked if she felt that the language aspect of her teaching detracts from the science literacy. To which she responded 'I don't think it detracts from it. I think it slows me down'. R1 responded to the same question with the following quote:

Oh I think that is true. I don't think there is any doubt about that. I will give you an example, just yesterday we were in the laboratory at the Rayyan campus and IA [Instructional Assistant] used the word odor and all seven of the students looked at each other what is she saying, and then of course someone said smell. Now I don't particularly like that word, but they were able to relate the word odor to smell. So they learned a word yesterday. One day I was talking about acids and bases and I used the word slippery. Now in North America that is a very common term because of weather conditions for the most part I suppose. And I assumed that they understood, slippery. I mean I think everyone understands that. And one student said what do you mean? So again I took the opportunity to illustrate what this particular term meant. And I had to use several examples, I couldn't use snow and ice. But I was able to use oil and grease and this kind of thing. So yes I think that statement is true that we are language teachers as will the science teachers but again it is a matter of balance. One can't go into a chemistry class where you are under the constraint of a certain number of outcomes that must be achieved in a certain period of time and focus on trying to develop real good English, but we should look for every opportunity to do that.

R1's comments remind us that apart from the language of science, the vernacular language that the instructor would use freely in the North American context can be problematic, and something that would seem insignificant to the L1 learner could become pivotal to the EFL learner. The EFL learner would not necessarily understand if the vernacular is a requirement in the formation of conceptual meanings. Without having any relevance for the vernacular language, the EFL learner concept formation could be clouded, as a result of their attempt to place meaning strictly from the context of the discussion between themselves and the instructor. In fact, this might lead to misinterpretation, but I could not find research to support this position. At this point, the research would be speculative and hypothetical.

R2 agreed with this statement but indicated that the instruction could make use of reiteration of the language so as to create their own meaning with the use of similar words or terms. R2 suggests that there has to be instructor awareness as indicated in the following quote;

> I must say that is one of the things that is a constant in my teaching where I have to be aware of what I am saying and will that cause confusion if I say it this way. Maybe I better repeat it and just say it a slightly different way so that it might make it clearer.

R3 likened his role in terms of the structured approach to the language lesson, rather the linguistic role as an instructor. R3 identified with the systematic approach to science, or the approach to a science problem or line of inquiry and how analogous the process of thought is with how language is structured; introduction to a problem, nature

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of the problem and conclusions fitting into a logical deductive framework. R3 suggests that

> You start with the given information, you draw a few parallels to it and you draw a conclusion at the end. I never knew how to write an essay until I studied Euclidean geometry. I think that in that sense my math teacher was an English teacher. I think that what I'm teaching them is to write a logical solution to a chemistry problem, it's sequencing. It's logic. It's explaining something. I tell my students when you are writing a solution you are telling me a story, and that has a beginning and it has an end. R3 considers the approach to science literacy as closely paralleled to language literacy in function and structure.

R5 on the other hand suggested that 'language is having a big effect' on the way he is teaching the physics, but this is not his primary concern. R5 suggests that he is not trying to emphasize the English, but R5 considers that the English concerns are dealt with automatically as a part of what he does. R6 posits that the language concerns should be dealt with from the language or English instructor. To satisfy the needs of the science instructor there should be more science training for the English instructors. R6 believes that the English training should be sciences specific with science instructors acting as subject matter specialist providing guidance on a regular basis throughout an academic semester. What R6 has proposed is a complete role reversal as opposed to what the other instructors were advocating. The researcher sensed that R6 was suggesting leaving the science to the science instructors and the English to the English instructors.

In the end the researcher in the role as instructor, felt the interviews had indicated to varying degrees that not only are they interviews of science instructors but that they fill the dual role as language instructors. At first this may seem odd but from a communication standpoint, no matter what the message is, there has to be some assurance that the fundamental channels of communication are present. If these fundamental channels are not present then the message is never going to be transmitted. It is from this perspective that the instructors are not necessarily acting as language instructors in a deliberate sense, but likely that the instructors are ensuring key vocabulary benchmarks are present thus allowing for the transmission of the science concepts. In some ways ensuring that minimum language proficiencies are present is taking a cautionary role. If instructors fail to assure the presence of basic language proficiency this could lead to injecting potentially flawed assumption in the lesson that could be critical in the conveyance of science concepts. One area of concern for example, is the basic assumption that the learner understands contextual language that may in fact be out of context with the learner. Such a concern can represent a real possibility considering the learner's socio-cultural profile and the instructor's socio-cultural profile. Therefore, if contextual language is going to be used the instructor will have to provide the context, which in many ways is the role filled by a language instructor. Regardless of the rationale the discussion at any level must occur with great clarity, sometimes this might require language clarifications of scientific or English vocab. There is no doubt however, that without the clarity in language the message becomes obscure.

*4.5 Philosophy of Adult Education Inventory (PAEI)*

The primary method of data collection was the interview process, however, two other sources of data collection were also used to provide more rigor in the data thus acting as a measure to some degree of reliability of the data. As well, the other methods of data collection would provide an opportunity to identify any consistencies with the interviews as measured by the interview process. The strategies of an instructor are undoubtedly influenced by their personal concept of instruction and their role in the learning environment. Wingenbach (1996) suggests that the greatest factor in the instructor's purposes, methodologies and practice is based on their philosophy of education. Therefore, a measure of their personal philosophy would be useful in any attempt to determine if there is a linkage between what they believe to be good instruction, their philosophies and the match between the EFL learner attempting to obtain science concepts and their instructional strategies. One tool that is useful is Lorraine Zinn's Philosophy of Adult Education Inventory [PAEI]. The inventory that was used was adapted from the original inventory. The reason for choosing this adapted inventory was; the ease in which the inventory could be administered, via web and the language used was adapted to the modern learning environment (see Appendix I for the original and the adapted version). The adaptation was a slight language modification that does not affect the integrity of the statements poised. The PAEI according to Kellermann (2001) is designed to assist the adult educator to identify his/her personal philosophy of education and compare it with prevailing philosophies in the field of adult education. The PAEI has 15 items, where each item begins with an incomplete statement that is followed by five optional statements that could be used to complete the

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sentence. Each optional statement is read and the reader is asked to rate the optional statement based on how they feel this statement closely represents their personal feelings. A rating scale of 1 to 7 is used to indicate a level of agreement with each optional statement. The scale goes from 1(strongly disagree) to 7 (strongly agree), with a neutral point (4) if you do not know the response or are not sure about a particular option. There are no right or wrong answers, just a scale of beliefs with regards to the optional statements. Once the inventory is completed a scoring matrix is used to assign a numeric value to the responses and group the scores into sub-groups. Each score from the five sub-groups will suggest a possible philosophy that the instructor holds with regards to adult education. The five sub-groups reflect five dominant educational philosophies; Liberal, Humanistic, Behaviourist, Radical, or Progressive Adult Education. The highest score of all the five sub-groups will suggest a philosophy that is closest to your personal beliefs; and the lowest score will reflect a philosophy that is farthest from your beliefs.

*4.5.1 The Five Sub-groups Defined*

*4.5.1.1 Liberal Philosophy.*

A liberal philosophy encourages the creation of rational, intellectual cognitive processes fostered by a subject-matter expert. The educator as an expert conveys a defined body of knowledge to the learner acting in the capacity as the authoritative figure controlling all aspects of the teaching-learning interaction. The educator envisions the methods and teaching strategies as dialectic and lecture based delivery (Price, 2001; Boone, 2001). Theorists of this tradition are Socrates, Plato, Thomas Aquinas, Van Doren, Piaget, and Houle (Gioti, 2010; Boone, 2001).

*4.5.1.2 Humanistic Philosophy.*

A humanisitic philosophy is representative of an educator that facilitates personal growth and development of the learner. According to Boone (2001) humanistic philosophy includes:

experiential learning, individuality, self-directed, and self-actualization. Humanistic teaching methods contain group discussion, team teaching, individualized learning, and the discovery method. Rogers, Maslow, Knowles, and McKenzie are facilitators of the humanistic philosophy. (p. 528)

*4.5.1.3 Behaviourist Philosophy.*

The behaviourist philosophy closely resembles the liberal philosophy. Strategies of the educator that represent this philosophy are those that uphold societal norms and expectations (Gioti, 2010; Price, 2001). The educator is the controller of the learning process, and is one who predicts and directs the learning outcomes through feedback (Gioti, 2010; Price, 2001). The learner is a product of the learning process that create change in learner attitudes and performance (Gioti, 2010). The learning environment fosters mastery learning, competency based instruction, and demonstration and practice (Gioti, 2010; Price, 2001).

*4.5.1.4 Progressive Philosophy.*

The tenets of the Progressive Philosophy are to foster the well-being of society and the learner's role in it (Gioti, 2010; Boone, 2001). The educational approach is concerned with practical knowledge and skills as it relates to the world around the learner, where the learner is an active participant. According to Gioti (2010) "the

methods that are utilized are problem-solving, scientific or experiential method, simulations, group investigation, projects, cooperative learning" (p. 395).

*4.5.1.5 Radical Philosophy.*

The radical philosophy fosters change through education. This philosophy is affective in all domains of the learner's life; social, political and economic (Boone, 2001). According to Gioti (2010) the "educator is the coordinator-convener who suggests rather than directs, the teaching process" and is responsible for "raising of the critical consciousness and emancipation of the learner" (p. 395).

