Motivating Adolescent English Language Learners to Study Science

By

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Abstract

With the rapid increase of English language learners in high school classrooms it has become increasingly important for teachers be able to engage students in course content even though there is a language barrier. This study examines ways in which high school science teachers can motivate adolescent English language learners (AELL) to study science in three of the most heavily ELL populated cities in British Columbia. In hopes of finding solutions for this study, a literature of current research was performed and five teacher participants were interviewed.

Data analysis reveals that techniques such as Flip classroom, Sheltered Instruction Observation Protocol and Experimental Laboratory Instruction have a direct affect on AELL motivation and ability to orally communicate content comprehension. Furthermore, the findings from the interviews suggest that direct science language instruction leads to noticeable improvement not only in the comprehension of the specific science topic but also in subsequent science courses. This study also indicates that in terms of Vancouver's Chinese AELL community, teachers must take into account the students home environment and support system when leaving students with homework and readings.
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Chapter 1: Introduction

1.1 Introduction to the Research Study

The purpose of this research project is to determine how secondary science teachers can better motivate and facilitate knowledge acquisition for Adolescent English Language Learners. I focus on this topic because of my own personal experiences and professional interests. As the daughter of immigrant parents, I was lucky to be offered a Canadian education that allowed my creativity and enthusiasm to thrive. While English was not an obstacle for me because of my early introduction to the language, I am highly aware of the impact it has on ELLs in Canadian classrooms. In this Chapter, I will outline the purpose of this study, the main research question and sub-questions, as well as my background as the researcher. The major components of this thesis are also summarized.

1.2 Purpose of the Study

“Adolescents ELLs have much to learn and little time to learn it” therefore it is of the utmost importance that their teachers are able to motivate them and engage them in their course content (Rance-Roney, 2009, p.37). Without motivation and engagement, adolescent language learners will become increasingly disinterested in studying science, since on top of the language barrier they will have to struggle with complicated scientific vocabulary. Many studies have been done on how to teach English language learners science, however they broadly group ELLs of all ages into one group and focus on teaching the English of science while teaching the concepts.
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However, studies on adolescent motivation show that high school science teachers must approach teaching their adolescent English language learner students differently than they would approach younger ELLs because during that specific time in child development they have different needs and require classroom structure and motivational models that allows for them to make real decisions and take leadership roles (Smetana et al., 2006, p.273). It is important that teachers learn the techniques and strategies to meet these needs because adolescent ELLs cannot afford to have neglectful teachers at any point since they simply do not have the time left in their secondary school education. Impacting the attitudes of AELLs is again emphasized in a recent study done by Duranczyk, Fayon and Goff (2010) that shows ELLs struggling to complete first year post secondary science courses due to having not developed that proper understanding of secondary school science content.

Immigrants make up over 20% of Canada population and over 40% of Greater Vancouver Area’s population (Statistics Canada 2011). Adolescent English Language Learners (AELL) from these families make up a large part of high school classroom in Vancouver, Richmond, and West Vancouver, thus, it has become increasingly important for teachers to be able to engage students in science course content even though many of these students feel as though it is almost impossible to study science, when struggling with English.

With this study I hope to examine the strategies that B.C. schools use to ensure that their AELLs are successful in science. Furthermore, I hope to survey the techniques, methods and practices that teachers have successfully used to motivate
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AELLS to study the sciences in hopes of finding some overarching concepts that lead
to effectively engaging and motivating AELLS in the sciences. Lastly, I hope this
study is able to motivate teachers across Canada to

1.3 Research Questions

In this study, I examined how secondary school science teachers are able to
motivate their students who are AELLS to study a subject that can be extremely
difficult for them because of the complicated English language that is used in science
education. This thesis focuses on the following question and sub-questions:

How can teachers motivate adolescent English language learners to study
and become interested in the sciences?

1. Why are AELLS unmotivated to study the sciences and how can you tell when
   they are unmotivated?
2. What are the key obstacles that AELLS face when learning science in a second
   language? And how does it affect their motivation?
3. What are some common tools used by science teachers to engage their AELL
   students?
4. How can teachers assess the effectiveness their motivation methods?

1.4 Background of the Researcher

My interest and passion for this topic is a result of my personal experiences
and goals as a science teacher. As a pre-service teacher, I would like to find new
ways to improve my teaching practice so that it caters to a diverse group of
students.
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As a student who grew up in a home where English is the second language I have personally experienced language obstacles when studying in a classroom that focuses on English first language learners. I was introduced to English at a young age and I believe it did not ultimately affect my studies in the sciences as I did eventually go on to successfully complete a bachelor's degree in biology. However, in my journey towards this degree I have taken many high school science classes in which I saw my peers, who were newly exposed to English at the high school level, struggle with science and subsequently become unmotivated to study the subject. Many of my English second language peers in high school came into Canadian high schools with strong academic backgrounds in science but soon found that studying science became like learning a third language. They no longer felt engaged with the science content since they had become unmotivated while trudging through so much English. By the time I was in grade twelve I found that many of my ELL peers had decided to opt out of higher-level science partially because of loss of interest and partially due to fear of the scientific English.

During my pre-service training, I found that very little emphasis was put on differentiated learning for English language Learners. Furthermore, it seemed that even though literacy was such a hot topic, it was being paid little attention in the science classroom. As student teacher in practicum, I discovered very little support for ELLs that were in mainstream courses.

My experience as a student, my passion for the sciences and my hopes of being a teacher in an ever so multicultural Canada is the reason why I have chosen
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to investigate how teachers can better motivate adolescent ELLs in the sciences so that they are able to retain their interest through the difficulties of scientific English.

1.5 Overview

There are five chapters in this thesis, organized to best describe the research in detail. Chapter One consists of the introduction, purpose of the study, the research question and the components of my personal background that have led me to picking this topic.

A review of current literature that is pertinent to the motivation of adolescent language learners in science is found in Chapter two. Firstly, terms such as Adolescent English Language Learners are defined, followed by the examination of different issues in adolescent motivation and ELL motivation. Also found in Chapter Two is summary of the British Columbian science curriculum and ELL guidelines and policies. Lastly, techniques such as Sheltered Instruction Observation Protocol and Flip Classroom are explored to further understand its effectiveness in motivating AELLs.

Chapter Three provides the methodology that will be used during this study. The qualitative approach is outlined and criteria for picking participants is defined. Furthermore, I discuss the data collection and analysis methods. Also, discussed is the ethical protocol and limitations for this study.

In Chapter Four, my thesis introduces the backgrounds of five teacher participants. Additionally, I present the interview data that is classified into four main themes. Finally, in chapter five, I share insights gained from the data collected to answer the questions posed in Chapter One.
Chapter 2: Literature Review

2.1 Introduction

As the diversity of British Columbia’s classrooms continues to increase every single day, teachers must equip themselves with the knowledge, tools and an attitude that will enable them to be the best educator possible. Being knowledgeable and up to date on current issues in science often helps teachers motivate their students to study science, but is not nearly enough as teachers need to seek out professional development opportunities to improve their ability to reach each and every student in their extremely diversified classrooms. Since the area of English Language Learner Instruction is extremely vast and thus can be quite daunting, this research project will try to streamline the current research and practical strategies to what is applicable to the secondary school science classroom.

This literature review will begin with defining a key term in this study, “adolescent English language learner” (AELL), and it will then move on to address the AELL motivation issues when it comes to studying in secondary school. Furthermore, the literature review will look at studies that address the reason for decrease of motivation in adolescents to study the sciences and methods teachers use to overcome it. In order to construct a clear picture of the obstacles that AELL students face within B.C. science classrooms I will examine B.C.’s policies and guidelines on ELL education and the secondary science curriculum. Lastly, I will survey current methods and techniques such as Sheltered Instruction Observation Protocol (SIOP) and flip classroom that are used to help ELLs study the sciences and assess if their effectiveness when used as a motivator for adolescent ELLs.
2.2 Defining “Adolescent English Language Learner”

Adolescence is a developmental stage that is often divided into three distinct periods: “early adolescence (ages 10-13), middle adolescence (ages 14-17) and late adolescence (age 18-early twenties)” (Smetana et al., 2006, p. 258). For the purpose of this study, I will be focusing on students that fall within the middle adolescence ages, which corresponds with high school grades 8-12 because it is at this point that science often transitions from the tangible concepts to a higher-level theoretical curriculum.