*4.5.2 The Philosophy of Adult Education Inventory Data*

Each instructor from the study group was asked to complete the inventory after the interview. The timing of the inventory after the interview was an attempt to allow continuity of thought from one data collection to the other method of data collection. The results that were obtained after analysis proved to represent some interesting findings. The following table is a summary of the findings:

Table 4.1: Philosophy of Adult Education Inventory (PAEI) Scores

|  | Liberal | Humanistic | Behaviorist | Radical | Progressive |
|---|---|---|---|---|---|
| H1 | 72 | 74 | 79 | 79 | 82 |
| H2 | 75 | 84 | 100 | 60 | 88 |
| H3 | 74 | 79 | 86 | 74 | 85 |
| R1 | 73 | 72 | 74 | 41 | 73 |
| R2 | 75 | 49 | 87 | 40 | 58 |
| R3 | 64 | 67 | 79 | 58 | 80 |
| R4 | 66 | 62 | 68 | 55 | 77 |
| R5 | 83 | 74 | 93 | 66 | 88 |
| R6 | 88 | 81 | 95 | 77 | 93 |

*Table 4.1: Philosophy of adult education inventory (PAEI) Scores*

The results are interesting in that there emerges some common trends. For example; H2, R2, and R5 indicate a philosophy more in line with the behaviourist's school of education. H3, R3, and R6 suggest schools of thought that could represent a mix of behaviourist and the progressive schools of thought. R4 could be described as possessing a philosophy that would be progressive. H1 and R1 might be deemed as inconclusive with possibly H1 representing a blend of philosophies, Behaviorist-Radical-Progressive and R1 as well representing a blend, behaviourist-progressive-liberal.

These varied orientations that represent the instructors' personal beliefs are relevant in that these beliefs may impact on the development of instructional strategies that could be appropriate or considered inappropriate for the EFL learner in the context of this research. These philosophies that represent affinities for a preferred style of

instruction can play a significant role in the classroom environment. For example, a behaviourist approach to learning may not represent the most appropriate approach to a diverse learning environment, or as in this study, an EFL environment. The tenets that represent the behaviourist approach may not necessarily represent, as some instructors described in the interviews, a student-centered learning environment. In fact, quite the opposite, a behaviourist approach of learning may be more in line with the tenets of a didactical approach to instruction, fostering a teacher-centered learning environment.

The research has indicated that the peer-peer learning between EFL learners can be instrumental with one learner acting as a 'silent instructor'. As indicated earlier, the EFL learner that is strong in both science and the languages can act as an intermediary between the instructor and the other EFL learners. If peer-peer learning, or co-operative learning is a successful strategy in the EFL learning environment, then the instructor will have to give the learner some control over the learning environment.

The idea of the learner sharing a large portion of the learning responsibilities would be more in line with the humanistic philosophy or progressive philosophy of learning. The research is not suggesting that the behaviourist approach to learning is a bad philosophy, but that a strict adherence to the behaviourist approach may not be the solution. A blended approach to instruction may represent greater success in the EFL learning environment. The question, 'do you feel that you are successful in the EFL learning environment' was never asked of the instructors, but the researcher did get a sense that they felt they were all successful in this learning environment. The data suggests that 5 out of the 9 instructors would fall into this notion of blended philosophies.

*4.6 Classroom Observations*

The classroom observations, like the PAEI, were another useful method of data collection that would add to the validity and the reliability of the study. The classroom observation was designed to observe a host of classroom management concerns, strategies of instruction that may be employed and modes of instruction that may be used to optimize science literacy in the classroom. These areas would reflect instructor observations but the classroom observation was intended to reflect the total learning environment and therefore as a necessary requirement would observe students' engagement, students' in-class discussions and students' response to questions asked. Greater detail of the outlined observations can be seen in Appendix J. The reader has to be reminded that the classroom observations were a two hour observational period and are no means meant to represent a comprehensive EFL learning experience. But it should be noted that the classroom observations were the last phase of the data collection in the research and as a result the interviewees had a minimum of two weeks to reflect upon their contribution to the research up to this point. This would in all likelihood have represented an opportunity for the instructors to create an instructional plan that would favourably reflect their own personal educational philosophies. It would be a showcase for the instructors', perhaps representing, an idylic learning episode. At best it would represent a brief moment in the EFL learning environment, a snapshot if you will.

The classroom observations were scheduled over roughly a three week period [May 27, 2009 – June 11, 2009]. As a result of the period representing the last weeks of the academic year, scheduling was on a narrow timeline. This proved to be problematic

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in R3's classroom observation as the course enrolment for his course was two students. As a result of scheduling, R3's classroom observation was on the last day of class and all students were absent on this day, therefore a classroom observation was not possible for R3. For the remaining eight research subjects' classroom observations were possible. The classroom sizes varied from 1 to 12 students depending on the research subject's course offering. The demographics of each class were typically Arabic with male to female populations ranging from all female to all male and a varying proportion in between for other classes.

This part of the research will focus on different aspects of the classroom learning environment in a collective sense for all the instructors and any anomalies will be noted. The discussion will look at common themes that were observed using Appendix J as a guiding reference for points of discussion.

### 4.6.1 Observed Classroom Instructional Strategies

One of the most important considerations of the classroom observation was the ability of the researcher to observe instructors' techniques/strategies as they related to the learning environment. Here observations provided evidence to support the previous findings in Chapter Four that the preferred instructional strategy by all the instructors focused on non-verbal techniques, rephrasing, and usage of visuals which at times included props. All instructors relied on nonverbal instructional techniques. Examples included the transmission of information from "discrete body movements which provided information about the items or location (e.g., pointing, nodding, holding up an item)" (Ellis & Rogoff, 1982). In many cases, instructors would become creatively animated. Unfortunately there is no comparative in this study to indicate whether this behaviour is

a response to the EFL environment, is a behaviour that is accentuated in the EFL environment or is behaviour that is unrelated to the EFL environment. Nonetheless, every instructor in this part of the study engaged and in many cases relied heavily on these instructional techniques. The gesturing not only served to convey information about content but many times became a method of infusing excitement into the learning event. Again there is no data in this study to support the effectiveness of this technique on the visual learner, but the impact has to be considered as meeting the needs of the visual learner.

These nonverbal techniques appear to be important in the EFL learning environment because they contain a wealth of coded information. For example, telling an EFL learner to look at a position through verbal instruction, if not communicated correctly, could be misinterpreted. However, a quick finger pointing seems to meet with universal appeal, and is language independent. The researcher posits that these techniques are quick innate behaviours learned, at quite an early age, to be effective for many of us in communicating needs and other information. At an early age communication in the verbal sense was limited and gesturing was a reinforced behaviour. In the EFL classroom when the communication becomes difficult we naturally revert to this earlier behaviour which at some levels is rudimentary but the nonverbal behaviour at the adult level can become quite complex and therefore just as effective as the verbal conveyance of information. Many times the researcher observed the usage of nonverbal techniques to be used when the content language was taxing in the classroom. In this situation the instruction would become more deliberate and slowed with the verbal discussion while increasing the nonverbal usage. Many times

this would lead into the second most commonly observed behaviour "rephrasing" or "reiteration". This observation directly supports what many of the instructions indicated in the interview portion of the research. The researcher observed that as the complexity and the nature of the language used increased reiteration was used more frequently.

The research regarding the effectiveness of reiteration was limited as the research plan did not provide any measures that would confirm or refute such effectiveness. At the surface, observed body language of the students when a topic was initially introduced showed little response but upon reiteration body language like head nodding would suggest some degree of effectiveness. Many instructors used frequent questioning techniques in conjunction with reiteration to check understanding of the students. Finally a summary process at the end of each topic would further ensure content understanding. Again, whether it was effective or not, all the instructors relied heavily on the use of reiteration, frequent questioning and content summary.

The usage of visuals as a strategy confirmed what was stated in the interview portion of the study. Most instructors believed that visuals played a large role in the instruction of the EFL learner. The classroom observations as stated earlier supported this position by the instructors. The most common usage of visuals involved the PowerPoint Presentations, modelling and writing on the whiteboard that included diagramming, and problem solving. There was not one classroom observation where an instructor turned his/her back to the classroom for an extended period of time and wrote volumes of content on the whiteboard. But with the usage of visuals like PowerPoint the instructor was always engaged with the learner in a visual manner, maintaining eye contact with the learner, always gauging the learner's response to the

content. The usage of PowerPoints as well, facilitated the opportunity to engage the learner more frequently with nonverbal teaching techniques.

*4.6.2 Observed Mode of Instruction*

The classroom observations allowed in a very limited sense a glimpse into the learning environment and a mode of instruction that would be employed to engage the EFL learner. This aspect of the classroom observation presented findings that would represent dominant modes of instruction. It should be noted however that because of a variety of dynamics that are present from one classroom to another classroom, the mode of instruction can vary depending on a number of variables that could influence the adoption of a specific mode one day and another mode on a different day. What this may suggest is that a two hour classroom observation statistically may not reflect necessarily the dominant mode of instruction throughout the semester. But when the data is viewed in its totality from nine instructors the data collected does present some interesting points of discussions. Therefore, the data is best viewed from the emergence of a mode of instruction resulting from the nine instructors interviewed rather than the data from the individual instructors themselves. This would be an approach of multiplicity rather than singularity where a common theme can emerge from similar events as opposed to a single event.

The field notes taken during the classroom observation all suggest that the primary mode of instruction centered on direct instructional techniques. Baumann (1988) suggests that direct instruction can have a varied range of connotations, ranging from "the use of regimented, scripted lessons" to "a generalized set of teacher behaviours and classroom conditions related to high levels of student achievement" (p.

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712). For the purpose of the research, the researcher will use a definition provided as the result of research from Kousar and Arid (2010) that suggests direct instruction refers to "academically focused, teacher-directed classroom instruction using sequenced and structured materials" (p. 99). Kousar and Arid (2010) further suggests that "thirty years of experimental research shows that direct Instruction fosters rapid and durable gains in the basic skills of language arts (vocabulary, interaction competence, reading, spelling, and writing, math, and science)" (p. 100). According to Parette, Blum, and Watts (2009b) direct instruction "emphasizes whole group, face-to-face instruction by the education professional using carefully sequenced, daily lessons" (p. 864). Further to this, Parette et al. (2009b) define a set of criteria for direct instruction as follows:

> (a) full-class or small group instruction; (b) organization of learning around questions posed by the education professional; (c) provision of detailed and redundant practice; (d) sequential presentation of material to facilitate mastery learning of each new fact, rule, or sequence before the presentation of subsequent ones; and (e) formal arrangement of the classroom to maximize recitation and practice. (p. 864 )

The previous discussion provides the context in which direct instruction is used with the research learning environment.

Chapter Five. Research Conclusions

5.0 Introduction

Chapter Five will provide a summary of the research findings based on the collected data. In this chapter the primary questions posed will be answered but in the spirit of grounded theory additional themes that have surfaced will be highlighted and further investigated. The research summary will answer the research questions posed as follows; what instructional strategies do current post secondary science instructors at one College in Qatar believe foster science literacy in an EFL environment. As well, do science instructors believe total immersion the best approach to science literacy in an EFL environment? Is the North American model of teaching/learning science appropriate in this Middle Eastern environment? Are the current modes of teaching/instruction optimizing students' chances of success for science literacy? What do you feel are the greatest challenges for the EFL learner as it relates to science?

Additionally, throughout Chapter Five the theories of Cummins will be used to support the findings in this research reaching deeper into the realm of the common underlying proficiency theory and the notion of one central processor that allows multi-language channels to advance the learners' understanding and act as a framework to formulate instructional strategies. Further into this chapter the research has provided evidence suggesting that instructional strategies that migrate the learner from low cognitive goals to higher cognitive goals as espoused by Cummins work in the transference of learning from BICS to CALP should be considered.

As well this chapter will introduce an affective strategy that through the research revealed as 'silent instructors' and what the research has referred to as 'relay-learning'.

Further to this, the chapter will also provide a summary discussion reflecting new insights that the classroom observation and the philosophical adult education inventory generated. The research suggested that there is a divide between philosophical notions of appropriate instructional methodologies/strategies for an EFL environment and the reality of practice within the classroom. Chapter Five will reflect upon this new dichotomy between the philosophical and the reality of the learning environment.

### 5.1 Summary of Findings

At first glance what becomes apparent is that science instruction of the EFL learner requires close and careful consideration of the learner's primary concerns or needs. This approach to learning is no different than in any other learning environment, it is a fundamental tenet in instruction. It is about learning about the learner or understanding the learner profile. The essential need to understand the learner is paramount in the need to develop successful instructional strategies and implement modes of instruction that foster and promote science literacy. The research suggests that in the foundational courses of the EFL learner, language plays a significant role and presents a major challenge in the learning event. Subsequent to this is the fact that the English language is presented to the learner in a full English immersion environment that created a challenge to cope with the language issues. The research has revealed that some of these informal learning strategies could involve the learner engaging in the loose English to Arabic translations in the margins of notes and communicating in class amongst themselves in Arabic given an opportunity to discuss the content of the lesson. What the research has indicated is that the learner often relies on the native language

to construct meaning, discussion earlier in Chapter Four eluded to this reality. This would suggest that regardless of the learning environment, whether it is full immersion or transitional bilingual model as the mode of instruction is irrelevant, the learner will choose, as learning strategies, an appropriate language that they feel better facilitates the learning event. This would speak to two of the research questions; do science instructors believe total immersion the best approach to science literacy and the greatest challenges that the EFL learner would face.

What the instructors in this study have indicated is that in some ways the learner will independently choose to use a language that easily facilitates their learning. In some regards the learner has indicated to the instructors in an indirect way that this is a preferred strategy to overcome their language challenges in the learning environment. As adult educators, some of the onus then would be to facilitate this learning behaviour either partially or fully. The learning behaviour in some ways would suggest that the total immersion environment is not always conducive for the learner.

The research provided findings that provided insights to the research question; do science instructors believe total immersion the best approach to science literacy in an EFL environment? As stated earlier, the research indicated that the six out of the nine instructors felt that total immersion in the context implied from this research was not the best model for language acquisition in conjunction with science concept acquisition. Three instructors felt the total immersion model was considered a logical language model for instruction primarily because of the preciseness of the science language and fears that the usage of Arabic would create imprecise science concepts learning. However, the remaining instructors felt that the use of native language [Arabic]

was important and in some cases a necessity for complex science concepts transmission.

The literature appears to support this position of the native language as a bridging mechanism for concept formation between Arabic and English. Many of the instructors felt that the total immersion model was a fit for students with high second language skills, but for learners with lower language proficiencies, the use of Arabic would be a mitigating factor for science literacy to occur. This notion of dual language would support bilingual models of instruction that favours two-way instruction or the transitional bilingual model.

In Chapter Two, there was some discussion regarding this very point. What is interesting is that this learner behaviour of native language usage supports Cummins suggestion that developing a common underlying proficiency (CUP) allows the learner the ability to choose a language to feed a central processor at the cognitive level. The research suggests that in one instance the central processor is receiving information in English and five minutes later, the learner may receive information in Arabic. In the early stages of their program multi-language channels prove in many cases for the EFL learner to be instrumental for science literacy. No matter which way you look at it, the research suggests many times that the EFL learner will use this approach as an effective learning strategy. As instructors in this study, whose sole method of communication with the EFL learner was via English, the research would suggest that instructors should become less resistant to multi-language approach and in fact develop strategies that allow multi-language usage.

Science instructors have to be cognizant of this reality and use this understanding of the EFL learner to their advantage. This in itself becomes an instructional strategy and necessitates science instructors to develop modes of instruction that facilitate this. What this suggests in many cases is that the language chosen by EFL learners personally allows them to cognitively navigate the complexities of the science concepts and challenges as they see fit. As suggested earlier by de Felix (1988), "some concepts are not language specific" (p. 3). The research from this perspective shines favourably on the work of Cummins with regards to the concepts of CUP.

The literature reviewed for this research and current findings of this research seem to indicate that as a result of the EFL learners need to sometimes engage the learning in their native language, they may sometimes turn to other EFL learners possessing high competencies in English and Science. This was an interesting finding addressing the language challenges that learners experienced in a total immersion learning environment. In fact, such behaviour would appear quite natural from a humanistic perspective. EFL learners who possessed higher competencies in language and science can, therefore, play a pivotal role in this regard. Their role can be as equally important as the role of the instructor in the conveyance of central learning goals. In fact, the research has deemed them as 'silent instructors' aiding in the learning event, acting as facilitators of the learning. The data suggests that the instructors in the research understand that the language issue is of some concern and realize that direct instruction is not necessarily the optimum learning mode. Philosophically, they understand the need to incorporate flexibility in the strategies used

to instruct the EFL learner. But as well, they demonstrate the need to be adaptive in their mode of instruction, from being purely based on direct instruction paradigms to modes of learning that facilitate collaborative learning and problem-based learning. The instructors to some extent feel that they are constrained in this regard, considering time constraints and the volume of content that is required to be delivered, another challenge brought forth by the instructors.

What this research has indicated is that the instructors believe, based on data collected from the interviews, that they are using adaptive modes of instruction to facilitate the learning but for three of the instructors the PAEI data suggests that they possess philosophies that could be described as founded in behavioural learning attitudes towards learning. The behavioural learning philosophy lends little to adaptive modes of instruction. Further to this the PAEI data indicates three instructors exhibit a blend of behaviourist and the progressive. As well two of the instructors could be classified as Behaviorist-Radical-Progressive and behaviourist-progressive-liberal, respectively. The final instructor would be best described as inconclusive. The data with regard to shared or blended philosophies, in itself, would tend to support the notion that some of the instructors philosophically would hold adaptive learning strategies and modes as espoused in the interviews towards learning in the EFL environment.

The final data collection, the classroom observation, suggests otherwise. The classroom observations overwhelmingly suggest that the single most commonly used mode of instruction with the exception of one instructor was direct instruction, which would fall in the domain of the behaviourist or liberal philosophy of learning. What could account for this discrepancy from what the instructors believe to be true and the reality

that exists in the learning environment? The research does provide some insights into this question. Immediately the research presents an instructional dilemma that spoke directly to the question; what do you feel are the greatest challenges for the EFL learner as it relates to science?

The instructors understand the need to be adaptive in the mode of instruction particularly when dealing with the language concerns of the learner. The impact on science literacy is dependent on overcoming the English language concerns. Once the English language is minimized as a challenge then the science literacy becomes a greater focal point for the learning, leading ultimately to greater science literacy. However, the learning goals represent a large number of science concepts and science language that must be covered within a time-frame that has the instructors choosing a mode of instruction that provides a middle ground, perhaps. That compromise would appear to be in the form of direct instruction; a teacher-centered environment, which is highly structured allowing for a high paced delivery. This mode of instruction allows for redundancy in the lesson and the usage of highly visual content delivery, all of which the research suggests is important for the EFL learning environment. The direct learning mode does not, many times allow for the more learner-centered philosophies of learning that would allow for more student-student learning interactions. These interactions provide a wonderful opportunity for EFL learners to address language issues as they deem appropriate. But more importantly, as stated earlier, the 'silent instructor' can play a greater role in bridging language and science concepts moving towards higher levels of science literacy.

The silent instructor can represent a tremendous learning asset in the learning environment and in many cases can be considered a resource. In some respects the silent instructor or usage of the native language would create a bilingual language environment that the research suggests is important for the EFL learner. However, full immersion runs the risk of superficial learning or surface learning that caters to "an emphasis on cramming and learning of facts for short-term memory" (Russell, 2004, p. 2). Upon reflection it would appear that cooperative or collaborative learning could be used in the classroom in conjunction with the notion of a 'silent instructor'. The notion of cooperative or collaborative learning in itself is a point posited by Roschelle, Rafanan, Bhanot, Estrella, Penuel, Nussbaum et al. (2010) suggesting that allowing the students to engage in group classroom discourse plays a significant role in increased learning. The idea of placing a weaker student with a stronger student is not that foreign in many educational environments. For example, Hui-Fang (2009) discusses the dual-spiral collaborative learning model, where the stronger student in many ways mentors a learner with weaker conceptual understandings, promoting the learning in a successive manner.