In the past, it seemed as though research had grouped all adolescents into categories depending on age or single racial/ethnic groups. More recently studies have been giving greater attention to the heterogeneity among adolescents that have been grouped by race and ethnicity (Chao & Tseng, 2002). Part of this attention has been focused on new demographic trends such as immigration due to a recently sizeable increase in the number of immigrants in North America (Smetana et al., 2006,p. 257). This brings us to current research by Rance-Roney (2009), which uses the term adolescent English language learners (AELLs) defined as immigrants who arrived within the past five years or first, second or third generation immigrants. Furthermore Rance-Roney outlines that the “immigrated within the past last five years” group of students is not only at risk but also often neglected, an obviously detrimental combination. Therefore, for the purposes of my research I will be focusing on middle adolescent English language learners who have immigrated within the past five years.
2.3 Adolescent Interest in Science

The decrease in adolescent interest in the sciences seems to spike dramatically as students enter their teenage years. 14-15 year old participants in Chamber’s (1999) study “articulated that their resentment at what they saw as restrictive rules and regulations of the science classroom” (p.119). The “strict rules of lab experiments and memorization of facts and theories” had students “counting down the minutes to the end of the lesson” (Chambers, 1999, p.119).

Smetana et al. (2006) believes that another reason for decrease in interest for the sciences among adolescents is because students 14-17 are looking for real life connections to their course content and are not finding it in the theoretical curriculum of high school science. Lastly, another issue discussed by Duranczyk et al. (2010) is that grade 8-12 science course work has much less group work and integrated curriculum aspects which helps to increase student interest and motivation. The lack of group work combined with the increase in strictly structured formal lectures has led to students developing negative attitudes towards an already complicated subject.

The developmental changes occurring in adolescence combined with curriculum changes in science often lead to classes that take away the freedom that allows adolescents to make real decisions and take leadership role which only promotes negative outcomes (Smetana et al., 2006, p.273). To motivate these adolescent ELLs, Chambers (1999) states that it is extremely important to pay attention to their transition between the age of 13 to 14 years old because at that age it seems as though there is an dramatic shift in focus. The fact that these
adolescents are learning in a second language makes the situation even more difficult because many of these students come from strong science backgrounds in their native languages, however, they become disillusioned when studying science in a new language.

2.4 Challenges for English Language Learners in Secondary School Science

ELLs face a multitude of different obstacles in a Canadian secondary school science class and only have a few short years to adjust and learn the science. According to the literature, science literacy and family cultural background seem to be the biggest challenges for AELLs.

2.4.1 Science literacy

Cummins (2000) states that in order for educators to teach effectively to culturally and linguistically diverse students in science they must first consider the students’ proficiency in the literacy aspect of the subject. Furthermore, Cummins emphasizes that even if the students have attained conversational fluency in everyday contexts, this does not mean that they have the academic language for succeed in science. Cummins believes that science teachers must change instructional methods and assessment methods so that ELLs are not bogged down by the language components and are treated in an equitable manner. Goldenberg (2011) is in agreement with Cummins; she believes that everyday conversational English that ELLs use when talking to their friends and going about daily routines is learned separately from academic English. In classes such as science, the academic English is even more demanding and necessary because it extends to instructional language for laboratory experiments.
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Short et al. (2011) believes that it is extremely important for science teachers to teach the academic language of science in conjunction with the science curriculum. For ELLs to not fall behind in science they must be able to actively use technical science language while conducting experiments, and participating in classroom discussion (Short et al., 2011). While most ELLs come to Canada with science knowledge, the language is so different that they are not able to connect what they know with what they are learning. Furthermore, textbooks that are filled with complicated science language also create and obstacle for ELLs.

2.4.2 Family background

According to Statistics Canada (2011) “Asia has been the largest source of immigrants during the past five years. This means that many of the students in our classrooms come from Asian cultural backgrounds. In Vancouver, B.C. the top three visible minorities are Chinese, South Asian and Filipino; therefore it is important for B.C. teachers to learn about the culture of the East (Statistics Canada, 2011).

Li’s (2002) research on four Asian immigrant families from different socioeconomic backgrounds gives teachers a lot of insight on home literacy, culture and schooling of children from Asian families. Li (2002) clearly conveys that the East is very different than the West and that when teachers teach their Asian students from a western point of view, these students very often will go home and encounter many obstacles in their learning. Many Canadian teachers send their students home with reading to do, thinking that it is the simplest activity for both the student and the parent if they choose to help, but for Asian AELLS from immigrant families this can actually be extremely difficult for the students.
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According to Li, in Eastern culture reading is often viewed as a solitary activity that parents would not participate in.

In addition to cultural background, many AELLS simply come from families where parents are also ELLs and thus cannot help them with their work. Furthermore, in Eastern culture parents tend to be less involved in the day to day operation of their child’s school and rely on communication from the teacher if something is needed (Li, 2002). One participant in Li’s research voices her confusion regarding her child’s studies:

“So how Yue is doing at school every day, and what she does not do well or understand well in class every day, we do not know. We occasionally find out, for example, what needs to be done in school, but Yue does not know. For example what she needs to bring to school for the next day, she was not very clear. Then we find that she did not understand what the instructions are sometimes.” (Li, 2002)

2.5 British Columbia’s Policies and Curricula

2.5.1 Science Curriculum

British Columbia Ministry of Education (2006, 2008) science curriculum divides secondary school science into two parts. In grades 8-10, all students must take Science, a course that has four goals:

1. Goal 1: Science, technology, society and the environment where students will develop understanding of the nature of science and technology, and of the social and environmental context of science and technology.
2. Goal 2: Skills- student will develop the skills required for scientific and technological inquiry, for solving problems, for communicating scientific ideas and results, for working collaboratively, and for making informed decisions.
3. Goal 3: Knowledge: students will construct knowledge and understanding of concepts in life science, physical science, earth and space science, and apply these understanding to interpret, integrate and extend their knowledge.
4. Goal 4: Attitudes- Students will be encouraged to develop attitudes that support responsible acquisition and application of scientific and
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  technological knowledge to the mutual benefit of self, society and the environment

This document, while complete and containing instructional suggestions and alternatives, does not include methods specific for ELLs.

The second part of B.C. secondary science addresses the needs for grade 11 and 12. At this level, science is split into Biology 11/12, Chemistry 11/12, Physics 11/12, Earth Science 11, Geology 12, and Science and Technology 11. To graduate, students must take at least one science at the grade 11 level.

2.5.2 Policies and Guidelines for ELLs

In British Columbia, school districts receive supplemental funding from the Ministry of Education for eligible students needing ELL support. For students to be reported as ELL the must take an annual assessment that determines that their English is sufficiently below standard English (British Columbia Ministry of Education, 2009). Once a student is considered eligible they will receive up to five years of funding and must receive services consistently throughout the throughout the ten months of each school year (British Columbia Ministry of Education, 2009).

Individual learning plans are created for each student who is designated as an ELL. The plans operate on the goal of helping ELLs achieve expected learning outcomes of the provincial curriculum and develop their language proficiency, skill and attitudes so that they can positively contribute to society (British Columbia Ministry of Education, 2009).

Furthermore, when ELLs are assessed prior to the creation of their learning plans they are placed into a level. In accordance to the five year of ELL funding, there are five levels. Most schools operate on the idea of one level a year but very
often that may not be the actual progression of the student. According to British Columbia Ministry of Education (2001), ELLs are to be assessed using the writing samples provided in the English language learning Standards document.