The idea of allowing one student the ability to act as a liaison between the instructor in the English and converse in the native language, Arabic, has tremendous potential for adaptive learning, allowing the students to become their own agents for learning. The learning from this perceptive becomes truly learner centered. The argument could be made that this is unethical or taking advantage of the learner. But this is really an opportunity for the learner to take more control of the learning and the instructor acting more like a facilitator. One can only surmise that the anxiety associated

with the learning becomes diminished, although the research does not confirm this but classroom observations reveal a relaxed attitude between learners engaging each other in a cooperative manner. The peer instruction would afford the learners to build confidence in the learning process as long as the learning environment has been established as a respectful learning environment. Further to this, the use of the native language could be considered a form of learner autonomy, or autonomous learning. Hikyoung (2008) posits that autonomy is achieved through collaboration and scaffolding provided by peers. Instructional strategies that facilitate this form of autonomy learning is an important precept in science literacy. Balcikanli (2008) suggests that "the promotion of learner autonomy is an important explicit goal of the language programme within the courses" (p. 9). Balcikanli (2008) citing Little (1994) believes that "learner autonomy does not arise spontaneously from within the learner but develops out of the learner's dialogue with the world to which he or she belongs" (p. 431). Balcikanli (2008) suggests that autonomy is a process that with time allows the learners to take responsibility for their own learning as a result of strategies and techniques applied in the learning event.

Related to the previous discussion, the instructors expressed, based on the research, some concern regarding learner autonomy as it relates to peer-to-peer learning (cooperative/collaborative learning) and how to validate the accuracy of the content conveyed when this occurs. The problem as expressed earlier in the research suggests that discussion in the native Arabic could be problematic as a result of the instructor not being fluent in Arabic. This would raise the issue of continuous learner feedback in a formative sense, allowing the 'silent instructor' to convey the main science

concept to another learner that is weak in language skills, in the native Arabic. The instructor would then ask the weak student to explain in a concise manner his /her understanding of the concept. This is what could be called 'relay-learning' and could be effectively used to assess the understanding of concepts using English. Caution would have to be used, as all attempts should be used by the instructor him/herself to engage the weak student without any aid from the silent instructor in the initial attempts to convey a concept. This is important from a number of considerations.

First, the classroom dynamics are adversely affected as other classmates could perceive the instructor interaction with the silent instructor as inequitable treatment, where the perception is one learner receives preferential treatment over another. This is not to suggest that this would represent a dominant perception. Nonetheless, it is a consideration that could not be ignored. Other concerns that may arise in this relationship is the weaker student feeling less adequate and a feeling of being stigmatized. Care must be used because any one of these considerations could create a negative impact on the classroom dynamics. However, the learner should be reminded that this mutual learning is typical and equally beneficial so that the learner can learn from each other. This approach to the EFL learner's literacy is important and the instructional strategy should recognize the merits of mutual learning, considering the next step for the learner is integration into the workforce, where learning from your peers is quite natural.

The research demonstrated that a strategy used to address the challenges facing the EFL learner with the language concerns is to increase the frequency of visuals. A higher frequency of visuals employed in the EFL learning environment accomplished

two goals; minimizing English language challenges reducing cognitive loads in the learning environment and providing context for abstract scientific concepts. The notion of the instructor guiding the EFL learner from a context embedded learning tasks, relying on the usage of visuals to the eventual learning outcome of context reduced learning tasks relying on the language itself as the main cognitive stimuli, is similar to what Cummins espoused for language acquisition. Nonetheless parallels can be drawn for the natural progression in science literacy. Science literacy would possess those same goals and objectives that Cummins espoused for language acquisition and take the learner from the less cognitive demanding learning environment to the more demanding cognitive learning environment. Once the learner has reached the more cognitively demanding learning environment, the reliance of visuals can be reduced so that the science language becomes the only cues. The research data suggested that most instructors felt that their EFL science students at the higher levels required less context in the learning, however instructors that also taught at the introductory level did acknowledge the greater need for strategies where the learning has greater context. Visuals in many cases were the most effective way to provide the context. What this would suggest then is a continuum of learning from the context rich learning environment to the context reduced learning environment. What the research suggests is that visual learning as an instructional strategy in the early stages of the learning can play an important role for the EFL learner in the attempt to reach higher science literacy goals. The role of visuals cannot be underestimated in overcoming language concerns, but many of the instructors in the study suggested that visuals by themselves are not adequate but that a lot of care must used in the selection of visuals that represent the

Arabic contextual way of life.  It has to be real for them.  Inappropriate usage of visuals that have no Arabic context will further complicate the learning event.

The research has highlighted, as discussed earlier, the need for science program design to provide for the EFL learner greater flexibility regarding time constraints imposed because of the heavily laden science content in the various course outcomes. The research did not investigate possible solutions other than the most obvious solution of reducing course content.  What has to be considered in this learning environment is that it is not the learner's native learning environment and thus there has to be a conscious effort by the instructor as a strategy to ensure a reduction in cognitive loads.

Additionally the research in both the interviews and the classroom data sets suggest that rephrasing is an important strategy for the EFL learning environment in an attempt to overcome language challenges. Presenting a science concept explained many ways with slight variances without affecting the structure of the science concept or term has a positive learning outcome. Young (2005) supports this approach for science teaching stating;

> Provide multiple exposure and usage of words: Promote
>
> accessibility, active manipulation, and internalization. Examples
>
> of multiple exposures for science terminology are word
>
> analogies, associations, classifications, definition examples, same-meaning
>
> words, opposite-meaning words, word origins, word parts, context clues, and
>
> close statements. (p. 12)

Mangubhai (2005) suggests that the communicative approach of rephrasing supported by research from Ellis (2005), Krashen (1994), Lighbown (2000), and

Van Patten (2003) allows "improved outcomes in our foreign language classrooms are more likely to occur if the amount of input in the second language [English] in class is increased substantively" (p. 204). Mangubhai (2005) states that rephrasing not only allows the EFL learner an opportunity to overcome language comprehension concerns, that would normally lead to incomprehensible content, but that the rephrasing provides for the learner alternative words that can denote the same context while expanding the learner's vocabulary. Mangubhai (2005) further adds that rephrasing is a teacher driven behavior that requires "active thought on the part of the teacher" (p. 206). This would suggest that the strategy of rephrasing becomes a discretionary behavior that the instructor uses as the classroom environment would dictate.

The instructor therefore must be cognizant of a variety of classroom cues that may include physical gestures or body language or increased learner verbal discussion amongst them, just to identify a few cues. This is an important consideration in any learning environment, but in the EFL environment the awareness of these concerns becomes enhanced. Cunningham-Florez (1999) when discussing the Brown (1994) and Burns and Joyce (1997) research with adult EFL learners indicates that the instructor in order to effectively communicate must "manage discrete elements such as turn-taking, rephrasing, providing feedback, or redirecting" (para. 3). Tan (1998) working with EFL mathematics learners indicated that word problems that were rephrased "to make them easier for comprehension helped students solve more problems correctly than working with the original problems from textbooks" (p. 60). It should be understood that rephrasing is not the same as repetition. Repetition from the standpoint of this research suggests repeating the same science concept with little variance in the

language, therefore constraining the conveyance of a science concept to 'fit' a particular sequence of wording. Lin (2005) citing Tsui (1985) research suggests that "paraphrase would provide a better linguistic input than that of exact-repetition"(p. 46). In summary, a strategy of rephrasing is important for the EFL learner, especially for those learners that have low English language competencies in a total immersion environment.

The research data resulting from the research question; Is the North American model of teaching/learning science appropriate in this Middle Eastern environment?, further suggests that the EFL learners from a Middle Eastern context rely on the memorization of ideas and concepts, which really caters to low level learning. To expand the learner's science literacy, a strategy that would enhance science literacy would be allowing the learner to construct their own precepts and allow personal meaning to occur. One of the concerns that the instructors identified when considering North American models of teaching as compared with Middle Eastern models was the reliance of the learner on science concept regurgitation espoused in the Middle Eastern model. One strategy to avoid regurgitation as the interview data suggested is the use of approximate language in the early stages. The use of approximate language in the foundational science courses for many of the instructors was an acceptable practice. The notion of expanding the science knowledge using strategies similar to scaffolding in other learning environments allow the learner to migrate from less complex cognitive loads to more complex cognitive loads. The use of approximate language for the research subjects was more of a means to an end. The end represents complete competency and fluency in the use of scientific language and scientific articulation that is more precise at a later time in the studies.

The idea of migrating the learner from low cognitive goals to higher cognitive goals echoes much of what Cummins described as the transference of learning from BICS to CALP. Further to this point is that the use of approximate language as a strategy in many ways reduces the English fluency requirement in order to gain a general science concept. Thus allowing for a transitional approach to the EFL learning from a limited English vocabulary to a more expansive English vocabulary later in their program. The idea is not to let the English language become an insurmountable barrier to the science understanding of concepts. The strategy of approximate language usage would represent one aspect of adaptive learning for the EFL learner. However, the previous statements are not suggesting that the strategy of approximate science language usage used in an English context, was not a final outcome of the learning but rather an initial building block for more precise language usage later in the EFL learner's program. One can only speculate that this makes the learning less threatening to the EFL learner, where the EFL learner is not only concerned about the compounding issues of correct English skills but as well developing correct science understandings. The instructor as the data suggests has acknowledged this as a reality in the learning environment.

Further to the differences in the Western model and the Middle Eastern model of learning most instructors felt that the largest differences were related to the level of cognitive learning outcomes. Instructors sensed that the lower cognitive skills of memorization were acceptable outcomes for the Middle Eastern learner. Whereas, the Western model of learning was more representative of the higher cognitive learning outcomes that could be realized through inquiry-based learning, instilling independent

thought processes. The sense was that there were greater expectations for the western student. The instructors suggested that the EFL's style of learning was probably the product resulting from previous learning experiences. In Chapter Four there was considerable discussion about the data, but in this chapter the discussion is more about what the instructor can do to create strategies and of instruction that foster science literacy. One question that should be asked is why the learner is reliant on the rote memorization.

Cox (2008) when describing the EFL learner suggests that adult learners engaged in learning a foreign language becomes "very intimate because of the embarrassment associated with the likelihood of misspeaking" (p. 35). Cox (2008) adds that it is difficult for the learners as adults themselves up to the vulnerability that this learning experience would bring. The research posits that it may be that rote memorization is a safe method of learning, it is right or wrong. Therefore the learner understands that the outcome is highly predictable, and perhaps this in itself acts as a motivator that allows many learners to engage in rote learning. Even though rote memorization can be time consuming, for the learner it is a safe way to learn. Aoki (2008) suggests that Asian learners [Middle East] come from a Confucian philosophy of education whereas the western learners come from the Socrates philosophy of learning. Aoki (2008) suggests that in "Confucian philosophy, studying means finding a good teacher and imitating his words and deeds" (p. 35). Further to this Aoki (2008) suggests that "Western education the learners are encouraged to engage in debate" and "Confucian education has emphasized rote learning and memorization" (p. 35). What Aoki is suggesting echoes the sentiment of many of the instructors as summarized in

Chapter Four, however Aoki (2008) suggests "that they need to be told clearly what are expected as students and they need to be taught how to meet such expectations" (p. 38). This avoids any misunderstandings about their role as a learner. Eventually, they will understand they have more responsibility as a learner, and the instructor will not become the center of their learning. One approach that could be pursued according Wagie & Fox (2005) suggests that the changes must happen at earlier levels of the learner's education, particularly in the primary and secondary level of their education. These skills must be a reality before they enter the post-secondary environment. More importantly, increasing the English competency levels in the primary and secondary levels will drastically "decrease the reliance for the remedial English foundation year now needed for most of the students entering higher education institutions" (Wagie & Fox,2005, p. 284). This would provide a wonderful solution to the resolution of language concerns for future generations, but the question for this study is what about the learner now. From the perspective of this research it is about instructional strategies that build up the learner and focus on the success of the learner, allowing the learner to make mistakes that are a natural part of learning, the focus should not be on accuracy at the early stages of the EFL program. It is about letting the learner understand that there are many ways to describe a concept, the focus of the learning should not confine the learner into a box of concepts and rationales. It is about concept building from any point not always from a predetermined 'right point of view'. It is about accepting crude concepts and through positive reinforcement, the learning of concepts becomes refined. The learning environment becomes learner-centered, and the anxiety for learning lessens. But more importantly it allows the learner to accept the notion that their

concepts are valid, no matter how crude their concepts are, it is their concepts and they are valid.

To most of the instructors a mode of instruction that fosters inquiry-based learning as opposed to rote learning was important. This was a response to the research question; are the current modes of teaching/instruction optimizing students' chances of success for science literacy? In some respects, the attitudes of most instructors can be summarized by a quote from the Educational Broadcasting Corporation (2004) website;

> Memorizing facts and information is not the most important skill in today's world. Facts change, and information is readily available…Educators must understand that schools need to go beyond data and information accumulation and move toward the generation of useful and applicable knowledge. (para. 5)

Looking beyond the critical thinking and encompassing the bigger picture, R5 defines the Western style as an "inquiry type learning approach". Blanchard, Southern, and Granger (2009) indicate that "Inquiry-based teaching is strongly recommended by the American Association for the Advancement of Science and the National Research Council as a strategy to develop deeper student understanding of science to apply to the everyday world" (p. 323). In the North American frame of reference, the educational mood then endorses inquiry-based teaching/learning as having a tremendous impact on the realities of many teachers in this field. Since the research subjects represent science teachers from this frame of reference, then it is no surprise to hear them embody this model of teaching/learning. Bybee (2004) as cited in Blanchard, Southern, and Granger (2009) suggests, "Inquiry as a teaching strategy should capture that spirit

of scientific investigation and the development of knowledge about the natural world" (p. 9).

Some recent research suggests that this lack of creative or critical thinking, normally associated with inquiry-based learning may not be unique to the Middle Eastern context. A study by Donald, Bohm and Moore (2009) report that many Australian universities complain that many of their first year students "fail to think creatively and have difficulty using logical reason in developing conclusions" (p. 579). Donald, Bohm & Moore (2009) echoing Splitter and Sharp (2003) suggest;

> First year students cannot sustain any questioning of their opinions and show little regard for exposing hidden assumptions. This is the result of secondary school students often being taught a string of facts and asked to assign major ideas or theorems to memory without the creative process of scientific inquiry. (p. 579)

The inquiry-based model or cooperative model of learning has a significant role in science literacy which the instructors have identified philosophically. However as stated earlier the reality for the mode of instruction is more direct instruction, more so out of the learning environment . The inquiry-based model or cooperative model would represent the Progressive philosophy whereas direct instruction would represent the liberal or behaviourist philosophical frame of reference in the Philosophy of Adult Education Inventory (PAEI).

Finally, the research was amiss to not mention secondary challenges that the instructors have identified. Again the instructors identified language as the biggest

challenge for the EFL learner in the context of this research. However, many instructors further indicated that secondary challenges for the learner were;

1.    Inappropriate text material, for example, using prescribed textbooks with language designed for learners where English is the first language.

2.    Stress created on the learner with weak language skills resulting in negative self-esteem concerns.

3.    The transmission of science concepts in a weak English environment require considerable amount of time with 'self-editing' and reiteration of concepts.

4.    A realization that science concepts conveyed in large blocks of information poorly suits the EFL learner and require fragmentation of concepts into more manageable information blocks.

5.    Language challenges resulted in lower learner outcomes or expectations.

6.    The difficulties of creating an effective learning environment that allow for learner socio-cultural discourse reflection.

Looking back at the findings, a large part of the instructors' strategies in the EFL environment focus on overcoming the variety of challenges identified earlier in the learning environment. This is natural since, challenges can be considered barriers to the learning, and once removed a dynamic learning evolves.

### 5.1 Study limitations

Research by its very nature can pose a number of challenges. This study was no different. The following limitations were identified within the research design;

1.    The study was based on the use of nine subjects which does not allow the results to be generalizable. The study only investigated instructors with a North

American frame of reference. To allow a more global perspective, additional research subjects that have a wider perspective could be added.

2.      The study utilized one campus. Each campus possesses its own set of external and internal conditions that can create a different dynamic in the research, thus producing data that would reflect these realities.

3.      The greatest single challenge was the lack of credible research in the way of substantive articles related to the Middle Eastern context. In fact, the electronic journals and databases such as; Academic OneFILE, CRCnetBASE, Education Research Complete, ProQuest Education, ProQuest Science Journals were filled with articles predominantly related to the West and Far East. One possibility is that there may be a wealth of research but that it may be written in Arabic with no accompanying translations of the articles to English. Another consideration is that Qatar representing largely a Bedouin society until recently in the last thirty years, would not have cultivated a large repository of research.

4.      Potential for bias always exists but every attempt was made to minimize this potential.

### 5.2 Recommendation for Future Research

All participants of this study were Canadian college instructors, possessing personal experiences in large part that could represent a North American pedagogy of instruction. The study could be widened to include other instructors from other institutions representing a greater variation in personal instructional experiences and context. This group was a small sample which could be problematic in creating generalizations of the research findings to other Middle Eastern learning environments.

With the understanding that instructors possessing variances in age, socio-economic backgrounds and cultural experiences comes the understanding that in comparison to other instructors from different backgrounds there could be the potential for heterogeneous attitudes and values, as well as different ways of expressing themselves.

The research could focus on the EFL learner thereby expanding the research to all stakeholders in the learning event. A more expansive study would include EFL learner sample cohorts that would provide potentially useful data and a research perspective shedding light about a more appropriate instructional strategy or mode of instruction that would enhance the EFL learner's environment from their point of view or frame of reference. The inclusion of EFL learners would bring to the equation the nuances that this research did not discuss in any detail, themes like cultural expectations and learner expectations for example.

Future research could take the research findings like those presented here as a foundation for professional development. Additional studies could be pursued to determine the effectiveness of the professional development on the modified practice, or is there still a more effective way to engage the learner? Either way the research requires further research, because with every new answer comes a new question.

### 5.3 Further Reflection

This chapter reviewed a number of findings that provide insights into all five questions posed by the research. Looking at all the research participants' data there is ample evidence that the instructors were some of the most dedicated and resourceful instructors that I have met. What was important in this research was that the educator

was willing to be educated and they all had a genuine desire to understand the learner. This is the essence of this research; it was a chance for discovery and introspection, a journey not only for myself but also for those who participated. All the instructors articulated a desire to be better educators, and indicated a willingness to optimize the learning environment: to create an environment that was complimentary for the learner and never antagonist.

For me personally, the outcomes and desires were no different. The research for me presented an opportunity to ask some basic questions "What am I doing?", "Can I do it better' and 'Is the learning meaningful? Through the course of this research, I have undoubtedly been affected in a positive way and it is because of this research that I try to engage in affective instruction. It is about caring and about letting learners know that they are the real reason we teach. It is about learning about the natural world and the wonders that abound. It is about learning with no barriers in a boundless way. For me it is the love of teaching!!!

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*Appendix A*

The Score Report

The CAEL Assessment Score Report provides a profile of English proficiency in the four skills of academic listening, reading, writing and speaking. CAEL Assessment results range from band level 10 to band level 90. Each band score corresponds to a descriptive statement summarizing the level of English of a test taker.

**CAEL Band Descriptors**

80- Expert User: Demonstrates exceptional competency required

90 for academic English use. Is fluent, accurate, flexible and adaptable in the academic setting.

70 Adept User: Demonstrates high level of competency required for academic English use. Is fluent, accurate, flexible and adaptable in the academic setting.

60 Competent User: Demonstrates satisfactory competency in using academic English. Minor limitations in fluency, accuracy, and flexibility in the academic setting.

50 Competent but Limited User: Demonstrates a degree of control in using academic English but fluency, accuracy and flexibility are somewhat limited in the academic setting.

40 Marginally Competent User: Demonstrates uneven control in

using academic English. Fluency, accuracy, and flexibility are
impediments to overall competence in the academic setting.

**30** Limited User: Demonstrates constrained competency in
academic English use. Noticeable problems in fluency
accuracy, and not sufficiently flexible in the academic setting.

**10-** Very Limited User: Demonstrates severely constrained
competency in academic English use. Insufficient fluency,
**20** accuracy, and flexibility in the academic setting.