2.6 Instructional Strategies for Adolescent English Language Learners

Although there is a lot of research that focuses on how to teach science to ELLs there are very few studies focused on teaching science to adolescent ELLs. Most studies can be divided into two main categories: the first category outlines that all science lessons need to be taught differently for ELL students, whereas the second category outlines that ELLs can learn the regular curriculum as long as it is taught in parallel to science vocabulary and science literacy lessons (Bergman, 2011; Gagnon & Abell, 2009; Haneda & Wells, 2012). The second category seems to be more widely recommended and integrates kinesthetic and visual learning, which seems to be a common suggestion across all research (Bergman, 2011).

2.6.1 Sheltered Instruction Observation Protocol

Throughout all the studies I’ve read for this literature review, a protocol that was often mentioned to be effective was the sheltered instruction observation protocol (SIOP). The Sheltered Instruction Observation Protocol Model is an approach to teaching developed by Dr. Jana Echevarria, Dr. Mary Ellen Vogt and Dr. Deborah Short that is aimed at increasing English language learner achievement by improving academic content skills and language skills (Echevarria et al., 2011). SIOP uses eight interrelated components to increase ELL achievement: Lesson preparation, building background, comprehensible input, strategies, interaction, practice and application, lesson deliver, and assessment.
SIOP outlines a teaching strategy that is 50% based on visual and hands-on materials. SIOP also states that tangible and relevant items are also necessary for effective inquiry based learning. On top of hands-on labs, SIOP also encourages the use of pictures and illustrations, models, graphs, charts, and multimedia resources such as videos, interactive software, and internet resources (Bergman, 2011). The visual models, graphs and charts would bring science into the real world and make it more relatable to ELLs, especially if it is culturally relevant for the student (Rance-Roney, 2009).

Bergman (2011) suggests that the sheltered instruction approach will help student motivation and attitude because students can first learn the science vocabulary which will help them feel less confused when introduced to science theory. Additionally, Bergman (2011) believes that the kinesthetic and visual side of the sheltered instruction approach will promote a positive attitude because it will help adolescent ELLs express what they know and what they learn which will motivate them further pursue scientific knowledge.

### 2.6.2 Flip Classroom

With the increase of technology in our classrooms, teachers are able to use it to help them differentiate instruction and create interactive lessons that reach all their students. According to Fallows (2013), “Flip classroom” also known as “Flip teaching” is an instructional model that “involves student doing what they would have traditionally done in class at home... then doing the homework in class time”. Teachers create content rich videos and audio content so that students can learn the course content prior to class. This way students are able to view the content as
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many times as they want and at their own pace. Students then bring their content knowledge to class where the teacher facilitates “activities that practice the concepts introduced in the flipped portion of the class” (Fallows, 2013).

Furthermore, Siegle (2014) believes that Flip classroom allows teachers to become “the guide on the side” instead of the “sage on the stage”. This can be very advantageous for the teacher-adolescent relationship because it gives the students more freedom and control over their own learning. Furthermore, it allows for students that are at different places in their content knowledge stay engaged in the subject (Siegle, 2014). For teaching AELLS this can be beneficial because they often come into our Canadian classrooms from many different educational backgrounds and thus bring different levels of content knowledge. With the Flip portion of the lesson being done at home, students can proceed slowly and go ahead depending on their comfort.

Bergman and Sams (2013) agrees that Flip teaching can be the ideal way to reach every student in a classroom on a daily basis. For students that have trouble keeping up in class with didactic based lectures, flip classroom help them slow down the pace. Bergman and Sams describe an ELL student who has trouble writing down notes when the teacher is talking too fast and struggles with his homework at home. With the application of Flip teaching, the ELL student would be able to slowly go through the lectures and take detailed notes. Furthermore, when it comes time for applying the content towards solving homework problems, the teacher and fellow classmates can help guide the student.
2.7 Summary

Current research shows that it is possible to motivate and engage AELLs in secondary school science content. Teachers must be aware of the developmental needs of their adolescent students and inform their teaching practice with research regarding adolescent psychology. Furthermore, it has emerged from the literature review that when assessing for an AELL’s motivation and engagement it is important for teachers to take into account not only the student's science literacy ability, but also his or her educational and cultural background. Practical models such as SIOP and Flip Classroom are effective in helping teachers engage students in scientific discourse and improve their overall science literacy.

The above literature reviews have given me much insight on my research topic and about methods in which to motivate AELLs to study the sciences. Additionally, it has also emphasized to me the importance of further reviewing this research topic because it is extremely prevalent throughout all classrooms and there has been little focus on adolescent ELLs.
Chapter 3: Methodology

3.1 Introduction

This qualitative research project focusing on how to motivate adolescent English language learners to study science was approached through two different paths: a literature review on the topic and interviewing science teachers who have had experience teaching ELLs in the Greater Vancouver Area. The data was gathered through face-to-face interviews with five teachers who each answered a set of 11 questions. The audio recording for the interviews was transcribed and coded for reoccurring themes. The findings and analysis are accessible in the form of a Master of Teaching Research Project and presentations at Reciprocal Learning Conference in April 2014 and CSSE at Brock University in May 2014.

3.2 Research Context

As the number of English language learners increase in Canadian schools there has also been an increase of research in the area of language acquisition for ELL students. I began my study with an initial review of literature, and supplemented that review as new topic emerged throughout the course of my study. I also informally gained some insight into how science teachers help AELLs with their learning through observation during my practicums. As I conducted my interviews, my participants’ responses opened up new areas of research for me to explore. From these reading I was able to formulate a strong and well-rounded literature review for Chapter 2. The second half of the research focuses on gathering data on how teachers are putting current research into practice and how they view AELLs’ motivation and success in their classrooms. The interviews were
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conducted in one sitting, at the schools of each teacher. The questions were focused on three main areas:

1. Teacher’s background experience, in the community and with AELLS
2. Teacher’s personal awareness and knowledge about AELL education
3. Instructional strategies that each teacher uses or have used in their science classrooms that have been effective in helping AELL students study science

3.3 Participants

The beginning of my research I had considered selecting participants from both Ontario and British Columbia (two from each province). However, after conducting a review of the provinces’ science and English language learning curriculums I realized the vast difference between the two systems would be better analyzed separately. I settled on British Columbia because I was able to secure a wider variety of participants who had taught both language adapted science classes and classes which ELL students were integrated. The purpose of interviewing participants with a vast amount of experience with AELLS was to find out what specific teaching practices and attitudes were able to increase AELL motivation and success in science. They were selected based upon the following criteria:

1. They were recommended as secondary school science teachers with at least 5 years of experience working with AELLS.
2. They were willing to be involved in the research process and to be interviewed in person.
3. They had taught in either Vancouver, West Vancouver or Richmond (three of the highest ELL populated cities in the GVA)
I identified these teachers through references from other practitioners in the field of AELL education since I had previously worked with them and knew them to be knowledgeable about both science instruction and instructional practices that benefit AELLs.

3.4 Data Collection

Data collection for this study took place in three different ways: a “get to know you” form, interviews, and observations of the participants’ classrooms and teaching materials. The data was collected during scheduled visits in November 2013 and December 2013 to each participant’s classroom. All three aspects of the data collection were done in one visit with the participant that was prescheduled. Data collection sessions began with participants filling out the “Get to know you” form (Appendix C) followed by the interview and then finally observational notes on the participants’ classrooms and teaching materials that they had shown me during their interview.

Each participant was interviewed once, and all interviews were recorded using a voice recorder iPhone application. Interviews lasted between 25 to 65 minutes, during which time 11 open ended questions were asked and displayed to the interviewee one at a time. Depending on participant answers, follow up questions were asked in order to get further explanation about certain topics.

3.5 Data Analysis

Once all interviews were completed they were transcribed and the transcripts were then reviewed to guarantee accuracy. Certain locations and details
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were omitted or modified to ensure the anonymity of the participants. Additionally, pseudonyms were used to identify each participant.