## How are the band scores interpreted?

**10-** need to increase your level of academic English before you

**40** meet admission requirements for Canadian University degree
programs.

**50** may meet academic English language requirements for
admission to a few Canadian degree programs.

**60** meet academic English language requirements for admission
to some Canadian University degree programs.

**70-** meet academic English language requirements for admission

**90** to Canadian University degree programs.

Electronic Source:

http://www.cael.ca/taker/resultsmean.shtml

Sample Email:

Good morning

I am presently in the final stages of completing my Master of Education at Memorial
University titled: ***A study to determine self-reported instructional strategies that***
***foster science literacy in an EFL (English as a Foreign Language) environment.*** I
am writing to invite you to participate in the data collection requirement for my thesis. I
have deliberately requested you to participate as a result of your experiences as a
science instructor in an EFL environment. I feel that you possess a wealth of
knowledge and expertise regarding this topic and I am hoping that you can share with
me these educational experiences. I am fully aware that this time of the year is a hectic
time for all involved; however I would truly appreciate your participation in this phase of
the research. If at any point you wish to withdraw from the study, you have the right to
exercise that option. I approximate your time requirement should not exceed 1½ hours,
for the entire process, see attached documents for further details.

The proposal for this research has been reviewed by the Interdisciplinary Committee on
Ethics in Human Research and found to be in compliance with Memorial University's
ethics policy. If you have ethical concerns about the research (such as the way you
have been treated or your rights as a participant), you may contact the Chairperson of

the ICEHR at icehr@mun.ca or by telephone at (709) 737-8368. You may also contact my supervisor, Prof. Robert Shea at rshea@mun.ca or (709) 737-6926. **ICEHR reference No. 2008/09-094-ED**

Thank you for your time and consideration.

Kindest Regards

Mark

## REQUEST FOR SUPPORT FROM SCIENCE INSTRUCTOR

### Informed Consent Letter

Mark Noseworthy, Building 7, Off. 206

College of the North Atlantic - Qatar

P.O. Box 24449

Main Campus - Duhail

68 Al Tarafa, Duhail North

Doha, Qatar                                                           May 05, 2009

Dear Instructor:

My name is Mark Noseworthy and I am a graduate student in the Faculty of Education at Memorial University of Newfoundland working towards a Master's of Education in post-secondary studies. As part of my thesis research, I am requesting your support and participation. This research is being supervised by Professor Robert Shea. I am writing to seek your consent to participate in study investigating the EFL learner in a science environment and the many challenges that these students are confronted with. In light of the realities facing the EFL learner in terms of English competencies, the learning can be compounded with the additional rigors of science literacy. As a result a greater understanding of the Qatari learner, learning science in an EFL environment is required. I invite you to consider becoming a participant in this

research endeavor. It is my belief that by examining the results of administered questionnaires and personal interviews within the post-secondary system, and finding validation in the research results, I will identify a model that will allow the EFL learner a greater potential for science literacy in the pursuit of a post – secondary education.

The methodology that will be employed to collect data will include the administration of a questionnaire that will act to pre – screen subjects to determine the suitability of the subject as a participant. Once selected, subjects will be asked to participate in a semi – structured interview where 5 questions will be asked. All of the interview sessions will be recorded via a tape or digital recorder and will be transcribed and later analyzed. After each interview, the transcript and interview summary will be sent to the instructor to check for agreement with the researcher's interpretations. The data will be stored in a safe with the researcher possessing the only key and the code to an electronic keypad lock. The data will be held in this secure location and will be destroyed after publication and appropriate peer review process has occurred. Any data in electronic format will be encrypted and stored on a writable CD-Rom in the safe as well.

Finally, a passive classroom observation will be scheduled as a final follow-up to the interview.

Possible Benefits of Being a Part of this Research Study

- The direct benefit from the research for you is that the research will allow you to express strategies that would better facilitate teaching in the EFL environment, from your personal perspective.
- Your responses will provide further insight into the challenges/opportunities that are realities for instructors at the College of the North Atlantic, Qatar Campus.
- Your insights will provide valuable insights when considering future programming and curricula development that, potentially, will better meet the many needs of the EFL learner in a science environment.

Possible Risk or Discomfort of this Research Study

- There are no risks as a result of your participation in this study. Your personal thoughts will be analyzed to construct common themes that reflect perceived relationships to the research questions.

Confidentiality of Your Data Profile

- Considering the nature of this study and the protocols described; every reasonable effort will be made to ensure the privacy and confidentiality of any information provided through the procedures and protocols listed. Your privacy and research records will be kept confidential. Access to the records will be granted to Mark Noseworthy and Prof. Robert Shea (Research Supervisor)
- The results of this study may be published. However, any data that you contributed will be coded so as to protect your identity. Each participant will be assigned an alphanumeric code that will be used to identify information regarding gender.
- This research will be accessed by members from a peer review committee

Ownership and Documentation of Research Findings

- All research findings, i.e. data will be secured in a locked safe at all times, and an alphanumeric code will be the only identifier of the participant.
- All research data will be destroyed after publication and appropriate peer review process has occurred.

Volunteering to Be Part of this Research

- Participation in this research is completely voluntary. You are free to disengage from the research at any time.
- If you choose **not** to participate, or if you withdraw, there will be no penalty.

If you agree to participate in this study, please sign below and return one copy to the me (Rm. 07.2.06) or Maria Avery (Rm. 06.2.12) . A second copy of this informed consent should be kept for your records as you see fit. If you have any questions or concerns, please do not hesitate to contact me at the College, Qatar Campus, 011-974-513-2330. If at any time you wish to speak with a resource person not associated with the study, please contact the Associate Dean, Graduate Programmes in Canada, at 001-709-737-3402. I would appreciate it if you would please return this sheet and the pre-screen interview questions to me or Maria by May 11, 2009. If you wish I can provide alternate methods of collection.

Instructions

- The pre-screen questionnaire will take approximately 15 minutes to complete.
- Complete the consent form below and attached questionnaire.
- Please write legibly and do not remove the staple or separate the sheets.
- If you wish to participate, please contact me via email for collection of both consent form and pre-screen questionnaire. A non-response to this consent letter will be equated to a desire to **not** engage in the research.

Note:

The proposal for this research has been reviewed by the Interdisciplinary Committee on Ethics in Human Research and found to be in compliance with Memorial University's ethics policy. If you have ethical concerns about the research (such as the way you have been treated or your rights as a participant), you may contact the Chairperson of the ICEHR at icehr@mun.ca or by telephone at (709) 737-8368. You may also contact my supervisor, Prof. Robert Shea at rshea@mun.ca or (709) 737-6926.

I would like to thank you for your time and consideration.

Yours sincerely,

Mark Noseworthy

By agreeing to participate in this study, you agree that:

- You have fully read this informed consent form describing the research project.
- You have had an opportunity to question any persons related to the research and have received satisfactory answers.
- You understand that you are asked to participate in this research knowing in its entirety the risks and benefits of the research as outlined.

**Researcher Statement**

I have carefully disclosed all knowledge regarding the nature and all protocols related to the aforementioned research. I hereby certify that to the best of my knowledge, the participant of the study fully understands his/her rights as a participant as outlined in the informed consent form.

I, _____, as of _____

(Print Name)                                              (M/D/Y)

consent to participate in this research project, *A study to determine self–reported instructional strategies that foster science literacy in an EFL environment.*

**(ICEHR No. 2008/09-094-ED)**

_____

Signature

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**PRE-SCREEN INTERVIEW QUESTIONS**

*Instructions:Please clearly write your answers to the questions provided. If you*

*feel more space is required, please feel free to attach any extra*

*response material to this questionnaire sheet.*

1. Briefly describe your role as a science instructor in an EFL learning environment.

2. Consider what stage your student was at, upon entry into the program. Briefly describe the learner's profile for your courses (See attached suggested Student Profile Checklist). Feel free to either respond in the space provided or you can use the attached checklist.

3. Do you think conversational English language or small talk represents a comprehensive grasp of the language?

4. How do you make learning comprehensible?

# Student Profile Checklist

Instructions:

Please accept this as a sample checklist used to formulate your profile or feel free to accept this as a comprehensive student profile checklist for the purpose of question #2 on the pre-screen questionnaire; i.e. if you leave question #2 unanswered then the checklist will be used to generate a response for question #2. Notice that the response cells are limited, and in some questions "yes" or "no" reply is acceptable.

Question #2:

Consider what stage your student was at, upon entry into the program. Briefly describe the learner's profile for your courses (See attached suggested profile checklist). Feel free to either respond in the space provided or you can use the attached checklist.

|  |  | Response |
|---|---|---|
| Demographics | Age Range? |  |
|  | Cultural background (Arab, Asian, etc or report a percentage of a cultural mix)? |  |
|  | Ratio (approx. male/female)? |  |
|  | Is there an identified student learning style preference? |  |
| Motivation | Learning for interest? |  |
|  | Learning to gain employment qualifications? |  |
|  | Learning to move to another job? |  |
| What they know | Is the subject new to them? |  |
|  | Do they have some experience in the subject area? |  |
| Particular needs | Are there language difficulties? |  |
|  | Should their prior knowledge be recognized? |  |
|  | Do you feel that the prior science literacy is high or low? |  |

Adapted from:
http://www.tds.holmesglen.vic.edu.au/donline/documents/learnchecklist.pdf

Rationale for Pre-interview questions:

Question #1 is an attempt to profile the research subject in context of the EFL environment. This question is trying to gain some insight into individual characteristic traits. The profile that be valuable in choosing the appropriateness of the subject for the research. Established Criteria will be;

- An awareness of the learning environment, learners needs, and a strong tendencies to act as a facilitator.

- Characteristics that reflect patience and tolerance (unbiased frames of reference)

Question #2 is an attempt to demonstrate the subject's understanding of the learner.

- Concepts of the learner would be awareness of the EFL environment and the relationship to the learner in a science rich language environment.

Question #3 is an attempt to shed some light on the subject's abilities regarding language acquisition of the learner. The language acquisition skills are important concepts related to this study. These skills are essential for trilingual studies.

Question #4 is attempt to gain some insights into the subject's teaching strategies.

*Appendix E*

**EXPLANATION OF INTERVIEW AND CONSENT**

The following is a continuance of my work towards a master's of education in post-secondary studies, I am required to submit a thesis. My thesis topic is entitled *A study to determine self-reported instructional strategies that foster science literacy in an EFL environment.*

The purpose of this interview is to provide insight and any perceptions regarding your experience regarding science literacy in an foreign language environment.. *The subsequent classroom observation will allow further theme development and is in no way meant to be critical or judgmental.*

The proposal for this research has been approved by the Interdisciplinary Committee on Ethics in Human Research at Memorial University. If you have ethical concerns about the research (such as the way you have been treated or your rights as a participant), you may contact the Chairperson of the ICEHR at icehr@mun.ca or by telephone at 737-8368. You may also contact my supervisor, Prof. Robert Shea at rshea@mun.ca or 737-6926."

By agreeing to participate in this study, you agree that:

- You have fully read this informed consent form describing the research project.
- You have had an opportunity to question any persons related to the research and have received satisfactory answers.
- You understand that you are asked to participate in this research knowing in its entirety the risks and benefits of the research as outlined.

**Researcher Statement**

I have carefully disclosed all knowledge regarding the nature and all protocols related to the aforementioned research. I hereby certify that to the best of my knowledge the participant fully understands his/her rights as a participant as outlined in the informed consent form.

Participant:

_____

I understand that this interview is part of the research project *A study to determine self–reported instructional strategies that foster science literacy in an EFL environment*, to which I previously consented to participate. I understand that the researcher will keep my participation in this interview confidential. I understand that I am free to stop participating in this interview at any time. I understand that I may ask questions and expect a reasonable answer.

I agree to participate in this interview.

_____       _____
Signature                                                                         Date

Notes:

- The semi-structured interview will take approximately 30 to 40 minutes

According to US General Accounting Office book, "Developing and Using Questionnaires" (1983) Chapter 9, you should do the following:

1. Explain to respondent the reasons for asking the questions,

2. Make response categories as broad as possible.

3. Word the question in a nonjudgmental style that avoids the appearance of censure, or, if possible, make the behavior in question appear to be socially acceptable.

4. Present the request as factual matter as possible.

5. Guarantee confidentiality or anonymity

6. Make sure the respondent knows the info will not be used in any threatening way.

7. Explain how the info will be handled

8. Avoid cross classification that will allow for pinpointing responses.

*Appendix G*

Interview Protocol:

Time of interview:

Date:

Place:

Interviewer:

Interviewee:

Position of Interviewee (Field):


Briefly describe the project:

Questions:

1.    Is total immersion the best approach to science literacy in an EFL environment?

2.    What strategies do foreign trained instructors use to enhance science literacy?

3.    Is the North American model of teaching science appropriate in this Middle

Eastern environment?

4.    Are the current modes of teaching optimizing students chances of success for

science literacy?

5.    What do you feel are the greatest challenges for the EFL learner as it relates to

science literacy in this foreign language learning environment?

(Thank the individual for participating in this interview.  Assure him or her of

confidentiality of responses and potential future interviews)

**REQUEST FOR SUPPORT FROM THE PRESIDENT'S OFFICE**

Dear Dr. Hal Jorch,

During our earlier meetings, we discussed possible research topics for my work towards a master's of education in post-secondary studies. The result is a research proposal entitled *A study to determine self-reported instructional strategies that foster science literacy in an EFL environment.* In conducting this research, I hope to provide information that could provide insights into the educational experience at the College of the North Atlantic, Qatar campus.

This study is designed to answer fundamental questions regarding science literacy in a English *as a second language* environment.

1. Is total immersion the best approach to science literacy in an EFL environment?

2. *What strategies do foreign trained instructors use to enhance science literacy?*

3. Is the North American model of teaching science appropriate in this Middle Eastern environment?

4. Are the current modes of teaching optimizing students chances of success for science literacy?

5. What do you feel are the greatest challenges for the EFL learner as it relates to science literacy in this foreign language learning environment?

Attached is an abbreviated version of the full proposal that I hope you are willing to support. If so, would you please send an email message regarding your support? If you would like more clarification, I would be happy to meet at a suitable time. Please note that completion of the questionnaire and interviews will occur towards the end of April.

This study has the approval of the Interdisciplinary Committee on Ethics in Human Research at Memorial University (**ICHER Approval No. 2008/09-094-ED** )

Sincerely,

Mark Noseworthy

Office: 07.02.06

mark.noseworthy@cna-qatar.edu.qa

513-2330

## PHILOSOPHY OF ADULT EDUCATION INVENTORY

(August, 1993[a])

### INSTRUCTIONS FOR COMPLETION

Each of the fifteen (15) items on the Inventory begins with an incomplete sentence, followed by five different options that might complete the sentence. Underneath each option is a scale from 1 to 7, followed by a small letter in parentheses. For the present, ignore the letters; use only the numbers on the scale.

To complete the Inventory, read each sentence stem and each optional phrase that completes it. On the 1-7 scale, CIRCLE the number that most closely indicates how you feel about each option. The scale goes from 1 (strongly disagree) to 7 (strongly agree), with a neutral point (4) if you don't have any opinion or aren't sure about a particular option.

Continue through all the items, recalling the sentence stem and indicating how strongly you agree or disagree with each of the options. Please respond to every option, even if you feel neutral about it. THERE ARE NO RIGHT OR WRONG ANSWERS.

As you go through the Inventory, respond according to what you *react frequently or most likely do*. If it helps you to respond more easily, you may want to focus on a specific course that you teach. If you do focus on a particular course, choose one that you feel most comfortable teaching—one that you think best reflects your preferred style of teaching.

HAVE FUN!

(L.M. Zinn, PAEI[TM] 10/21/004, Lifelong Learning Options, Boulder, CO 80308)

1. IN PLANNING AN EDUCATIONAL ACTIVITY, I AM MOST LIKELY TO:

Identity, in conjunction with learners, significant social and/or political issues and plan learning activities around them.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | (h) |

Clearly identify the results I want and develop a program (plans, workshop) that will achieve these results.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | (b) |

Begin with a lesson plan that organizes what I plan to teach, when and how.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | (a) |

Assess learners' needs and develop valid learning activities based on these needs.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | (d) |

Consider the areas of greatest interest to the learners and plan to deal with them, regardless of what they may be.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | (c) |

# Philosophy of Adult Education Inventory

Adapted from: Zinn, L. M. (1983). Philosophy of adult education inventory (PAEI). An assessment tool used to identify

personal philosophies. Boulder Co: Livelong Learning Options.

| STRONGLY | | NEUTRAL | | | STRONGLY | |
|---|---|---|---|---|---|---|
| DISAGREE | | | | | AGREE | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

**1. In planning an educational activity, I am most likely to:**

identify, in conjunction with learners, significant social and/or political issues and plan learning activities around them.

1 ☐  2 ☐  3 ☐  4 ☐  5 ☐  6 ☐  7 ☐

clearly identify the results I want and develop a program [class workshop] that will achieve those results.

1 ☐  2 ☐  3 ☐  4 ☐  5 ☐  6 ☐  7 ☐

begin with a lesson plan that organizes what I plan to teach, when and how.

1 ☐  2 ☐  3 ☐  4 ☐  5 ☐  6 ☐  7 ☐

assess learners' needs and develop valid learning activities based on those needs.

1 ☐  2 ☐  3 ☐  4 ☐  5 ☐  6 ☐  7 ☐

onsider the areas of greatest interest to the learners and plan to deal with them, regardless of what they may be.

1 ☐  2 ☐  3 ☐  4 ☐  5 ☐  6 ☐  7 ☐

| STRONGLY DISAGREE | | NEUTRAL | | | STRONGLY AGREE | |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

**2. People learn best:**

when the new knowledge is presented from a problem-solving approach.

1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐

when the learning activity is clearly structured and provides for practice and repetition.

1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐

through dialogue [discussion] with other learners and a group coordinator.

1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐

when they are free to explore, without the constraints of a "system".

1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐

from an "expert" who knows what he or she is talking about.

1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐

| STRONGLY DISAGREE | | NEUTRAL | | | STRONGLY AGREE | |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

### 3. The primary purpose of adult education is:

to facilitate personal development on the part of the learner.

1 ○  2 ○  3 ○  4 ○  5 ○  6 ○  7 ○

to increase learners' awareness of the need for social change and to enable them to effect such change.

1 ○  2 ○  3 ○  4 ○  5 ○  6 ○  7 ○

to develop conceptual or theoretical understanding.

1 ○  2 ○  3 ○  4 ○  5 ○  6 ○  7 ○

to establish the learners' capacity to solve individual and societal problems.

1 ○  2 ○  3 ○  4 ○  5 ○  6 ○  7 ○

to develop the learners' competency and mastery of specific [knowledge and] skills.

1 ○  2 ○  3 ○  4 ○  5 ○  6 ○  7 ○

| STRONGLY DISAGREE | | NEUTRAL | | | STRONGLY AGREE | |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

## 4. Most of what people know:

is a result of consciously pursuing their goals, solving problems as they go.

1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○

they have learned through critical [reflective] thinking focused on important social and political issues.

1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○

they have learned through a trial-and-feedback process.

1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○

they have gained through self-discovery rather than some "teaching" process.

1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○

they have acquired through a systematic [comprehensive] educational process.

1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○

| STRONGLY DISAGREE | | NEUTRAL | | | STRONGLY AGREE | |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

**5. Decisions about what to include in an educational activity:**

should be made mostly by the learner in consultation with a facilitator.

1 ◌ 2 ◌ 3 ◌ 4 ◌ 5 ◌ 6 ◌ 7 ◌

should be based on what learners know and what the teacher believes they should know at the end of the activity.

1 ◌ 2 ◌ 3 ◌ 4 ◌ 5 ◌ 6 ◌ 7 ◌

should be based on a consideration of key social and cultural situations.

1 ◌ 2 ◌ 3 ◌ 4 ◌ 5 ◌ 6 ◌ 7 ◌

should be based on a consideration of the learners' needs, interests and problems.

1 ◌ 2 ◌ 3 ◌ 4 ◌ 5 ◌ 6 ◌ 7 ◌

should be based on careful analysis by the teacher of the material to be covered and the concepts to be taught.