I began the analysis of my data with two overall reads of the transcribed data looking for themes, patterns and notable statements. After the initial reads I separated the interviews, blanked out the names and approached my data one interview at a time, leaving a few days between coding each interview to refresh my mind so that I would not carry concepts and look for codes found in one interview in another. Codes were identified, and sorted using Nvivo qualitative research software. To identify patterns I used a combination of a priori and a posteriori (Wellington, 2000). In vivo coding was used for most of my a priori categories. To uncover my a posteriori categories I largely relied on descriptive coding. Next, the initial codes which Glaser and Strauss (1967) refer to as concepts were sorted by similarity into sub-themes. The sub-themes were then sorted into the over arching themes.

Four overall themes were identified from the interview data: key signs of unmotivation/motivation, factors contributing to ELL lack of motivation, common tools to engage AELLS in science class, assessment of effectiveness for motivating methods. While these four themes are the principal source of findings for this study, the data gained through the literature review were also taken into account for the formation of the hypothesis, which could be relevant for current practice and research.
3.6 Ethical Protocol

For my research project I will be following the ethical review approval procedures allowed by the Masters of Teaching program. Research participants were first approached via an email outlining the purpose, context and format of my MTRP and were then asked if he/she would be interested in participating in my study and meeting with me to further discuss my research and their participation. At the first meeting, participants were given the letter of consent for an interview, which outlines that (a) the information they give will be used in a final paper, as well as informal presentations to my classmates and/or potentially at a conference or publication, however their name or anything that may reveal their identity will not be (b) they are free to change their mind at any time, and to withdraw even after they have consented to participate and (c) they may decline to answer any specific questions if they feel uncomfortable (see appendix B for copy of the consent letter).

The raw data, in form of anecdotal notes, audio recording and transcripts will be stored only on my personal computer and hard drive for 5 years from the date of the interview.

3.7 Limitations

This project is meant to be one puzzle piece in a much larger puzzle that is the motivation of adolescent language learners. The construction of this puzzle piece may have several limitations. The literature review is possibly limited due to the time constraint of the MTRP and also because of certain resources being unavailable in the library.
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In terms of data collection the small sample size is a limitation in the variety of data collected and also may lead to over generalization of themes. The teacher participants interviewed teach at schools that may have different access to resources, which may cause differences in answers that are not related to the research.
Chapter 4: Findings

4.1 Introduction

In this chapter, the findings from the data collected during my five interviews, which explored how science teachers motivate their adolescent English language learners (AELLs), are analyzed and interpreted. Firstly, the participants are introduced and then the chapter goes into an analysis of the emerging themes. From reviewing the data, the four main themes of key signs of motivation and unmotivation, factors contributing to AELLs lack of motivation, common tools to engage ELLs in science class, and assessment of effectiveness for motivating methods are addressed and examined. The chapter concludes with an overview of the findings.

4.2 Meet the Participants

All the participants are professionals in the field of science education in Greater Vancouver Area (GVA). They are all classroom teachers that have taught Science 9 to Science 12 in public schools; two also teach the grade 11/12 International Baccalaureate Biology course. All five have a minimum of ten years of teaching experience in the most highly ELL populated districts in the GVA. The participants will remain anonymous through pseudonyms.

Joey

Joey is currently in his 10th year of teaching science in a diverse, predominantly upper-middle to upper class public schools in West Vancouver, Canada. He is truly a diverse teacher in that he has taught chemistry, physics, biology and math. Prior to teaching science in Canada, Joey spent three years
teaching English in Japan. Currently he is concentrated on teaching and developing the Science 10 Language Adapted and Technology class while completing his M. Ed. which focuses on using the flip classroom in AELL science education.

*Phoebe*

Phoebe also teaches in West Vancouver and she has been teaching there for over twenty years. In past years she has taught Science 10, Biology 11, Biology 12, and IB Biology Standard level and higher level. In hopes of becoming a better teacher to her ELL students, Phoebe participated in a Reciprocal Learning Exchange with teachers at a sister high school in Beijing, China. Additionally, Phoebe has taken undergone SIOP training as part of her professional development.

*Rachel*

Rachel has been a classroom teacher for twenty years in East Vancouver. In her twenty years, she has taught grades eight to ten science and grade 11/12 Biology. While she has not worked exclusively with ELL students in a specialized setting she has always had a few ELL students in her classes every single year. Rachel feels that her enthusiasm and high energy in her classroom is key in her being able to motivate her students and keep their attention even when they are struggling with the subject matter.

*Monica*

Monica has taught Science 8, Science 9, and Science 10, ESL Science 9 and 10, Biology 11/12, IB Biology HL, and Physics 11 in three Richmond schools for over ten years. Since Richmond has a 54.7% immigrant population (the highest of any municipality in Canada) Monica has had an immense amount of experience working
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with AELL students in both a regular science classroom and language adapted science classroom. Furthermore, Monica, like Joe, has spent time teaching English abroad in Asia to ELL students.

Janice

Janice has been teaching in Vancouver for twenty years and has taught Science 8 to 10, Modified/Adapted Science 8 and 9, and Biology 11 and 12. Like Joe, and Monica, Janice has taught AELL students as part of a modified and adapted science class and in a regular science classroom. In order to keep her students motivated, Janice stresses the importance of making sure that students know all their work and effort counts towards their marks and is acknowledged in some way.

4.3 Themes

There are four main themes with several sub themes that emerge as a result from the finding obtained:

• Key signs of un-motivation/motivation?
  o Physical manifestation in the classroom
  o Academic indicators
  o Long term signs

• Factors contributing to ELL lack of motivation?
  o Factors that are specific to the science instruction
  o Language specific factors
  o Factors outside of their current school and classrooms

• Common tools to engage ELLs in science class?
  o Science specific
  o Language specific
  o Sheltered Instruction Observation Protocol (SIOP)
  o Flip Classroom
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- Assessment of effectiveness for motivating methods?
  - For the Student
  - For the Teacher

4.4 Key signs of motivation/unmotivation

4.4.1 Physical signs

All my participants have an immense amount of experience teaching in high schools. They recognize that that their adolescent English language learners are a unique set of students that face a unique set of obstacles. All teachers have mentioned that they often notice that these obstacles lead to physical manifestations in the classroom. All five teachers stated that they could tell that their adolescent students were unmotivated, for example:

“they walk down the hall and they are on their cell phones texting and they come into class and they are still on their phone texting and they sit down at their desk and they are still teaching under the desk. They try to avoid eye contact with me... Especially for the ELL students, they often tend to prefer to sit at the back or at the outside corners so that’s where they prefer to be.” (Teacher interview, November 25, 2013)

“So the ESL kids, they will put their head down and they won’t do the work. I had one last year; he just wouldn’t do the work. I said it was for marks and he just didn’t care, he just wouldn’t do the work” (Teacher interview, November 28, 2013)

Phoebe believes that body language can be an indicator of motivation. While she says that falling asleep in class may be a sign of un-motivation, she also recognizes that staying up late studying may also be the cause. In addition, Joey and Phoebe also agree that the most clear physical demonstration of un-motivation is the lack of physical presence in the classroom such as consistently skipping without making an effort to make up missed work. Joey states during his interview:
4.4.2 Academic indicators

All the teachers agree that motivation is harder to gage in terms of academic results because marks and content acquisition are not always a good indicator. As Rachel says:

“I can tell if students are not doing well but they are still motivated because at least they come in for some help, they will ask questions, sometime even students that are almost failing will come up with wonderful questions so that at least [she] knows that they are on task” (Teacher Interview, November 25, 2013)

Janice and Phoebe both believe that adolescent English language learners often need a bit of an extra nudge from the teacher to come in after school to ask for help. However, both agree that if they make consistent efforts to reach out to the student and he or she still does not make an effort to come in for extra help, then most likely it is because he/she is not motivated in the subject area. Janice found that marks were a huge motivator with her AELL students, more so than her native English students. Therefore if they won’t do the work, even if it is for marks, then it is pretty clear that something is not going right. Phoebe says that for unmotivated students “there would be more cheating on tests, so they are not there to write the tests on the day they are suppose to” although she also recognizes that “maybe not that they are unmotivated, but that they just think there is a quicker way of getting what they need, which is an A mark” (Teacher interview, December 16, 2013).

4.4.3 Long-term signs

Since all of these teachers have been teaching at their current schools for 8 to 20 years, they have been able to follow some of their AELL students from their first years in Canada to graduation. Phoebe finds that, in terms of motivation, her AELL
students tend to fall on the extreme ends of the spectrum. Both Monica and Phoebe give examples of AELLS that arrived in Canada with minimal English in grade 10 but were so extremely motivated and tenacious that they were able to become top students in Biology by the time they graduate. Monica describes a student:

“When I met him he was in grade 10 and he worked really hard, and when he graduated in grade 12 from that same school he got a full scholarship to Cornell which [she] thought was amazing because he was just this kid that was destined to excel and it was neat to say that there’s a kid where when I first met him his English was quite terrible. He was so enthusiastic but you know it wasn’t his first language, but he just grew, like blossomed, it was so cool”. (Teacher interview, November 25, 2013)

However, on the other end of the spectrum, the unmotivated students tend to have bad experiences in grade 9 or 10 science, which will often lead to a systemic lack of motivation to study all science, especially biology. All the teachers agreed most of their AELLS seem to feel more comfortable with chemistry and physics, and thus when they are given the choice in grade 11 to pick a science they often opt for those instead of language ridden biology. Phoebe, who has been focused on teaching grade 11 and 12 Biology and IB Biology in recent years, says that she has very few AELL students in her Biology 11 classes and even fewer in her grade 12 classes.

4.5 Factors contributing to AELLS lack of motivation

4.5.1 Factors specific to the science instruction

Joey and Phoebe, both teach classes that are made up of about 50% AELLS from China and Iran. According to them, their students are often surprised by how science is taught in Canada. Joey says:

“So particularly with my Chinese students, just based on some feedback they have given me, they were used to more rote learning. They didn’t do as many hands-on labs. It is a lot more teacher demonstrations so they came in thinking a science class is kind of you sit there and you write and listen, most of them are
like that anyways. So when we start doing group projects and creative things, making videos or more lab work. Just doing a lab report... getting the first lab reports back from the students was a real surprise because it wasn’t just the language barrier, a lot of them had never write a lab report before, so they didn’t know how to go about it” (Teacher interview, December 18, 2013)

Phoebe confirms this through her reciprocal learning experience with Chinese science teacher. She states that she was surprised when watching a science lesson in China because she had not realized how teacher directed the science lessons were. At the same time, she realized that many of her students were unmotivated because they didn’t know what to do, and felt behind regarding the scientific method and process. Janice also emphasizes the possibility that AELLs may lack knowledge regarding social conventions when she says, “It’s pretty hard for them to get connected into a study group or anything like that” (Teacher interview, November 25, 2013)

4.5.2 Language specific factors

Teacher participants communicated during their interviews that language is perhaps the biggest obstacle that AELLs face when it comes to science content acquisition and motivation to studying the sciences. Many of teachers echoed the idea that these AELLs already have to learn an entirely new language (English), thus studying “science which is a language of and in itself” is extremely difficult. Monica says:

“I would say the largest hurdles that they face is when the teacher is teaching or when they are reading or any class discussion, they need to not only grasp the science which is in some ways its own language they need to get the English to keep up with the science.” (Teacher interview, November 25, 2913)
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Many of these students have a significant amount of science knowledge prior to coming to Canada, and are interested in studying science because it leads to respectable medical and research careers. However, the obstacle is that these students find it extremely difficult to connect their prior knowledge with what is being taught in their new Canadian classrooms. All teachers recognize that students seem to find chemistry and physics to be easier than biology. According to Janice:

“Students tend to be able to connect prior knowledge regarding atomic elements and kinetic equations with new chemistry content with much more ease than the new vocabulary in biology that is unlike anything they learned before.” (Teacher interview, November 28, 2013)

Joey and Phoebe, find that the Chinese students have the most trouble with biology language because it is nothing like their first language. In order to understand the extensive textbooks that are used in grade 11 and 12 biology, AELL students that are motivated are often “translating the books, word for word”, Joey jokes that at the end of the year, he will have to hand out erasers before collecting the textbooks (Teacher interview, December 18, 2013).

4.5.3 Factors outside of their current school and classrooms

All my teacher participants agree that their adolescent students are at an age where they are trying their best to be independent but still need a lot of support to manage their responsibilities. Phoebe feels as though her students are becoming more and more stressed and anxious regarding their grades. For example a few years ago, one of her students who is an AELL had studied so hard that by grade 12 she had gone from speaking no English to being the top of her biology class. However, even though she was motivated at times, she did not even make it through the year and “literally broke by March”. Joey describes a student who studied
extremely hard but had very little success over a two-year period. The student is now is having trouble sleeping, starting to skip classes and showing signs of depression. What these two students both have in common is that outside of the school environment they are both on their own, living in West Vancouver. According to my interviews with Phoebe, Joey and Monica, many of the AELLs in their classes are living in the GVA on their own or with homestay families. Many of these students are sent to Vancouver by their parents so that they can have more opportunities for their post-secondary education and careers. Their parents invest a lot of monetary support and thus often expect academic accomplishments from their children that match. However, being on their own during the adolescent years is difficult, and often when faced with academic obstacles these students give up due to the lack of support. Monica says:

“I think another hurdle for them or difficulty that they face is that they have little support from home and I don’t mean financial support because a lot of times the parents are very happy to pay for tutors but its just that the spoken language you know having someone who can read with them, look over their homework, or help them with their homework.” (Teacher interview, November 25, 2013)

Phoebe says that these students are often under so much pressure and lack discipline at home so they often think “Vancouver is fun on Robson so why don’t I just go party” (Teacher interview, December 16, 2013). Monica and Phoebe suggests another issue that factors into an AELL’s motivation to study the sciences is their aptitude. Phoebe states:

“Teachers need to keep in mind that sometimes these students are sent to Canada by their parents because of aptitude issues, when parents don’t think that their children can be competitive in their home country they will often send them to Canada where it seems less competitive.” (Teacher interview, December 18, 2013)
Lastly, Joey adds that often these students come from countries where disabilities are not diagnosed or are not disclosed in school records. He describes a student that he has this year who he believes has undiagnosed/undisclosed Tourette’s syndrome which greatly affects his experience in the classroom (Teacher interview, December 18, 2013).

4.6 Common tools to engage AELLS in science

4.6.1 Science specific

To increase motivation and engagement in the science classroom, all teachers interviewed found that their AELL students were very motivated by hands-on assessments. While at first they were hesitant to participate because it was a learning method that they were often not used to, most AELL students soon found that the hands-on activities allowed them to demonstrate their knowledge in a way that wasn’t always tied to their ability to communicate in English. Furthermore, Monica found that the hands-on laboratory activities helped students memorize the vocabulary. At her school, the students must pass quizzes regarding the labs before going into the actual lab to perform. She believes that because the students are eager to do the laboratory activities, they are more motivated to study and practice the vocabulary that will be on the lab quizzes (Teacher interview, November 25, 2013). Joey also mentioned that he takes his grade 9 and 10 classes on fieldtrips to the University of British Columbia Michael Smith labs to help inspire his students and motivate them to study science so that they too can become researchers in the future.

4.6.2 Language specific – adapted classrooms
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While most schools integrate their AELLs into the mainstream classroom from day one and rely on their ESL support to help them keep up, some schools with student body populations that are upwards of 50% AELLs will have language adapted science classrooms if the budget allows. Monica used to teach a language adapted science class for grade 9 students in Richmond. Students could take the course in the first semester of the school year so that they would be better equipped for Science 9 in the second semester. Monica feels that it was a great opportunity for those AELL students because the classes were smaller and thus a much more comfortable environment where students were able to open up and improve their oral English. For Monica, she felt as though it was important for these students to gain confidence by having conversations about their weekends and discussing what they already know about science and the scientific method. Because the classes were small, Monica was able to conduct many conversational/oral activities to improve her students confidence. She found that her students were much more successful in Science 9 after taking the language adapted course first. Joey has been teaching a beginner level language adapted Science 10 course for the last two school years and feels that the course has both advantages and disadvantages for the students. On one hand he appreciates that the small class sizes allow him more time with each student and that having his students all at the same level has allowed him to focus on language aspects that his level one and two ESL students really need. However, he has found that because his language adapted class is comprised almost solely of Chinese AELL students, they are more inclined to speak Chinese in class. While Joey feels that it is understandable because “these students are integrated
into regular classrooms for all their other subjects and often do not have anyone to talk to because their language barrier” thus when they come to science class they finally have a space where they can communicate with their peers (Teacher interview, December 18, 2013). While some of the Chinese communication is translating and explaining the science content, Joey feels that it may actually slow down the students language acquisition rate. Also Joey says:

“It may also be an ethical issue because these students’ parents are paying good money for a Canadian, English education and having them all in one class may completely defeat the parents’ original purpose.” (Teacher interview, December 18, 2013)

### 4.6.3 Sheltered Instruction Observation Protocol (SIOP)

Both Joey and Phoebe utilize aspects of SIOP in all of their science classes but especially emphasize the use of it in their classes that have a high number of AELLs. As the head of the Biology department, Phoebe attended a five day intensive SIOP training seminar last summer and brought back many of the techniques to share with her fellow teachers. While many of the teachers were already using some of the techniques, the SIOP course really served to emphasize the importance of those instructional strategies. Consistent with SIOP, all the teachers find that separating the vocabulary from the rest of the science lesson and focusing on breaking down those words and defining them prior to going into content helps students keep up and stay motivated while learning science. Furthermore, all the teachers agree that allowing the students to communicate orally about the science content in smaller pair groups helps the students gain confidence and retain the content better while not putting them on the spot and stressing them out about presenting in English. Lastly, Phoebe and Joey both find the their AELL students are able to follow along
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with lessons much better if the curriculum outcomes are reworded in simplified English and clearly stated and kept on the board throughout the lesson.

4.6.4 Flip Classroom

Joey at West Vancouver Secondary School has been using the flip classroom technique in his Science 10 Language Adapted Beginner class over the last couple years. He believes that by using flip classroom model he is able to pack in course content for the students to process at their own speed outside of class time so that he is able to utilize class time to slowly work through the scientific literacy that his AELL students struggle with the most. Furthermore, Joey believes that if flip classroom is utilized effectively, then it decreases the need for AELL students to be separated from the other students into language adapted classrooms because they will be able to go through the science content at their own pace outside of the classroom. In addition, Joey believes that the flip classroom model may actually be effective for all adolescent science students because it offers the flexibility that they desire. Joey says:

“With our ESL specialist teacher, we went through the entire chemistry unit and we looked at every lesson and tweak it to build in language activities. That is the goal of the flip classroom. So if we push some of the content online then we can have more time in class to do the language development stuff” (Teacher interview, December 18, 2013)

4.7 Assessment of effectiveness for motivating methods

4.7.1 For the Student

In this area, instead of separately assessing motivation, our teachers generally correlate motivation with a student’s grades and a student’s ability to
complete homework assignments proficiently. However, this may be problematic because motivation does not always translate into good marks, and content acquisition. Joey emphasizes this point when he talks about a student that has been in his language adapted class for two years in a row and works extremely hard, translating the textbook, memorizing vocabulary and coming in for extra help but has improved very little. Nevertheless, most of the teachers agree that formative assessment of motivation is extremely important because it helps them take care of their students. Monica says:

“Sometime when I’ve done an activity with them I just ask them for feedback. How did that work for you? What was that like? What was hard about that? What was easy about that? If you could change anything what would you do?” (Teacher interview, November 25, 2013)

Janice states:

“I assess motivation by work completion, but what work they can get completed in class, not saying they understand it but that they are using class time. I can watch them in class and they are trying and trying to complete their work. That is how I assess it, not necessarily by their marks because you can have a really hard worker that doesn’t get high marks.” (Teacher interview, November 28, 2013)

Stress and anxiety is a growing issue within all adolescents and the teachers believe that AELLs are particularly vulnerable. Thus as teachers they must keep a close eye on their students to make sure that the struggles and stresses associated with school do not lead students towards mental health illness. When Phoebe notices that her AELL students are unmotivated, she always makes sure to call home or connect with their counselor to learn more about the students life outside of the science classroom. She believes that while these adolescents want to feel independent they appreciate and need to feel that someone is looking out for them.
4.7.2 For the Teacher

Across all teacher participants’ experiences, assessment of motivation seems to be used more commonly as a tool for teachers to gauge whether or not their lessons and teaching tools are successful in engaging the students and conveying course content. By reading their students’ body language, questions during and outside of class time, and level of enthusiasm during class discussions and activities, Rachel, Jasmine and Joey find that it helps them tune their lessons so that they provide the appropriate amount of enthusiasm and a good balance of games and activities to suit the motivation needs of the students. For example, Rachel says “The motivation that I see in the kids is actually helpful for myself because it gets me more excited and it keeps me animated in my teaching” (Teacher interview, November 25, 2013).

4.8 Summary

It is clear that motivating adolescent English Language learners is not an easy feat. With multiple factors contributing to un-motivation, it takes teachers who are caring, persistent and enthusiastic in order to make a difference. I have ascertained an incredible amount of insight from my participants, all of whom have had years of experience and are clearly excellent and caring teachers. While they do have a few differences, overall their teaching ideologies in regards to teaching AELLs are very similar. It was also very interesting to see how their teaching practices mirrored those that were recommended in the literature review. Seeing techniques such as Flip classrooms and SIOP being used effectively is extremely encouraging because it shows that putting theory and research into practical strategies can indeed be
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effective. In addition to the practical use of research, one of the most vital things that these teachers had in common was that they showed an immense amount of care for their students, which was demonstrated through continuous professional development, taking the initiative to get to know their students, and making sure to communicate with their students ESL support and counselors. From what has been seen in practice by all these GVA educators, I am confident that AELL students can be motivated to study sciences and even biology and that when used correctly, techniques that improve science content acquisition also increase student motivation and performance in other aspects of their academic and home lives.
Chapter 5: Discussion

5.1 Introduction

Within this chapter, I will revisit the research questions that were initially posed in Chapter One and assess how the literature review, combined with the interviews of my participants, have answered those questions. Next, I examine the major findings from the study and connect them to the current literature. Lastly, I will make suggestions for further development of this research in the area of improving science education for adolescent English language learners.

5.2 Research Questions

The focus of my thesis was directed towards the research questions outlined in Chapter One. Those questions were:

*How can teachers motivate adolescent English language learners to study and become interested in the sciences?*

1. Why are AELLs unmotivated to study the sciences and how can you tell when they are unmotivated?

2. What are the key obstacles that AELLs face when learning science in a second language? And how does it affect their motivation?

3. What are some common tools used by science teachers to engage their AELL students?

4. How can teachers assess the effectiveness their motivation methods?
5.3 Discussion of Each Research Question

5.3.1 Why are AELLS unmotivated to study the sciences and how can you tell when they are unmotivated?

According to my participants, their AELLS come from extremely diverse cultural, educational and family backgrounds, and depending on the each student’s unique situation, the cause for a lack of motivation can differ. However, the three most common causes for lack of motivation were: i) complicated scientific language, ii) unmet needs outside of school, and iii) unreported learning exceptionalities and needs.

Many AELLS enter into Canadian classrooms with an abundance of scientific knowledge from previous courses that had been taught in their native language. However, they become quickly discouraged and unmotivated when they find that they are unable to connect what they already know to the new science content taught in English. Moreover, these AELLS often do not have the language ability to communicate their lack of understanding. Combined, the two issues often decrease a student’s academic self-efficacy, which in turn decreases a student’s motivation to persevere when faced with obstacles (Pajares, 1996). Seemingly, these AELLS are becoming stuck in a vicious cycle of academic obstacles leading to lack of motivation and thus decreased ability to overcome academic obstacles.

Most of my participants in this study state that the majority of their AELLS are of East Asian decent, which is consistent with Statistics Canada’s 2012 records stating that about 31% of immigrants in Vancouver are Chinese. According to my participants, these students are often sent to Canada for their education, many of
them stay with home-stay families, or may even be living by themselves in a house or apartment that their parents have supplied for them. For some students, their parents only visit a few times a year. While this much freedom may seem to be a dream for adolescents, the teachers feel that is detrimental and that these AELLs basic needs such as safety, and love/belonging are not being met (Maslow, 1943). Without security and stability in their home life, these AELLs are unable to focus on their schoolwork, causing them to fall behind and thus become unmotivated. Some students that are fortunate enough to have their families in Canada with them are also disadvantaged. Some are not receiving support in the evening at home because their parents are also English Language Learners and cannot help them with their readings. Furthermore, in some cultures, such as the Chinese culture, “reading is seen as a individual solitary exploration”, therefore, parents may not participate in evening homework rituals (Li, 2002, p. 135). Regardless of the reason, it is obvious that these AELLs would benefit from extra help with schoolwork or simply some guidance with daily life. These students are often the quiet ones, the ones that don’t ask for help, so teachers may need to take the first step.

5.3.2 What are the key obstacles that AELL face when learning science in a second language? And how does it affect their motivation?

While my participants try their best to design equitable lessons for all their students, there are some aspects of the Canadian science classroom that carry innate obstacles that every AELLS must face. Educational materials such as textbooks are already difficult and sometimes boring to read for adolescent students. For the AELL, this obstacle is multiplied many times over. All participants in this study
stated that their students are often spending hours and hours each night reading the textbook and often translating it word for word. The perseverance of these students may at first seem like a positive demonstration of motivation, but realistically teachers believe that it can only be sustained for a short duration of time. By grade 11 and 12, enrolment of AELLs in Biology dramatically decreases because the reading and vocabulary becomes too much to keep up with. Since the B.C. curriculum requires students to take a science in grade 11 and 12, most AELLs will opt for courses in chemistry and physics because there is comparably less reading and new vocabulary.

In addition to the English only resources, many AELLs come from educational backgrounds that focus on didactic teaching and the banking method, where students simply listen and take notes while the teacher transfers knowledge to them via lectures and homework assignments (Freire, 2005, p. 72). This means that AELLs, upon first entering Canadian science classrooms, are quite shocked by the experimental learning methods that many teachers use. Not only are they new to hands-on experiments and laboratory reports, they also may not be familiar with the vocabulary needed to follow instructions for those activities. While students in Canada begin practicing the scientific methods as early as primary school, teachers of AELLs must review and often teach these skills as new knowledge to their students. Furthermore, AELLs may also be unfamiliar with teaching practices such as group work and open discussions, that combined with low confidence in their own oral communication skills often cause AELLs to feel left out of group work and disengaged during discussions.
5.3.3 What are some common tools used by science teachers to engage their AELL students?

The professional development opportunities that my participants have been exposed to over their long teaching careers have, without a doubt, positively affected their ability to address the needs of their AELLs. Many teachers have either taught abroad for an extended amount of time or done teaching exchanges internationally. From those experiences it is clear that the participants have learned about the education culture of different countries and thus become more understanding when approaching the education of AELLs.

SIOP method that is detailed in Chapter Two is also a popular set of teaching practices used by the participants. Strategies such as having a word wall in the class, modified language worksheets, and alternate materials for AELLs seem widespread and effective according to the participants (Short et al., 2012). Many teachers feel these strategies have been effective for all their students, not just the AELLs. In addition to SIOP, the flipped classroom technique, where students do much of the content learning at home through videos, seems to increase AELLs’ content acquisition. This format allows AELL’s to learn at their own pace and review sections that are more difficult in language content prior to coming to class. Consequently, teachers find that they are able to stay on pace with curriculum expectations and spend more class time focusing on oral communication and the “analyze”, “evaluate”, and “apply” areas of science. This scaffolding technique succeeds in increasing student motivation because less time is spent on mundane
activities, like trying to define and remember vocabulary, and more on using metacognitive strategies (O'Donell et al. 2008, p. 207).

5.3.4 How can teachers assess the effectiveness their motivation methods?

The interview data suggests these secondary school science teachers are sensitive to their students’ academic, social and emotional well-being. By getting to know their students, they are able to equip themselves with the necessary tools to adapt their lessons according the their students’ abilities and needs. While most of the teachers interviewed are not using formal methods to assess their students’ motivations, all the participants are using informal methods to gauge their students’ motivation and adjusting their teaching practices accordingly. Participants in this study emphasize that many signs of high motivation, such as participation in class and interest in talking about science, may not be apparent in AELLs who are often quite motivated. AELLs who are motivated, may not speak up in class, ask questions, or participate in discussion because of a language barrier. With AELLs, participants find they often have to rely on outside communication with the student, attendance metrics, and homework completion rates to accurately gauge motivation.

5.4 Major Findings

This research project explored how secondary school science teachers motivate their AELL students to actively engage in science content, in and outside of the classroom. The study showed that these experienced teachers had an arsenal full of teaching strategies and showed genuine care for their students by working to
ensure that their AELL students were not only keeping up, but also staying motivated. Furthermore, these teachers were professionally responsible in the sense that they not only hoped their students would successfully acquire the science content that was being taught in their classes, but also wanted to improve their students’ overall science literacy and ability to succeed in future science classes.

The Major findings for this research study can be summarized as follows:

1. Experienced science teachers felt that science literacy is by far the biggest academic obstacle for AELLs. The complicated vocabulary used to convey science content is extremely difficult for AELLs to decipher when they are still struggling with basic English. Methods such SIOP, science journaling, and playing science language games promoting oral participation have seen to be effective in increasing content acquisition and decreasing AELL frustration.

2. The science teachers also emphasized the impact of cultural differences. For AELL who have newly arrived in Canada and are new to Canadian classrooms and Canadian teaching practices, the science classroom can be quite a shock. Many students come from backgrounds that focus on didactic teaching methods. Such students have trouble adjusting to the constructivist methods used in many Canadian science classrooms. Aside from content English, they may be also unfamiliar with science laboratory experiments, group work and class discussions.

3. The teachers felt that it was important for teachers to take the initiative. In order to motivate and engage AELL students, they suggested that instructors
approach students outside of class time, in one-on-one or small group situations. AELLS frequently speak less frequently in class due to lack of oral communication confidence but will often eagerly converse with teachers and accept help when approached outside of class time.

4. The teachers also remarked that the AELLS are a competitive bunch. This means that if teachers are looking to engage these students, they may want to include science games in their lessons that promote healthy competition. Also, while we do not want to make learning solely about marks, consistently assessing the majority of work done by students and handing it back may increase AELL motivation to study the content.

5. While inclusive classrooms seem to be the popular method for ELL education, language adapted science classes may be more effective in helping Level 1 & 2 ELL students gain confidence in the oral communication of scientific concepts and for science content acquisition. Furthermore, Language-adapted classes taken in lieu of regular Science 9 or 10 show that students have a better likelihood of succeeding in subsequent science classes.

6. The science teachers felt that flipping the classroom allowed AELL students to learn science content through web casts and supplemental online video at home and at their own pace. This helps alleviate anxiety for many students and increases class participation. Furthermore, this allows teachers to spend more time in class on hands-on, constructivist learning that students find exciting and motivating.
5. 5 Implications for Further Research

This study shows how five B.C. teachers have been able to adapt their teaching practices and classrooms to better motivate and accommodate the growing number of English Language learners. While all of my participants have different teaching styles and personalities, they all continually seek out professional development opportunities so they can stay at the forefront of their profession. While these teachers are putting research into action by using strategies such as SIOP and The Flip Classroom technique, further research may uncover more effective strategies to use in AELL science education.

Another area that would benefit from additional research would be the effectiveness of language adapted science classrooms for increasing motivation and content. The present study suggests that language-adapted classrooms may be effective in focusing on science literacy and increasing AELLS’ oral communication confidence. However, the recent push for inclusive classrooms raises an important question: Are AELL students actually better off in regular classrooms where they are surrounded by more native speakers and thus forced to use their English? Some additional questions that need to be answered about language-adapted science classrooms include: At which ELL levels and grades are language adapted classrooms the most effective? What is the long-term effect of student success in science in comparison to the mainstream classroom?

This case study examines only teachers in the Greater Vancouver Area. Although they are all exemplary models of how science teachers can facilitate learning in highly AELL populated classrooms, it is just one of many densely
MOTIVATING AELLS TO STUDY SCIENCE

immigrant populated areas of Canada. Future study of more areas in Canada that are heavily ELL populated such as Greater Toronto Area, in Ontario would add pieces to the puzzle that is AELL education.

Additionally, since this study looks that the motivation AELL students to study science it would be interesting to follow AELL students throughout their secondary school science careers and into their post-secondary education to see if their experiences in secondary school classrooms were influential on their success in post-secondary science classrooms.

This study has delivered a vast amount of information regarding best practices for motivating AELLs to study science and for helping AELLs successfully become active participants in the science classroom. Even more exciting, possibly, is the multiple doors it has opened for further research on how to best motivate AELLs across Canada, and in different types of classroom/teaching formats.
References


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Appendices

Appendix A: Letter of Consent for Interview

Date: ______________

Dear ______________,

I am a graduate student at OISE, University of Toronto, and am currently enrolled as a Master of Teaching candidate. I am studying “Motivating Adolescent English Language Learners to Study Science” for the purposes of investigating an educational topic as a major assignment for our program. I think that your knowledge and experience will provide insights into this topic.

I am writing a report on this study as a requirement of the Master of Teaching Program. My course instructor who is providing support for the process this year is Dr. Arlo Kempf. My research supervisor is Dr. Jim Hewitt. The purpose of this requirement is to allow us to become familiar with a variety of ways to do research. My data collection consists of a 40 minute interview that will be audio recorded. I would be grateful if you would allow me to interview you at a place and time convenient to you. I can conduct the interview at your office or workplace, in a public place, or anywhere else that you might prefer.

The contents of this interview will be used for my assignment, which will include a final paper, as well as informal presentations to my classmates and/or potentially at a conference or publication. I will not use your name or anything else that might identify you in my written work, oral presentations, or publications. This information remains confidential. The only people who will have access to my assignment work will be my research supervisor and my course instructor. You are free to change your mind at any time, and to withdraw even after you have consented to participate. You may decline to answer any specific questions. I will destroy the tape recording after the paper has been presented and/or published which may take up to five years after the data has been collected. There are no known risks or benefits to you for assisting in the project, and I will share with you a copy of my notes to ensure accuracy.

Please sign the attached form, if you agree to be interviewed. The second copy is for your records. Thank you very much for your help.

Yours sincerely,

Researcher name: Sijia Cynthia Zhu
Phone number, email: 647-456-5961

Instructor’s Name: Dr. Arlo Kempf
Phone number: 416-978-0078 Email: arlo.kempf@utoronto.ca

Research Supervisor’s Name: Dr. Jim Hewitt
Phone #: 416-978-0123 Email: jim.hewitt.utoronto.ca

Consent Form

I acknowledge that the topic of this interview has been explained to me and that any questions that I have asked have been answered to my satisfaction. I understand that I can withdraw at any time without penalty.

I have read the letter provided to me by ________________ (name of researcher) and agree to participate in an interview for the purposes described.

Signature: ______________________________

Name (printed): __________________________

Date: ______________________
Appendix B: Final Interview Questions

Teacher’s Experience

1. How long have you been teaching in this community?
2. What kind of experience do you have working with Adolescent English Language Learners?

Teacher and Their Students

3. From your experience, what are some of the difficulties Adolescent English Language Learners have when learning science?
4. What difference to you notice – if any- in students’ performance between your AELL and non-AELL science students?
5. What differences to you notice- if any- in motivation to study the sciences, between your ELL and non-ELL science students?
6. How can you tell when your students are unmotivated in a subject area?

Teaching Practice

7. What specific techniques do you use to increase students motivation in the science classroom?
8. When planning your lessons what specific instructional strategies do you use that you think benefit ELL students in particular?
9. How do you assess student motivation in your classroom?
10. In what ways do you think kinesthetic and visual teaching methods might be useful in increasing adolescent motivation to study the sciences.
Appendix C: Get to Know You Survey

Motivating Adolescent ELLs to Study the Sciences

Name: ____________________________________

Number of Years Teaching Science: _________

Science Courses Taught (grade, course name):

_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________

School taught at:
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________

Education Background (Undergraduate, BEd Specialization, Other applicable certificates/diplomas):
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________


## Appendix D: Data Analysis – Coding Genesis

### Table 1: Themes in relation to Interview Questions

<table>
<thead>
<tr>
<th>Themes</th>
<th>Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Key signs of motivate/un-motivation?</td>
<td>Q3, Q5, Q6</td>
</tr>
<tr>
<td>2. Factors contributing to ELL lack of motivation?</td>
<td>Q3, Q4, Q5,</td>
</tr>
<tr>
<td>3. Common tools to engage ELLs in science class?</td>
<td>Q7, Q8, Q10</td>
</tr>
<tr>
<td>4. Assessment of effectiveness for motivating methods?</td>
<td>Q9</td>
</tr>
</tbody>
</table>

### Table 2: Coding Map – 3 Iterations of Analysis

#### First Iteration: Initial Codes/Surface Content Analysis

| 1A2: Asleep | 2A2: Biology | 3A2: Fieldtrips | expression |
| 1A3: Talking | 2A3: Group work | 4A2: Verbal |
| 1A4: Outside the Class | 2B1: Context | 3A4: Science in the real world | feedback |
| 2B2: Instructions/Questions | 4A3: Increase in academic achievement |
| 1B1: Late work | 3B1: Role play |
| 1B2: Incomplete work | 3B2: Discussions | 4A4: Comfort |
| 1B3: Failing/low grade | 3B3: Games | 4A5: indirect |
| 1B4: Translations | 2C1: Parents |
| 1C1: Decreased Participation | 2C2: Study groups |
| 1C2: Decreased # in Biology | 2C3: Individual |
| 1C3: retaking courses | 3C1: Word Wall |
| 3C2: Integrated classroom | 3C3: Journals |
| 3C4: Study Skills | 3D1: Own pace |
| 3D2: Frees up class time | 3D3: Discussion |

#### Second Iteration: Sub Themes

| 1A: Physical | 2A: Science Specific | 3A: Science Specific |
| 1B: Academic Specific | 3B: Language |
| 1C: Long Term Language | 3C: SIOP |
| 2B: Language Outside of School | 3D: Flip Classroom |

#### Third Iteration: Themes

| 1. Key signs of unmotivation/un-motivation? | 2. Factors contributing to ELL lack of motivation? |
| 3. Common tools to engage ELLs in science class? | 4. Assessment of effectiveness for motivating methods? |
Appendix E: Figure 1 – Findings

AELL Profile

- Educational Background
- Cultural Background
- Adolescent Development
- Science Literacy

Major Findings

- LVL 1 & 2
  - Language adapted science classroom
  - SIOP
  - Increase confidence in oral communication

- LVL 3 & 4
  - 2:1 ratio of inclusive to language adapted instruction
  - Introduction of Flip Classroom
  - Focus on scientific method
  - Continued use of SIOP

- LVL 5
  - 100% integrated into mainstream classroom
  - Teacher initiated check-ins
  - Continued use of SIOP