1 ◌ 2 ◌ 3 ◌ 4 ◌ 5 ◌ 6 ◌ 7 ◌

| STRONGLY DISAGREE | | NEUTRAL | | | STRONGLY AGREE | |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

**6. Good adult educators start planning instruction:**

by considering the end behaviors they are looking for and the most efficient ways of producing them in learners.

1 ☐  2 ☐  3 ☐  4 ☐  5 ☐  6 ☐  7 ☐

by identifying problems that can be solved as a result of the instruction.

1 ☐  2 ☐  3 ☐  4 ☐  5 ☐  6 ☐  7 ☐

by clarifying the concepts of theoretical principals to be taught.

1 ☐  2 ☐  3 ☐  4 ☐  5 ☐  6 ☐  7 ☐

by clarifying key social and political issues that affect the lives of the learners.

1 ☐  2 ☐  3 ☐  4 ☐  5 ☐  6 ☐  7 ☐

by asking learners to identify what they want to learn and how they want to learn it.

1 ☐  2 ☐  3 ☐  4 ☐  5 ☐  6 ☐  7 ☐

| STRONGLY DISAGREE | | NEUTRAL | | | STRONGLY AGREE | |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

**7. As an adult educator, I am most successful in situations:**

that are unstructured and flexible enough to follow learners' interests.

1 ○  2 ○  3 ○  4 ○  5 ○  6 ○  7 ○

that are fairly structured, with clear learning objectives and built-in feedback to the learners.

1 ○  2 ○  3 ○  4 ○  5 ○  6 ○  7 ○

where I can focus on practical skills and knowledge that can be put to use in solving problems.

1 ○  2 ○  3 ○  4 ○  5 ○  6 ○  7 ○

where the scope of the new material is fairly clear and the subject matter is logically organized.

1 ○  2 ○  3 ○  4 ○  5 ○  6 ○  7 ○

where the learners have some awareness of social and political issues and are willing to explore the impact of such issues on their daily lives.

1 ○  2 ○  3 ○  4 ○  5 ○  6 ○  7 ○

| STRONGLY DISAGREE | | NEUTRAL | | | STRONGLY AGREE | |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

**8. In planning an educational activity, I try to create:**

the real world-problems and all-and to develop learners' capabilities for dealing with it.

1 ⃝ 2 ⃝ 3 ⃝ 4 ⃝ 5 ⃝ 6 ⃝ 7 ⃝

a setting in which learners are encouraged to examine their beliefs and values and to raise critical questions.

1 ⃝ 2 ⃝ 3 ⃝ 4 ⃝ 5 ⃝ 6 ⃝ 7 ⃝

a controlled environment that attracts and holds the learners, moving then systematically towards the objective(s).

1 ⃝ 2 ⃝ 3 ⃝ 4 ⃝ 5 ⃝ 6 ⃝ 7 ⃝

a clear outline of the content and the concepts to be taught.

1 ⃝ 2 ⃝ 3 ⃝ 4 ⃝ 5 ⃝ 6 ⃝ 7 ⃝

a supportive climate that facilitates self-discovery and interaction.

1 ⃝ 2 ⃝ 3 ⃝ 4 ⃝ 5 ⃝ 6 ⃝ 7 ⃝

| STRONGLY DISAGREE | | NEUTRAL | | | STRONGLY AGREE | |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

### 9. The learners' feelings during the learning process:

must be brought to the surface in order for learners to become truly involved in their learning.

1 ○  2 ○  3 ○  4 ○  5 ○  6 ○  7 ○

provide energy that can be focused on problems or questions.

1 ○  2 ○  3 ○  4 ○  5 ○  6 ○  7 ○

will probably have a great deal to do with the way they approach their learning.

1 ○  2 ○  3 ○  4 ○  5 ○  6 ○  7 ○

are used by the skillful adult educator to accomplish the learning objective(s).

1 ○  2 ○  3 ○  4 ○  5 ○  6 ○  7 ○

may get in the way of teaching by diverting the learners' attention.

1 ○  2 ○  3 ○  4 ○  5 ○  6 ○  7 ○

| STRONGLY DISAGREE | | NEUTRAL | | | STRONGLY AGREE | |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

**10. The teaching methods I use:**

focus on problem-solving and present real challenges to the learner.

1 ⊙ 2 ⊙ 3 ⊙ 4 ⊙ 5 ⊙ 6 ⊙ 7 ⊙

emphasize practice and feedback to the learner.

1 ⊙ 2 ⊙ 3 ⊙ 4 ⊙ 5 ⊙ 6 ⊙ 7 ⊙

are mostly non-directive, encouraging the learner to take responsibility for his/her own learning.

1 ⊙ 2 ⊙ 3 ⊙ 4 ⊙ 5 ⊙ 6 ⊙ 7 ⊙

involve learners in dialogue and critical examination of controversial issues.

1 ⊙ 2 ⊙ 3 ⊙ 4 ⊙ 5 ⊙ 6 ⊙ 7 ⊙

are determined primarily by the subject or content to be covered.

1 ⊙ 2 ⊙ 3 ⊙ 4 ⊙ 5 ⊙ 6 ⊙ 7 ⊙

| STRONGLY DISAGREE | | NEUTRAL | | | STRONGLY AGREE | |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

## 11. When learners are uninterested in a subject, it is because:

they do not realize how serious the consequences of not understanding or learning the subject may be.

1 ⌀  2 ⌀  3 ⌀  4 ⌀  5 ⌀  6 ⌀  7 ⌀

they do not see any benefit for their daily lives.

1 ⌀  2 ⌀  3 ⌀  4 ⌀  5 ⌀  6 ⌀  7 ⌀

the teacher does not know enough about the subject or is unable to make it interesting to the learner.

1 ⌀  2 ⌀  3 ⌀  4 ⌀  5 ⌀  6 ⌀  7 ⌀

they are not getting adequate feedback during the learning process.

1 ⌀  2 ⌀  3 ⌀  4 ⌀  5 ⌀  6 ⌀  7 ⌀

they are not ready to learn it or it is not a high priority for them personally.

1 ⌀  2 ⌀  3 ⌀  4 ⌀  5 ⌀  6 ⌀  7 ⌀

| STRONGLY DISAGREE | | NEUTRAL | | | STRONGLY AGREE | |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

**12. Differences among adult learners:**

are relatively unimportant as long as the learners gain common base of understanding through the learning experience.

1 ⃝  2 ⃝  3 ⃝  4 ⃝  5 ⃝  6 ⃝  7 ⃝

enable them to learn best on their own time and in their own way.

1 ⃝  2 ⃝  3 ⃝  4 ⃝  5 ⃝  6 ⃝  7 ⃝

are primarily due to differences in their life experiences and will usually lead them to make different applications of new knowledge and skills to their own situations.

1 ⃝  2 ⃝  3 ⃝  4 ⃝  5 ⃝  6 ⃝  7 ⃝

arise from their particular cultural and social situations and can be minimized as they recognize common needs and problems.

1 ⃝  2 ⃝  3 ⃝  4 ⃝  5 ⃝  6 ⃝  7 ⃝

will not interfere with their learning if each learner is given adequate opportunity for practice and reinforcement.

1 ⃝  2 ⃝  3 ⃝  4 ⃝  5 ⃝  6 ⃝  7 ⃝

| STRONGLY DISAGREE | | NEUTRAL | | | STRONGLY AGREE | |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

**13. Evaluation of learning outcomes:**

is not of great importance and may not be possible, because the impact of learning may not be evident until much later.

1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○

should be built into the system, so that learners will continually receive feedback and can adjust their performance accordingly.

1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○

is best done by the learners themselves, for their own purpose.

1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○

lets me know how much learners have increased their conceptual understanding of new material.

1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○

is best accomplished when the learner encounters a problem, either in the learning setting or the real world, and successfully resolves it.

1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○

| STRONGLY DISAGREE | | NEUTRAL | | | STRONGLY AGREE | |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

**14. My primary role as a teacher of adults is to:**

guide learners through learning activities with well-directed feedback.

1 ○  2 ○  3 ○  4 ○  5 ○  6 ○  7 ○

systematically lead learners step by step in acquiring new information and understanding underlying theories and concepts.

1 ○  2 ○  3 ○  4 ○  5 ○  6 ○  7 ○

help learners identify and learn to solve problems.

1 ○  2 ○  3 ○  4 ○  5 ○  6 ○  7 ○

increase learners' awareness of environmental and social issues and help them learn how to have and impact on these situations.

1 ○  2 ○  3 ○  4 ○  5 ○  6 ○  7 ○

facilitate, but not direct, learning activities.

1 ○  2 ○  3 ○  4 ○  5 ○  6 ○  7 ○

| STRONGLY DISAGREE | | NEUTRAL | | | STRONGLY AGREE | |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

**15. In the end, if learners have not learned what was taught:**

the teacher has not actually taught.

1 ○  2 ○  3 ○  4 ○  5 ○  6 ○  7 ○

they need to repeat the experience, or a portion of it.

1 ○  2 ○  3 ○  4 ○  5 ○  6 ○  7 ○

they may have learned something else which they consider just as interesting or useful.

1 ○  2 ○  3 ○  4 ○  5 ○  6 ○  7 ○

they do not recognize how learning will enable them to significantly influence society.

1 ○  2 ○  3 ○  4 ○  5 ○  6 ○  7 ○

it is probably because they are unable to make practical application of new knowledge to problems on their daily lives.

1 ○  2 ○  3 ○  4 ○  5 ○  6 ○  7 ○

**Classroom Observations:**

Instructor:

Date:

Number of Students:

Demographics:

Describe techniques/strategies the classroom instructor may utilize to optimize science literacy in the classroom:

Describe modes of instruction the classroom instructor may utilize to optimize science literacy in the classroom:

Demonstrate use of learner feedback and questioning techniques

Other sources of student formative assessment

Depth of response to learner's questions

Demonstrate use of audio/visual aids

Demonstrate use of the summary process for reinforcing understanding

Student's engagement.

Student's discussion in foreign language.

Student's Response to questions asked, demonstrating science literacy in the classroom:

General Notes: