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THE INFORMATION SEEKING AND USE OF ENGLISH LANGUAGE LEARNERS  
IN A HIGH SCHOOL SETTING

by

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Professor Ross J. Todd

And approved by

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## ABSTRACT OF THE DISSERTATION

### THE INFORMATION SEEKING AND USE OF ENGLISH LANGUAGE LEARNERS IN A HIGH SCHOOL SETTING

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Professor Ross J. Todd

This study examines the information seeking and use behaviors of English language learners (ELLs) while performing a research task, using Vygotsky's Zone of Proximal Development and Kuhlthau's Information Search Process as theoretical frameworks. The research tasks implemented in this study were curriculum based units where students engaged a diverse range of information sources to demonstrate their understanding of a topic.

Participants of this study were 48 ELL students from three classes at a public high school in New Jersey. During a 4-5 week period, 10 students from one class were required to choose potential future careers and write a research paper on the college preparation, whereas the 38 students from the other two classes were required to create a foldable on a genetic disorder of their choice. Data were collected through a demographic questionnaire, process surveys at three times (initiation, mid-point and completion), observation, and

semi-structured interviews with students and teachers. All manipulated data from the questionnaire and process surveys were statistically analyzed. To corroborate the findings from the questionnaires and process surveys, field notes and transcripts were underwent content analysis.

This study shows what ELL students experience when searching for information throughout the course of a research project in English and what factors interact with individuals' primary patterns in their information behavior. The findings indicate that having a fluent English speaker or using some English at home gives ELL students more confidence in their English language abilities, which might impact their information behavior. Among the ELL groups, only the intermediate ELL group exhibited significant increases in estimated knowledge and in positive feelings, particularly relief and satisfaction, as they progressed in their research project. In addition, this study addresses how ELL students' research process is influenced by gender, ethnicity, and the nature of the research task.

This study sheds light on how cultural and linguistic background can influence people's information seeking and use. At a pedagogical level, the findings facilitate understanding of the unique needs of ELL students in K-12 school contexts and suggest effective strategies and instructional interventions for meeting those needs.

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## CHAPTER 1 INTRODUCTION

### 1.1 Problem Statement

The number of immigrants with diverse linguistic and cultural backgrounds has been dramatically increasing in the United States. According to the National Clearinghouse for English Language Acquisition (NCELA), total PK-12 enrollment has increased 3.66 % from 1995-96 to 2005-06, whereas limited English proficiency (LEP) enrollment has increased 57.17% during the same period. It comprises 10.29 % of the total number of PK-12 enrollment as shown in Table 1 (NCELA, 2007). LEP students are enrolled mainly in large, urban school districts, and 25 of the 100 largest school districts have at least 15% LEP population (NCES, 2002).

The growing number of LEP students in the PK-12 enrollment has decreased the overall literacy level of adolescents, decreased the high school graduation rate, and

Table 1  
The Growing Number of LEP Students 95/96–05/06 (NCELA, 2007)

Year	Total PK-12 Enrollment	PK-12 Growth Since 95-96	LEP Enrollment	LEP Growth Since 95-96	% of LEP of Total PK-12
95-96	47,582,665	0.00%	3,228,799	0.00%	6.79%
96-97	46,714,980	-1.82%	3,452,073	6.92%	7.39%
97-98	46,023,969	-3.28%	3,470,268	7.48%	7.54%
98-99	46,153,266	-3.00%	3,540,673	9.66%	7.67%
99-00	47,356,089	-0.48%	4,416,580	36.79%	9.33%
00-01	47,665,483	0.17%	4,584,947	42.00%	9.62%
01-02	48,296,777	1.50%	4,750,920	47.14%	9.84%
02-03	49,478,583	3.98%	5,044,361	56.23%	10.20%
03-04	49,618,529	4.28%	5,013,539	55.28%	10.10%
04-05	48,982,898	2.94%	5,119,561	58.56%	10.45%
05-06	49,324,849	3.66%	5,074,572	57.17%	10.29%

created more diverse learning environments. Nationally, only 30 % of all secondary students read proficiently. Eighty-nine percent of Hispanic and 86 % of African-American secondary students read below grade level (NCES, 2005). Only 4% of eighth-grade LEP students and 20% of former LEP students scored at the proficient or above levels on the reading portion of the 2005 National Assessment for Educational Progress. This shows that 96% of the eighth-grade LEP students scored below the basic level (Perie, Grigg, & Donahue, 2005).

With respect to completing high school, 31% of English language learners (ELLs) fail to complete high school, compared to 10% of native English speakers. Among ELLs, 51% of former LEP students graduate a high school, compared to 18% of LEP students. (NCES, 2004).

Moreover, research suggests that the linguistic and cultural diversity of ELL students strongly influences their learning experience in predominantly two ways. First, they have double the work of native English speaking students by learning English at the same time they are studying a subject area through English (Short & Fitzsimmons, 2007) and second, they have different frameworks to interpret information due to their different linguistic and cultural backgrounds (Agosto & Hughes-Hassell, 2007; Agosto, 2001).

Nevertheless, the needs of adolescents with linguistic and cultural diversity in school settings have been rarely recognized. As Short and Fitzsimmons (2007) pointed out:

Despite the growing societal awareness of the need for interventions and programs to increase literacy levels of adolescents, education policymakers and school reformers have mostly overlooked the needs of the large and growing

English language learner (ELL) population. Though recent reports have helped to focus attention on the adolescent literacy crisis, they offer very little guidance on how best to meet the varied and challenging literacy needs of adolescent ELLs.

(p.1)

Particularly regarding school library services for ELL students, Agosto and Hughes-Hassell (2007) stated that the linguistically and culturally diverse backgrounds of ELL students influence their understanding and interpretation of library resources and learning experiences beyond mere language comprehension. Also, they emphasized that school librarians have to collaborate with other teachers to figure out how to use a library's resources on cultural diversity in the classroom.

However, educational research on ELL students has mainly focused on reading comprehension and writing in primary school (Elley, 1991). Few studies have been conducted on ELLs at the secondary level (NREL, 2004), with even fewer that have focused on non-Spanish speaking ELLs (Short & Fitzsimmons, 2007). Although research in library and information science has recognized the ELL population as a growing user group, it still focuses mainly on providing material primarily for Hispanic students. Few studies have paid attention to how ELLs interact with information during the learning process or when they need instructional interventions throughout the research process.

## **1.2 Purpose of the Study**

This study aims to understand the information seeking and use behavior of high school students with diverse linguistic and cultural backgrounds within a research task, using the frameworks of Vygotsky's Zone of Proximal Development (ZPD) and

Kuhlthau's Information Search Process (ISP). The research tasks implemented in this study were curriculum based units where students engage with a diverse range of information sources and demonstrate their understanding of a topic. In this study, the participating students were guided mainly by the ESL teacher or subject teacher for content knowledge, and intervened by the school counselor or school librarian for information access.

To understand the information seeking and use of ELL students during research tasks, this study examined the following research questions:

RQ1. What primary patterns, if any, do ELL students have in terms of cognitive dimension (substance and amount of knowledge, labeling of knowledge, estimated knowledge, interest, and learning outcome), as they engage in the research task?

RQ2. What primary patterns, if any, do ELL students have in terms of affective dimension, with particular focus on positive affect (confidence, relief, optimism, and satisfaction), negative affect (disappointment, frustration, confusion, uncertainty, and anxiety) and concern about their English proficiency?

RQ3. What enablers and inhibitors do ELL students encounter during the research process, with particular focus on easy or difficult tasks, the type of assistance they needed, and teachers' instructional interventions?

This study shows how ELL students search and use information and construct knowledge throughout a research task in English. It reveals what factors interact with individuals' primary patterns in their information seeking behavior. There has been lack of formal support for linguistically and culturally diverse students, and school librarians need to

know how these factors influence assessments, student learning and socialization (Agosto & Hughes-Hassell, 2007). At a pedagogical level, the findings will facilitate understanding of the efficient strategies and instructional interventions for ELL populations in K-12 school contexts. This study will suggest potential interventions that school librarians can provide to support ELL students' academic achievement and lead them to obtain their learning goals. At a theoretical level, the findings of the study will contribute to Kuhlthau's Information Search Process by adding linguistic and cultural dimensions as critical factors which influence human information behavior.

### 1.3 Glossary

This section describes the definitions of terms which are used in the study. There exist various terms to identify linguistically and culturally diverse students, including English language learner (ELL), English as a second (foreign or additional) language (ESL, EFL or EAL), limited English proficient (LEP), potentially English proficient (PEP) and language minority/international/immigrant students. The term *ESL* emerged and was commonly used both educationally and linguistically through the 1980s; however, *ELL* has been increasingly preferred because students might be learning English as a third or fourth language (NREL, 2004). LEP and ELL are sometimes used interchangeably; however, they are defined differently in this study. ESL is still used in schools as a specialized program for ELL students.

**English Language Learners (ELLs):** *English language learners (ELLs)* are those who are in the process of acquiring English and have a first language other than English. Some ELLs newly arrived in the U.S., whereas some were born in the U.S. or

have been living in the U.S. for many years in households where family members speak a language other than English (The Knowledge Loom, n.d.). They include both LEP students and former LEP students.

**Limited English Proficient (LEP):** *Limited English proficient (LEP)* persons are ELL students without “sufficient mastery of English to meet state standards” who are receiving specialized ESL programs, whereas *former LEP* persons are ELL students “who have made the transition out of specialized ELL programs and into the regular course of study” (U.S. Department of Education, 2005b). Former LEP persons are sometimes referred to as *fluent English proficient (FEP)* (Short & Fitzsimmons, 2007).

**English as a Second Language (ESL):** *English as a Second Language (ESL)* is defined as “a program of techniques, methodology and special curriculum designed to teach ELL students English language skills, which may include listening, speaking, reading, writing, study skills, content vocabulary, and cultural orientation. ESL instruction is usually in English with little use of native language” (U.S. Department of Education, 2005a).

**Linguistically Isolation:** *Linguist Isolation* is defined as living in a household in which all members aged 14 years and older speak a non-English language and also speak English less than “very well.” That is, all members of the household who are 14 years old and over have at least some difficulty with English (U.S. Census Bureau, 2004).

## CHAPTER 2 LITERATURE REVIEW

### 2.1 School Libraries and Student Learning

Research has been conducted to indicate how school libraries can provide services to support students' academic achievement. In effect, the positive relationship between a quality school library program and student academic achievement has been proved through a number of state-wide studies with school/community demographic information controlled.

Analysis of 1715 surveys from Florida K-12 public schools indicated that school library programs with more certified staff and staff hours, technology, and books have students who frequently use school libraries, and the increased usage produces higher academic achievement (Baumbach, 2002). According to the Wisconsin study, a quality school library program explains between 3.2% and 3.4% of the variance in reading and language arts performance at the elementary level, 9.2% at the middle school level and between 7.9% and 19.0% at the high school level (Smith, 2006). The Missouri study shows that school library services account for 10.6% of the variation in student achievement as measured by MAP (Missouri Assessment Program) test scores. Among the 11 library components they measured, three of them – library usage, summer reading, and library access – have the most significant impact on student achievement (Quantitative Resources, LLC., 2003). Lance (1995) stated that students with better funded school libraries tend to perform better than average in reading regardless of economic status or the educational level of the community.

A study conducted in Ontario, Canada, revealed that grades 3 and 6 students in schools with school librarians are more likely to enjoy reading, which is positively linked to student achievement in reading. In addition, schools with professionally trained library staff could be expected to have reading achievement scores that were approximately 5.5% points higher than the average (Klinger, 2006). Studies performed in Massachusetts and in Indiana also verified the impact of school library programs on student learning. For instance, it is found that at each grade level, schools with library programs have higher MCAS (Massachusetts Comprehensive Assessment System) scores (Baughman, 2002), and Indiana schools with better-staffed, better-stocked, and better-funded school library programs tend to perform better (Lance, Rodney, & Russell, 2007). Furthermore, *Student Learning through Ohio School Libraries* (2004) shows that students themselves recognize that school library services promote their learning outcomes while indicating that 99.44% of the participating students respond that the school library and its services, including roles of school librarians, have helped them in some way with their learning achievement (Todd, Kuhlthau, & OELMA., 2004).

Among the activities of school librarians, collaboration with classroom teachers or with public libraries appears to be a critical factor in raising students' academic success. In the Colorado study, school librarians planned collaboratively with teachers, identified materials for teachers, taught information literacy to students, provided teacher in-service training, and managed information technology. The study shows that students who are supported by the teacher/librarian collaboration tend to have higher reading scores. For instance, students who have the most collaborative school librarians have reading scores 21% higher than those who have the least collaborative school librarians

(Lance, Rodney, & Hamilton-Pennell, 2000). Also, Illinois schools with more flexibly scheduled libraries tend to have more students who perform well on tests by allowing students to access information resources upon their needs and enabling teachers to collaborate with school librarians (Lance, Rodney, & Hamilton-Pennell, 2005). The Alaska study shows that schools with a cooperative relationship between the school library and the public library tend to have higher test scores (Lance, Hamilton-Pennell, & Rodney, 1999).

Studies have shown that information literacy instruction in school libraries has a positive relationship with students' learning achievement. Massachusetts students, at the elementary and middle/junior high school levels, score higher on the MCAS (Massachusetts Comprehensive Assessment System) tests when there is a library instruction program (Baughman, 2002). The Alaska study found that the more often information literacy instructions are offered by school librarians, the higher the test scores (Lance, Hamilton-Pennell, & Rodney, 1999). Moreover, in the Wisconsin study, students value most the school librarian's help in acquiring information and technology skills which are not taught in classroom instruction (Smith, 2006).

Furthermore, according to the Indiana study, the school community's perceptions of the roles of school librarians turned out to have a relationship with students learning. This study found that across grade levels, better-performing schools tend to be those whose principals and teachers consider the roles of school librarians as reading motivators, instructional support staff, teachers, instructional resources managers, in-service providers, and school leaders (Lance, Rodney, & Russell, 2007).

Some of the studies addressed the roles of school libraries to support the learning experience of students at risk who may struggle with low family income, single parent status, and recent immigration. The Ontario Ministry of Education's (2003) Expert Panel on Students at Risk identified that the barriers these students encounter may include: 1) lack of foundational knowledge and skills, 2) lack of motivation, interest, or direction, 3) personal, social, or family issues, 4) belief that school is not relevant to their interests or needs, 5) lack of appropriate instruction targeted to their learning needs, 6) lack of appropriate programs designed for their intended pathway or career choice, and 7) a cultural or first-language background that is not prevalent in their school. Research showed that children from a lower economic status who have a school library tend to have higher test scores than those who do not have such a program (Baughman, 2002). In the Florida study, it is argued that for students from poorer schools and from poorer homes, quality school library programs are even more critical because they may find their best access to various types of information resources through the school library program (Baumbach, 2002).

## **2.2 Children and Young People's Information Seeking and Use in Learning Contexts**

The paradigm shift to a user-centered perspective in library and information science changed research focus of the study of children and young people from the effectiveness of technologies to the information behaviors of children and young people in learning contexts and everyday life contexts (Chelton & Cool, 2004). In general, research on children and young people's information seeking and use in the learning

context includes various aspects of the relationship between learning and the information environment (Todd & Edwards, 2004). Relevant studies in the learning context are reviewed in terms of online catalogs, electronic multimedia resources, Internet and World Wide Web, digital libraries, and information search process.

**Online catalogs.** Research studies on children and young people's information seeking and use of online catalogs include overall patterns, comparison between browsing and keyword searching, and factors influencing search behavior and search success in online catalogs.

It is shown that children and young people can successfully find information by browsing without training. Keyword searching is more attractive to older children, whereas browsing is preferred by younger children who like the graphics and lack required spelling and key-boarding skills. In addition, multiple search options enable children to use the system more efficiently (Borgman, et al., 1995; Hirsh & Borgman, 1995). Domain knowledge and computer experience appear to influence children's searching behavior. Both make children skillful searchers; however, domain knowledge helps children successfully retrieve information, whereas computer experience seems to have little effect on success (Hirsh, 1997, 2004). Additionally, Hirsch reports that neither gender nor experience with video games or online catalogs influences children's search behavior and success in online catalogs (Hirsh, 1997, 2004).

These findings imply that online catalogs need to provide both browsing and keyword searching for children and young people to be able to employ one or the other depending on the situation and purpose. Also, when using online catalogs, children and young people need search tips or vocabulary aids based on their level of domain

knowledge. However, the effect of domain knowledge on information search needs to be verified across various types of information systems.

**Multimedia resources.** Research on children and young people's information seeking from and use of CD-ROM encyclopedia have been studied in terms of information behaviors with multimedia resources, visual effects on information seeking, and comparison between multimedia and print.

Children and young people easily learn how to use electronic multimedia resources and need little training to navigate in them (Large, Beheshti, Breuleux, & Renaud, 1994). Regarding age differences, older children appear to be more successful in information searching and take less time than younger children. In addition, older children prefer examining title and text, whereas younger children tend to refine queries (Liebscher & Marchionini, 1988; Marchionini, 1989).

In comparing different information formats, children and young people prefer multimedia to textual information but use only textual information for their assignments (Perzylo & Oliver, 1992). During their research at school, middle school students who use multimedia resources are likely to successfully navigate information and be more engaged in activities, while those using a print resource are likely to extract information from the text to achieve a research task. It is shown that children may place more trust in video or audio media than in print format resources (Small & Ferreira, 1994). Different media combinations (text, animation, and caption) do not influence children and young people's recalls and inferences; however, visual clues help children and young people perform the process more easily (Large, Beheshti, Breuleux, & Renaud, 1995).

**The Internet and World Wide Web.** As the Web has become a primary information source for many users and deeply influenced learning environments, research on children and young people's use of the Web has been increasing since the late 1990s. Bilal (2000, 2001, 2002) and Schacter, Chung, and Dorr (1998) examined the effect of task characteristics on information behavior and success in using the Web. Moreover, children and young people's information behavior on the Web has been studied in terms of search strategies, information evaluation, gender effect, and interface design.

Comparing different search tasks, research indicates that children and young people are more successful on self-generated tasks than fact-finding tasks. They browse more often than they search by keywords on both self-generated tasks and fact-finding tasks; however, they employ more keyword searches on fact-finding tasks than on self-generated tasks (Bilal, 2000, 2001, 2002; Schacter, Chung, & Dorr, 1998).

In terms of search strategies, children and young people tend not to use systematic search strategies. They generally do not use any search refinement features and online help offered by search engines (Hirsh, 1999; Large, Beheshti, & Moukdad, 1999) and promptly enter search terms without enough time for thought (Bowler, Large, & Rejskind, 2001).

Students from the elementary school level through the high school level have difficulties in finding desired information on the Internet and do not attempt to check the credibility of the retrieved information (Shenton & Dixon, 2003). They need help to evaluate the authority of Web pages (Enochsson, 2001; Kafai & Bates, 1997).

They show gender differences in using the Web. While girls tend to use natural languages in searching, boys tend to use single keywords in search statements. Girls

spend more time reading the Web pages they visit than boys (Large, Beheshti, & Rahman, 2002), whereas boys browse significantly more than girls (Schacter, Chung, & Dorr, 1998).

Recently, as the Web 2.0 environment has gained attention, a variety of social software is frequently used by children and young people in their school lives as well as daily lives. Research by Lenhart and Madden (2007) shows that girls are more active in blogging and creating content than boys, whereas boys are more interested than girls in watching or sharing videos through media sharing sites. Regarding teens' prevalent usages of social software, Todd (2008) pointed out that school libraries have great potential to take advantage of Web 2.0 technology as an instructional tool as well as a means of communication.

Regardless of the age of user groups, studies on Web search behavior have continued to grow. To establish a holistic depiction of Web search behavior, it should be noted that researchers need to reflect on how to represent rapidly changing and growing Web users, how to manage various factors involved in the complexity of Web search behavior, and how to deal with the situational nature of research contexts in some studies (Hsieh-Yee, 2001).

**Digital libraries.** Reuter and Druin (2004) examined elementary school students' book searching and selection in a digital library and found that younger children prefer a simpler and more interactive interface, whereas older children employ more sophisticated concepts in using a digital library. Moreover, boys tend to run more queries than girls, whereas girls tend to select more books than boys (Reuter & Druin, 2004). Abbas (2005) indicated that the terms used in digital libraries are not adequate or age-appropriate for

children and young people. In addition, Neuman (1997) focused on learning benefits from a digital library and stated that digital libraries should be viewed from both the information studies and instructional technology perspectives.

**Information Search Process (ISP).** Kuhlthau's (1991) ISP model was derived from a series of five studies investigating users' information seeking patterns (Kuhlthau, 1983, 1988a, 1988c, 1989; Kuhlthau, George, Turock, & Belvin, 1990). Afterwards, the ISP model has been verified and extended by later studies on children and young people from various perspectives. McGregor (1993) and Pitts (1994) extended the ISP model by collecting data from various environments and focusing on cognitive aspects more deeply. Moreover, the impacts of gender (Burdick, 1996) and concept mapping (Gordon, 2000) on the ISP were examined and Todd (2006) investigated how students build knowledge using retrieved information in a guided inquiry project.

Research shows that uncertainty in the early stage of the ISP is associated with unclear thoughts about a topic, while relief is common at the completion stage of the ISP (Kuhlthau, 1991). Children and young people tend to gather and organize facts for papers or presentations without understanding their topics. Their own perspective and understanding on the topic should be made in the stage of formulation, which is the most critical stage of the ISP (Gordon, 1999; Kuhlthau, 1991; McGregor & Streitenberger, 2004; Todd, 2006). Regarding gender differences, Burdick's (1996) study found that girls are more likely to work together and boys are less likely to ask for help. Some girls lack confidence regardless of whether they are clearly focused or not. Girls tend to be optimistic at the early stage of the process, but uncertain at closing, whereas boys show confidence as they finish (Burdick, 1996). Also, those with concept mapping are able to

apply various search terms and execute deep and precise searching (Gordon, 2000). More studies on ISP are addressed in Section 2.4.3.

## **2.3 English Language Learners**

### **2.3.1 Education**

Educational research on linguistically and culturally diverse students had, until the 1990's, mainly focused on their reading comprehension and writing. For instance, Elley and Mangubhai (1983; Elley, 1991) showed that free voluntary reading helps LEP students improve their English and that learning the primary language is a short cut to learning the second language. However, fewer studies have been conducted on LEPs at the secondary level than at the elementary level (NREL, 2004), with even less focus on other language speakers than Spanish (Short & Fitzsimmons, 2007).

In the 2000's, educators and researchers gave more attention to better meeting the needs, other than English proficiency, of students with diverse linguistic and cultural backgrounds in school settings. Valadez (2008) examined the educational decision making process of Mexican immigrant high school students for 18 months and found that their decision making process and choice for college preparation are influenced by limited access to information, structural constraints and cultural constraints. In terms of academic achievement, track placement is a better way to measure students' performance than their proficiency in English (Callahan, 2005). Moreover, the amount of time that students spend speaking English in informal contexts is considered as an influential factor determining their English proficiency (Carhill, Suarez-Orozco, & Paez, 2008). However, few studies have been conducted on how ELL or LEP students' language and culture

interact with their learning process.

### **2.3.2 Library and Information Science**

Research in library and information science has recognized the ELL population as a growing user group. Although it is revealed ELL students and their parents use public libraries considerably less than native English speakers (Constantino 1994, 1995), the library is considered as a place for ELL students to learn literacy skills (Bordonaro, 2006; Selnik, 2004).

The recently revised competencies for librarians serving youth, developed by the Young Adult Library Services Association (YALSA), include librarians' abilities to support linguistic and culturally diverse young adults. They are:

- Demonstrate an understanding of, and a respect for, diverse cultural, religious, and ethnic values.
- Identify young adult interests and groups underserved or not yet served by the library, including at-risk students, those with disabilities, non-English speakers, etc., as well as those with special or niche interests.
- Develop a collection of materials from a broad range of selection sources, and for a variety of reading skill levels that encompasses all appropriate formats, including, but not limited to, media that reflect varied and emerging technologies, and materials in languages other than English (YALSA, 2010).

However, library and information science research on ELLs still focuses mainly on material provision, especially for Hispanics, and few studies have been conducted on information seeking and use of ELLs in learning contexts.

Regarding school library services for ELL students, Dame (1994, 1995) suggested school librarians should foster a positive environment in the school library for ELL students by providing a welcoming atmosphere, stocking collections in their native language, offering resources for teachers – including multicultural activities and literacy activities – and collaborating with other agencies. A few studies have suggested collaborative partnerships between school librarians and subject teachers for serving ELL students (Alexander & Morton, 2007; Filson, 1992; Naidoo, 2005); however, the role of the school librarian is limited to developing and providing multi-cultural and multi-language materials.

In *School Reform and the School Library Media Specialist*, Agosto and Hughes-Hassell (2007) observed that students' linguistic and cultural backgrounds affect teachers' assessments, their comprehension of information resources, and socialization process. To help ELL students overcome the learning barriers they may encounter in schools, Agosto and Hughes-Hassell provided nine strategies for school librarians to apply to promote their information services and instruction for ELL students (Table 2). These suggested strategies for ELL students include collaboration with teachers to plan instructional units that integrate content knowledge, language and information literacy, which calls for an instructional role of the school librarian that goes beyond mere material provision (Agosto & Hughes-Hassell, 2007). However, to effectively plan and implement a collaborative instructional unit for ELL students, it should be examined when ELL students need interventions and what interventions they need from teachers and school librarians during their learning process.

Table 2  
Strategies School Librarians Can Use to Support English Language Learners

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<p><b>Learning and Teaching</b></p> <ul style="list-style-type: none"> <li>• Promote the use of multicultural and bilingual resources across the curriculum.</li> <li>• Help English language learners make personal connections to library resources representing unfamiliar cultures.</li> <li>• Facilitate the language acquisition process for English language learners.</li> <li>• Collaborate with teachers to plan instructional units that integrate content and language learning for English language learners.</li> <li>• Encourage learning partnerships between English language learners and English language proficient students.</li> </ul>
<hr/> <p><b>Information Access and Delivery</b></p> <ul style="list-style-type: none"> <li>• Create a culturally diverse library collection.</li> <li>• Establish and maintain ties with information resources and services in the community that can help meet the information needs of English language learners.</li> <li>• Introduce English language learners to the library and the library's resources.</li> </ul>
<hr/> <p><b>Program Administration</b></p> <ul style="list-style-type: none"> <li>• Create a culturally diverse library environment.</li> <li>• Collaborate with teachers, students, and parents to develop a library policy that promotes equity and respect.</li> </ul> <hr/>

With educational systems across the world giving increased emphasis to responding innovatively to the needs of learners, it is timely to examine how ELL students engage with information to build new knowledge in the context of research tasks in a school setting.

## 2.4 Theoretical Frameworks

### 2.4.1 Constructivism

The theoretical frameworks of this study are Vygotsky's socio-cultural perspective from education and Kuhlthau's Information Search Process from library and information science, both of which reflect a constructivist learning paradigm.

Constructivism is a theory of learning which describes what knowing is and how people

learn. It considers humans as goal-directed agents who actively construct new knowledge based on prior experiences (Bransford, Brown, & Cocking, 2000). Therefore, while behaviorists view learning as “a process of expanding the behavioral repertoire” (Phillips & Soltis, 1998, p.23), constructivists view it as “a self-regulatory process of struggling with the conflict between existing personal modes of the world and discrepant new insights, constructing new representations and models of reality...” (Fosnot, 2004, p. ix). The essential core of constructivism is that learners actively construct their own knowledge based on prior experience and prior knowledge. This concept is based on subjectivism, which assumes that while reality may exist apart from experience, people can know reality only through their unique experiences (Doolittle, 1999), and relativism, which assumes the social construction of reality (Berger & Luckmann, 1966).

Constructivism suggests new teaching methods which provide the student with more opportunities for meaningful experiences. From the constructivist viewpoint, the educational setting is seen as a community of learners who encourage one another to interpret, discuss, represent, and interact, and the role of teachers is not to transfer knowledge to students, but to facilitate students’ knowledge construction process (Fosnot, 2004). Therefore, many researchers have used constructivist learning theories to better understand students’ learning processes and ultimately to develop effective teaching methods in structured learning environments, such as classrooms and school libraries.

#### **2.4.1.1 Constructive Learning in Education**

Research studies of constructivist learning in education emphasize prior knowledge, metacognition, deep knowledge understanding, social interactions and

practical contexts. The following findings can be made about constructivist learning in education based on the analysis of the research.

1. *Prior knowledge*: Students may have prior knowledge and experience about a topic when they face new information (Piaget, 1952; Vygotsky, 1978). Prior knowledge can offer a good foundation for supporting students' knowledge building; however, incorrect preconceptions may lead to learning difficulties (Lionni, 1970; Vosniadou & Brewer, 1989). Therefore, teachers and school librarians should design assignments that acknowledge students' pre-existing knowledge.
2. *Metacognition*: Students need to know the strengths and weaknesses of their capabilities during the learning process (Greeno, Collins & Resnick, 1996). Many researchers maintain that students who know where they are and what they should do will show better performance in solving problems (Palincsar & Brown, 1984; Scardamalia, Bereiter, & Steinbach, 1984; Schoenfeld, 1991). Metacognitive instruction helps students learn to take control of their own learning by defining their goals and monitoring their progress (Brandford, Brown, & Cocking, 2000).
3. *Deep knowledge understanding*: Students understand deep knowledge of each subject area in different ways (Chi, Feltovich, & Glaser, 1981; Resnick, 1989; Wineburg, 1991). For example, physics experts have more conceptual chunks and their relations in memory so that they can efficiently use their knowledge (Chi, Feltovich, & Glaser, 1981). And history experts understand historical events and can pose alternative explanations for them (Wineburg, 1991).
4. *Social interactions*: Students learn from the interactions with their peers in the classroom or the school library. Teachers and school librarians need to support

students' understanding within the Zone of Proximal Development (Vygotsky, 1978) and their role is to facilitate students' knowledge building through these interactions (Brandford, Brown, & Cocking, 2000).

5. *Practical contexts*: Students learn more efficiently from solving concrete, practical problems than from abstract, decontextualized ones (Saxe, 1988). Moreover, knowledge gained from instruction that uses practical contexts is more easily transferable to non-school contexts (Brandford, Brown, & Cocking, 2000). Therefore, teachers and school librarians can facilitate students' learning by engaging real issues in everyday life.

#### **2.4.1.2 Constructive Learning in Library and Information Science**

Research that has been conducted on constructivist learning in library and information science emphasizes the information search process, zones of intervention, concept mapping, social interactions, gender differences, and teacher-librarian collaboration. This research has produced the following findings.

1. *Information search process*: the information search process is more iterative than linear. In the early stage of the ISP, unclear thoughts about a topic often produce uncertainty, while at the completion stage of the ISP, confidence and relief are common. Although the significance of the early stage of the ISP is easily ignored in practice, more attention should be given to the exploration and focus formulation stages for increasing students' understanding on a topic (Kuhlthau, 1991).
2. *Zone of intervention*: When students face problems they cannot solve alone, intervention enables them to minimize difficulties and successfully accomplish their

- tasks. The situation can be divided into a source problem and a process problem (Kuhlthau, 2004).
3. *Concept mapping*: If students do not have enough knowledge on a topic, they cannot know what information they need. Therefore, mapping concepts prior to an information search helps students know what is needed and search more efficiently (Gordon, 2000). Concept mapping is one way to increase students' metacognitive thinking.
  4. *Social interactions*: Children's cognitive categories of library information change from personal and concrete terms to sophisticated and abstract ones through interaction with their social environment (Cooper, 2004). Moreover, students' interactions with peers, teachers, and parents in classrooms and libraries promote their knowledge development (McKechnie, 1997).
  5. *Gender differences*: The information search process varies according to gender. For instance, girls generally lack confidence regardless of whether they are clearly focused or not. Girls tend to be optimistic at the early stage of the process, but uncertain at closing, whereas boys show confidence as they finish. Furthermore, girls are more likely to work together and boys are less likely to ask for help (Burdick, 1996).
  6. *Teacher-librarian collaboration*: Teachers and school librarians need to support each other to enable students to actively construct their own knowledge as an independent learner (Montiel-Overall, 2005a, b; Bhavnagri & Bielat, 2005).

### **2.4.2 Vygotsky's Socio-Cultural Perspective**

While other constructivists such as Dewey (1933, 1944), Kelly (1963), Bruner (1973) and Piaget (1952) focused on the individual's inner process of knowledge construction, Vygotsky viewed an individual-in-context participating in an event as the smallest meaningful unit of study (Miller, 2002). Vygotsky (1978) argued that learners are in a social context and that learning occurs through interactions with or within this social environment, stressing the significant role of languages and interactions with peers. He emphasized that a child's ability should be measured not by his or her product in a certain moment, but by his or her potential ability or the process of change (Miller, 2002). Vygotsky (1978) defined the Zone of Proximal Development as "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (p.86). For example, a child can develop knowledge through interaction with his or her mother in the Zone of Proximal Development. This interaction may enable the child to solve a problem which he or she cannot deal with alone. Conversely, if there is no help from a more capable person in the Zone of Proximal Development, even a potential child could remain in the existing developmental status.

Vygotsky's socio-cultural perspective has been actively used as a key framework in many studies and fields for peer collaboration, dynamic assessments for tracking progress, and students' diverse contexts which might impact on their activities. This study is framed with Vygotsky's perspective in that 1) the context of the study is a research project developed by the collaboration between the teachers and encouraging the

interactions between the students, and 2) the main focus of the study is on how different student backgrounds, such as language and culture, interact with the learning process.

### **2.4.3 Kuhlthau's Information Search Process**

Influenced by constructivists Dewey, Kelly, and Bruner, Kuhlthau (1991, 2004) developed the Information Search Process (ISP) viewing the information searching process as the process of construction. As shown in Figure 1, the ISP demonstrates feelings, thoughts and actions according to users' six information tasks: initiation, selection, exploration, formulation, collection, and presentation. It was first developed when Kuhlthau (1983) examined high school students' information search process to complete their project and later verified and generalized through other sequential studies (Kuhlthau, 1988a, b, 1989; Kuhlthau, Turock, George, & Belvin, 1990). Modeled on Vygotsky's Zone of Proximal Development, Kuhlthau (2004) defined the Zone of Intervention in information seeking as "that area in which an information user can do with advice and assistance what he or she cannot do alone or can do only with great difficulty" (p. 129).

As a research-based and validated model showing the information search process from the initiation to the completion of a project, Kuhlthau's ISP model has been frequently used as a framework in many information behavior studies in learning and research at the elementary through graduate and faculty levels (e.g., Bilal, 2002; Harada, 2005; Jiao et al., 2006; Todd, 2006) as well as in occupational contexts (e.g., Bystrom, 2002; Vakkari, 1999).

<b>Tasks</b>	<b>Initiation</b>	<b>Selection</b>	<b>Exploration</b>	<b>Formulation</b>	<b>Collection</b>	<b>Presentation</b>
<b>Feelings (affective)</b>	uncertainty	optimism	confusion/ frustration/ doubt	clarity	sense of direction/ confidence	satisfaction or disappointment
<b>Thoughts (cognitive)</b>	vague	—————	—————	focused	—————	increased interest
<b>Actions (physical)</b>	seeking relevant information exploring	—————	—————	—————	seeking pertinent information documenting	—————

Figure 1 Model of the Information Search Process (ISP) (Kuhlthau, 2004, p.82)

Elementary school students showed emotional changes similar to the patterns in Kuhlthau's ISP model during the research process and keeping journals was considered as a significant tool through which to understand students' feelings and cognitive process (Harada, 2005). In addition, journals made students more confident about their ability to create meaning from information (Harada, 2002). Bilal (2000, 2001, 2002) examined 7<sup>th</sup> grade students' cognitive, affective and physical behaviors while they used a Web search engine to perform three different search tasks: fact-based, assigned and self-generated research tasks. This study indicated that children browse less on the assigned task than on the fact-based task and in general they have less difficulty with the self-generated research task than with the others. Moreover, the importance of the focus formulation stage in the ISP model and instructional interventions was emphasized by Todd (2006) who studied middle and high school students' knowledge change through the curriculum-based projects in New Jersey schools.

Research based on the ISP model has been more actively conducted in college and graduate research contexts than in elementary and secondary school contexts. This research covers the research process of undergraduate students (Fister, 1992; Holliday &

Li, 2004; Kennedy et al., 1999; Pennanen & Vakkari, 2003; Serola & Vakkari, 2005; Sihvonen & Vakkari, 2004; Swain, 1996; Vakkari et al., 2003; Yang, 1997), changes in relevance assessment during the research process (Anderson, 2001, 2005; Tang & Solomon, 1998; Vakkari & Hakala, 2000), library anxiety (Jiao et al., 1996, 2006; Jiao & Onwuegbuzie, 1997, 1999; Onwuegbuzie, 1997; Onwuegbuzie & Jiao, 1998, 2004) and document selection (Wang & Soergel, 1993, 1998) and use (Wang & White, 1995, 1999) by faculty and graduate students. In addition, the ISP model was verified in various contexts such as doctoral research in History (Cole, 1997, 1998), group-based educational settings (Hyldegard, 2006), and online classrooms (Byron, 1999).

#### **2.4.3.1 Guided Inquiry**

Inquiry requires students find and use a variety of information resources to understand a topic. Guided Inquiry offers “an integrated unit of inquiry, planned and guided by an instructional team of a school librarian and teachers, allowing students to gain deeper understandings of subject area curriculum content and information literacy concepts” (p.1, Kuhlthau, et al., 2007). Guided Inquiry was developed from the foundation of Kuhlthau’s series of ISP studies.

Guided Inquiry should be carefully planned so as to include close supervision, continuous assessment and timely intervention by an instructional team of teachers and librarians. From the constructivist perspective, Guided Inquiry emphasizes the process of learning rather than product. Being integrated into the content of the curriculum, Guided Inquiry helps students gain more meaningful understanding of the curriculum content, which is connected to their experience and interest, while incorporating information

literacy skills (Kuhlthau, et al., 2007). During the inquiry process, students are engaged in five kinds of learning: curriculum content, information literacy, learning how to learn, literacy competence, and socialization (Table 3).

Table 3  
Five Kinds of Learning in the Inquiry Process

1. Curriculum Content:	fact finding, interpreting, and synthesizing
2. Information Literacy:	concepts for locating, evaluating, and using
3. Learning How to Learn:	initiating, selecting, exploring, focusing, collecting, and presenting
4. Literacy Competence:	reading, writing, speaking, and listening
5. Social Skills:	interacting, cooperating, and collaborating

Guided Inquiry has been implemented in a variety of school contexts in collaboration with teachers and school librarians. About their experience of implementing Guided Inquiry, teachers and school librarians reported lack of time, confusion about instructional roles and poorly designed assignments as inhibitors. They considered constructivist view of learning, team approach to teaching, competence in designing assignments, and commitment to developing information literacy as enablers (Kuhlthau, 1993).

In Gordon's (1999) study, tenth graders who participated in a Guided Inquiry unit in their English class valued the research experience, especially the individual help they received from the instructional team. Although 78% of them found bibliographic charts useful, it appeared that they had difficulties in citations. In this regard, teachers concluded that students need more time in class for writing process for revision and editing. Students valued carefully designed research processes such as writing a proposal and formulating a research question. They showed a recursive process of inquiry by returning to the background readings and revising their research question (Gordon, 1999).

Chu (2009) examined an inquiry project-based learning (PBL) approach which entailed collaboration between three kinds of teachers (general studies, language, and information technology) and the librarian. The findings of this study indicated that the project grades of the students who participated in the inquiry PBL were significantly higher than those of the control students. Although the students found the tasks challenging, they enjoyed performing the projects. Teachers, parents as well as students themselves perceived that they made remarkable improvements in the eight dimensions of learning: subject knowledge, information literacy, IT skills, reading comprehension, writing ability, social and communication skills, presentation skills, and research skills. Although extra workload from the teacher's side was identified as an inhibitor in implementing an inquiry PBL, participating teachers and the librarian agreed that communication among them improved during the collaboration. Moreover, this collaborative approach provided more opportunities on integration of subject areas and development of effective pedagogy (Chu, 2009).

#### **2.4.3.2 Student Learning through Inquiry Measure (SLIM)**

To keep track of students' knowledge development during inquiry-based learning and to identify when and what intervention is needed, the Center for International Scholarship in School Libraries (CISSL) developed an assessment tool called Student Learning through Inquiry Measure (SLIM). This toolkit was tested and refined through the study of ten New Jersey public schools where inquiry projects are undertaken (Todd, Kuhlthau, & Heinström, 2005).

The purposes of the SLIM toolkit are to:

1. track changes in students' knowledge as they move through the inquiry process;
2. provide input for designing interventions for effective information seeking and learning; and
3. enable school librarians and teachers to provide evidence of the learning role of the school library (Kuhlthau, et al., 2007, p.127).

The SLIM toolkit is administered three times during inquiry learning. The first survey is performed when students choose a topic but before starting to seek information. The second survey is performed when students are formulating a focus with some background knowledge. The third survey is performed when they complete the inquiry task (Kuhlthau, et al., 2007). The SLIM toolkit consists of questions about their knowledge development on the curricular content, process of learning over time, emotional changes and information literacy skills (Figure 2).

1. Write the title that best describes your research project at this time.
2. Take some time to think about your research topic. Now write down what you know about this topic.
3. What interests you about this topic?
4. How much do you know about this topic? Check one box that best matches how much you know.  
 nothing  not much  some  quite a bit  a great deal
5. Write down what you think is easy about researching your topic.
6. Write down what you think is difficult about researching your topic.
7. Write down how you are feeling now about your project. Check only the boxes that apply to you.  
 confident  disappointed  relieved  frustrated  confused  
 optimistic  uncertain  satisfied  anxious  other
8. What did you learn in doing this research project? This might be about your topic or new things you can do or learn about yourself. (only for the third survey)
9. How did the school librarian help you? (only for the third survey)
10. How did the teacher help you? (only for the third survey)

Figure 2 Student Learning through Inquiry Measure (SLIM) Toolkit Survey Questions

## 2.5 Research Objectives

This study aims to understand the information seeking and use behavior of high school students with diverse linguistic and cultural backgrounds within a research task with the frameworks of Vygotsky's Zone of Proximal Development and Kuhlthau's Information Search Process (ISP). The research tasks, implemented in this study, were curriculum based units where students are required to engage with a diverse range of information sources and demonstrate their understanding of the topic. In this study, they were guided mainly by the ESL teacher or subject teacher for content knowledge and intervened by the school counselor or school librarian for information access.

The findings of this study will contribute to understanding of how students with diverse linguistic and cultural backgrounds experience information searches and knowledge building processes through a complex research project in English and what factors interact with their primary patterns in their information seeking behavior.

To understand the information seeking use of ELL students during the research tasks, this study examined the following research questions.

RQ1. What primary patterns, if any, do ELL students have in terms of cognitive dimension (substance and amount of knowledge, labeling of knowledge, estimated knowledge, interest, and learning outcome), as they engage in the research task?

RQ2. What primary patterns, if any, do ELL students have in terms of affective dimension, with particular focus on positive affect (confidence, relief, optimism,

and satisfaction), negative affect (disappointment, frustration, confusion, uncertainty, and anxiety) and concern about their English proficiency?

RQ3. What enablers and inhibitors do ELL students encounter during the research process, with particular focus on easy or difficult tasks, the type of assistance they needed, and teachers' instructional interventions?

## CHAPTER 3 METHODS

In the 1990s, the use of citation analysis and experimental research faded from prominence within library science, while triangulation of research methods has been increasingly used (Julien & Duggan, 2000). As the process of information seeking gains interest from researchers, a longitudinal qualitative case study is necessary for eliciting the cognitive processes of information seeking and real experience (Dervin & Nilan, 1986; Kuhlthau, 2004).

In recent years, the integration of quantitative and qualitative has become increasingly common and unremarkable (Bryman, 2006). This study applied mixed methods with a concurrent procedure where quantitative and qualitative data are corroborated to comprehensively analyze the research problems on the information seeking and use of ELL students. In this design, both forms of data are collected at the same time and integrated in the interpretation of the findings (Creswell, 2003).

### 3.1 Recruiting a School Site

The participants of this study were 48 ELL students from three classes, one ESL theme class with 10 students and two LEP Biology classes with 18 and 20 students, respectively, at a public high school which is located in one of the most diverse districts in New Jersey. The characteristics of the recruited school and selected classes are described in Section 3.1.3. In this study, the recruitment process of the research site carefully proceeded with selective criteria because the school needed to meet specific

conditions required for the purpose of the study.

The researcher was to identify a public high school where the study could be conducted under favorable conditions with supportive teachers. High schools with grade 9 or higher grades were considered as appropriate sites for this study, because grade 9 is estimated as a minimum level where students are expected to do a research project with intensive information searches. In addition, public schools were given priority over private schools, so as to better reflect the common ELL population in the United States, especially in terms of their socio-economic status and school environment. The selective criteria and decision-making process of the recruitment are described in the following subsidiary sections along with the characteristics of the selected school.

### **3.1.1 Recruitment Criteria**

In order to meet the requirements of the study, the following four criteria were considered mandatory in recruiting a school site:

- 1) A large number of ELL students,
- 2) Low student mobility rate,
- 3) A history of implementing research projects for ELL students with the collaboration between teachers and a school librarian, and
- 4) Supportive faculty.

Firstly, the desired research site was a public high school with a large number of ELL students. Not only would a good number of ELL students increase the sample size, but it was expected that schools with a large number of ELL students would implement

advanced curriculum such as research projects for ELL students, which are collaborated by teachers and a school librarian, beyond language acquisition instructions.

Secondly, the research site should be a public high school with a low student mobility rate. Mobility rate refers to the percentage of students who both entered and left during the school year. Sustained attendance of the students in classroom instructions was considered critical because the study expected participating students to be engaged in their research task in a good-faith manner and also to answer process surveys requested by the researcher on the scheduled dates. Another reason for taking student mobility rate into account was the fact that in general ELL students show a higher drop-out rate than native English speaking students.

Thirdly, the research site should have a history of research project lesson plans, collaborated by teachers and a school librarian, as part of the ESL curriculum. A well-established research curriculum for ELL students would set the stage for this study on ELL students' information seeking and use.

Lastly, the research site should have supportive faculty who could understand the purpose of the study and cooperate with the researcher for its implementation. The school principal's consent was also required for approval from the Institutional Review Board (IRB) and discussion with teachers on research possibilities. Then, teachers and a school librarian would need approval from their supervisors to work with the researcher. Also, the research instruments, such as questionnaires, process surveys and interviews, were expected to take time from their fixed class schedule which would only be possible under teachers' agreement. Furthermore, teachers' supportive attitude would encourage students

to better cooperate with the researcher.

The criteria described above had to be necessarily met to be an eligible research site for this study. If there were more than one school with the above criteria met, a close location would be preferred for frequent visits to the school for data collection and occasional visits for the interactions with teachers. Also, prompt initiation of the research unit was preferred.

### **3.1.2 Recruitment Process**

The recruitment process was performed in order to find an eligible school site for this study, which included collecting school information, contacting school librarians, authorization from the principal, and scheduling with teachers.

**Collecting school information.** A list of public high schools in New Jersey was extracted from the 2006-07 School Report Card on the New Jersey Department of Education's Website. The school names were entered on an Excel sheet along with district and county in alphabetical order by county name. Data on student language diversity, percentage of LEP students, student mobility rate and drop-out rate were retrieved from the School Report Card of an individual school and added to the list. In addition to the general type of high schools with 9<sup>th</sup> through 12<sup>th</sup> graders, the list included junior high schools with 7<sup>th</sup> or 8<sup>th</sup> graders through 9<sup>th</sup> graders because it was expected that there would be a possibility of research projects with 9<sup>th</sup> graders in those schools. This process resulted in 333 public high schools on the final list.

**Contacting school librarians.** The school librarians of the schools with more

than 3.9% LEP rate (state average in 2006-07) and less than 10.1% student mobility rate (state average in 2006-07) were contacted by phone calls and emails for more information on their history and scheduled plan of implementing research projects for ELL students and their interest in joining this study. The school librarians were contacted instead of ESL teachers or other teachers because they were expected to know research project curriculum accompanied by intensive information search and be able to suggest appropriate ELL research projects with which the study could be conducted. When a phone call was not answered, the researcher left a voice message with her cell phone number for callback. When there was no response to the phone message or email, the researcher initiated follow-up emails and calls. When the second attempt was unsuccessful, it was assumed that either their curriculum did not meet the requirements for the study or they were not interested in the study.

As a result, two high schools were found which had more than the state average LEP rate (3.9%), less than the state average student mobility rate (10.1%), and a history of research projects for ELL students. School librarians in both schools had a scheduled plan of research projects for ELL students and expressed interest in joining the study.

**Authorization from the principal.** For further discussion with the school librarians and ESL teachers on conducting the research in their school, it was required to have authorization from the principal or superintendent of schools. During this process, one of the schools refused to participate in the study. Approval and agreement from principal, superintendent, and supervisors of the ESL teacher and school librarian were successfully made in the other school.

**Scheduling with the teachers and school librarian.** The school librarian

introduced ESL teachers in various ELL levels to the researcher. ESL curriculum and possibilities to join the study were discussed with them. Research instruments and estimated amount of time for students to participate in the study were explained to the ESL teachers. After several conversations, the ESL theme class with ELL level 5 students was chosen for this study, because they have a research project requiring an intensive information search and the ESL teacher was supportive to the study. After the data collection process was completed with the ESL theme class, the ESL teacher introduced the LEP biology teacher, who also implements a research project for ELL students, to the researcher for further study. The way the recruited school used the terms *ELL*, *ESL*, and *LEP* is explained in Section 3.1.3.

### **3.1.3 Characteristics of the Recruited School**

The recruited school was a 4 year public high school in New Jersey. According to the New York Times (2009), New Jersey classrooms are the seventh most diverse the United States. New Jersey had 55.7% White, 17.4% Black, 18.8% Hispanic, 7.9% Asian, and 0.2% Native American in K-12 student population in 2006. The school is located in a county ranking fifth of 21 in classroom diversity in New Jersey. The county had 47.7% Black, 28.5% White, 19.3% Hispanic, 4.4% Asian, and 0.1% Native American in their student population in 2006 (New York Times, 2009) (Table 4).

Table 4  
Classroom Ethnic Diversity in 2006

Ethnicity	New Jersey	County
	Number (%)	Number (%)
White	773,660 (55.7)	35,525 (28.5)
Black	242,310 (17.4)	59,498 (47.7)
Hispanic	261,323 (18.8)	24,090 (19.3)
Asian	109,142 (7.9)	5,447 (4.4)
Native American	2,377 (0.2)	116 (0.1)
Total	1,388,812 (100.0)	124,676 (100.0)

According to the 2008-09 School Report Card of NJ Department of Education, the school has a LEP rate of 5.2% (state average in 2008-09 : 3.9%) and a student mobility rate of 6.7% (state average in 2008-09: 9.6%). Twenty-three percent (22.6%) of the students are English language learners who have their first language spoken at home rather than English. Spanish (16.5%) and Creole/French (4.2%) were the major first languages of ELL students in this school (Table 5).

Table 5  
First Languages of the Recruited School

Language	Percentage
English	77.4
Spanish	16.5
Haitian (Creole/French)	4.2
Tagalog	1.3
Mandarin	0.5
Cantonese	0.5

With respect to performance in the High School Proficiency Assessment (HSPA), 85.8% of the students performed at the proficient or advanced level in Language Arts Literacy (state average: 84.5%) and 69.5% of them performed at the proficient or advanced level in Mathematics (state average: 73.7%).

Because the school provides various programs for ELL students depending on the language proficiency level and grade level of the students, the New Jersey Department of Education designated it as having a model bilingual/ESL program. There are two ESL classes; one is an ESL theme class which focuses on contemporary themes in various content areas and the other is a literature class which focuses on literature study and HSPA skills. In addition, the school offers LEP sections of history, biology, chemistry, and physics classes for ELL students who have not met requirements. These LEP courses are taught by mainstream subject teachers in collaboration with the bilingual/ESL supervisor (New Jersey Department of Education, n.d.).

To make the distinction between the two kinds of curriculum, language and literature curriculum for ELL students are called *ESL classes*, and subject curriculum for ELL students taught by mainstream teachers are called *LEP classes* in this school. And a group of students who are served in ESL classes or LEP classes is called *ELL*.

### **3.2 Research Tasks**

An ESL theme class and two LEP biology classes participated in this study while students were doing a research task. The ESL theme class consisted of ten ELL students with ELL level 5, and the LEP biology classes consisted of eighteen students and twenty students, respectively, with mixed ELL levels from level 2 through level 5. Research tasks undertaken by these students are described in the following sections.

### 3.2.1 ESL Theme Class

As part of the ESL curriculum, ten students in the ESL theme class were required to write a research paper on their career and college preparation for five weeks. The lesson plan included instructional sessions for two weeks about vocabulary, background knowledge, and research skills needed for the research project. Students began to actively search for information regarding the college preparation necessary for their future career in week 3 (Table 6).

In their research paper, they were required to write about their career goal, higher education institutions for the career, financial plans, and the college application process. All research activities were performed in their classroom, which was equipped with computers, a printer, and a projector. The ESL teacher mainly guided the research process and a school counselor from the guidance department held an instructional session for using a database specified in college information in week 2. At the end of the research project, they were expected to submit note cards, an outline and a final research paper to the ESL teacher.

Table 6  
Research Task of the ESL Theme Class

Week	Research Task
1 <sup>st</sup> Week	Building vocabulary and background knowledge
2 <sup>nd</sup> Week	Research process overview
3 <sup>rd</sup> Week	Searching and making note cards
4 <sup>th</sup> Week	Making an outline and a draft paper
5 <sup>th</sup> Week	Submitting a final paper

The ESL theme class has a 42 minute session from Monday to Friday. During the five week research period, three sessions were wholly or partially spent answering

research instruments, one session was omitted for a holiday, and one session was canceled due to inclement weather. Thus, though the research task was spread over a period of 5 weeks, it only occupied twenty sessions. The detailed activities for each week are described below.

**1<sup>st</sup> Week.** Before starting to do the research, the ESL teacher taught the students basic vocabulary and background knowledge about careers and college life using Power Point slides. The lessons included information about financial aid, different kinds of colleges/universities, vocational schools, and careers (Table 7). They also included information on prerequisites for college, such as high school coursework and important college admissions tests.

On the last day of week 1, the ESL teacher distributed a research paper guideline (Appendix 1) to the students and asked them to think about their potential careers over the weekend as homework.

Table 7  
Examples of Basic Vocabulary

Categories	Vocabulary
College Vocabulary	Acceptance, Admissions Office, Award Letter, Bachelor's Degree, Campus, Candidate Reply Date, College Fair, Community College, Commuter Student, Dormitory, ELPT, EOF, Semester, TOEFL, Transcript, Transfer, Trimester, Tuition, Wait List
Financial Aid Vocabulary	FAFSA, Federal Aid, Financial Aid, Free Aid, Financial Aid Package, Gift Aid, Grant, Loan
Kinds of Colleges / Universities	Public, Private, 4-year college or university, B.A.(Bachelor of Arts), B.S. (Bachelor of Sciences), 2-year college, A.A.(Associate of Arts), A.S. (Associate of Sciences)
College & University Careers	Doctors, Lawyers, Dentists, Finance, Designers, Teachers, CEO, Accountants, Engineers
Vocational Schools & Careers	Vocational Schools, Military, Mechanics, Assistants, Secretaries, Electricians, Cosmetology, Cook, Electronics Technology, Construction

**2<sup>nd</sup> Week.** The ESL teacher provided an overview of the research process, which included lessons on how to use a variety of sources, how to take notes from sources and how to compose an outline. The ESL teacher prepared instructions on note cards (Appendix 2) and the outline (Appendix 3). In the middle of week 2, a school counselor from the guidance department came to class to provide an orientation session on the database, *Family Connection*, which is a web-based system designed to support the college and career planning process. With given IDs and passwords, students logged into the system and searched college information for their career with the instruction and assistance of the counselor. The ESL teacher sometimes interrupted the instruction from the counselor to explain college relevant vocabulary and concepts used in the database.

**3<sup>rd</sup> Week.** Students started to individually research their career and college institutions and make note cards with the information found from various resources, including *Family Connection* and other Websites. Students were required to paraphrase the found information on their note cards and provide bibliographic information to its source. The ESL teacher provided printed materials such as books, newspapers and magazines, which were customized for individual students.

**4<sup>th</sup> Week.** The writing phase of the research project started in week 4. The ESL teacher reminded them of what an outline is for and how to make an outline with the projector screen and board. She also provided a handout (Appendix 4) on formatting, following MLA (Modern Language Association) citation styles, for the students. The handout contained a sample outline and final paper (e.g., title page, first page and works cited). Using the information written on their note cards, students first made an outline on paper and then typed them on computers. When they realized they did not have enough

information while making an outline, they were encouraged to conduct additional searches and make new note cards. Those who completed an outline went back to their desk to draft papers by developing the outline into full sentences and paragraphs. Students were required to write an outline and a draft on papers first, instead of the computer, to practice spelling and grammar without corrections by word processing software.

**5<sup>th</sup> Week.** Students began to type a final paper from the hand-written draft. On the first day of week 5, they received instruction on how to do citations using the MLA format. This lesson also included information about the concept of plagiarism, the consequences of plagiarism, the benefits of citations, and an originality checking software *Turnitin*. At the completion of the research project, the students submitted their note cards, outlines and final papers to the ESL teacher.

### **3.2.2 LEP Biology Classes**

Thirty-eight students in two LEP biology classes were required to create a six page multi-layered foldable on a self-chosen genetic disorder disease for four weeks. The classes were taught by the same biology teacher with the same curricular lesson plan in the same laboratory classroom. There were six tables in the laboratory and students sat in a group of three to four per table.

The LEP biology classes had a 42 minute session for the research tasks for three days a week, because they had a laboratory class for the rest of week. The four week period included a Spring break during which students were to find information on the research topic as homework. Table 8 describes the detailed activities for each week.

Table 8  
Research Task of the LEP Biology Classes

Weekly	Research Task
1 <sup>st</sup> Week	Building vocabulary and background knowledge; Searching information in the school library
2 <sup>nd</sup> Week	Search for information as homework (Spring break)
3 <sup>rd</sup> ~ 4 <sup>th</sup> Week	Creating a foldable

**1<sup>st</sup> Week.** During the first two days, the biology teacher built students' background knowledge by overviewing different kinds of genetic disorders using Power Point slides. Each slide showed the title of a genetic disorder disease, pictures of those who have the disease and the karyotype of the genetic disorder. Guidelines, including research instruction and grading, were distributed to the students, along with a list of 28 genetic disorders as possible topics (Appendix 5). Also, the biology teacher showed students how to make a foldable with papers. After the instructions for two days, they were asked to choose a disease as a research topic.

On the third day of week 1, they visited the school library media center to search for information. A guideline for searching (Appendix 6) was distributed and five Websites were recommended by the biology teacher as reliable sources. While searching, they were allowed to search in their own language and translate to English for the project. Students printed out the information that they retrieved.

**2<sup>nd</sup> Week.** This week was spring break. Students were required to finish searching for information for the project as homework during the break.

Table 9  
Research Instruction for the LEP Biology Classes

Page (points)	Content
Cover (15)	Artwork Name of Disorder Your Name & Period
Page 1 (10)	<u>What is it?</u> A general description (in your own words)
Page 2 (10)	<u>How is it inherited?</u> Actual number & type of chromosome (sex or auto) Kind of mutation (autosomal recessive, autosomal dominant, sex linked, nondisjunction, genetic deletion, multifactoral)
Page 3 (15)	<u>What is wrong with the person?</u> Give major symptoms, physical appearance, diagnosis (in your own words, use bulleted statements)
Page 4 (10)	<u>Outlook:</u> Give treatment, if any, and prognosis (progress of disease) (in your own words, use bulleted statements)
Page 5 (15)	<u>Glossary:</u> Define 5 new words used within this project
Page 6 (20)	Pictures and/or karyotype showing abnormality with explanations
Overall (15)	Appearance, Accuracy & Organization

**3<sup>rd</sup> – 4<sup>th</sup> Week.** Students set up a foldable with the colored papers and colored pens provided. Foldable was created by folding three sheets of color papers with layers. In the research foldable, they were required to write a general description of their chosen genetic disorder disease, as well as include information about its inheritance process, major symptoms, and treatment options. They also needed to make a glossary of five new words with definitions, display a picture of the disease with explanations, and decorate the cover page. They were expected to put the information in their own words and use bulleted statements instead of full sentences. Detailed instructions for each page of foldable are presented in Table 9. They were asked to 1) see if they had all the information they need, 2) read the information and put it in their own words, and 3) create a list of vocabulary words for their glossary. Each student put this information in

their foldable and decorated their cover page. Students, at most three students at a time, were allowed to go to the library media center for printing out further information with the permission of the biology teacher. They completed the research task in week 4 with individual help from the biology teacher.

### 3.3 Data Collection

As part of Institutional Review Board (IRB) requirements, authorization letters (Appendix 7) from the superintendent of the school district, consent forms from the students' parents (Appendix 8) and assent forms from the students (Appendix 9) were obtained prior to data collection. After discussions with the ESL teacher and the biology teacher, the consent form had four different language versions for ELL students' parents: English, Chinese, French and Spanish.

While the participating students were undertaking their research project, data were collected through questionnaires, process surveys (at the beginning, mid-point, and completion of the project), observations, and semi-structured interviews with the students and teachers (ESL teacher, biology teacher and school librarian). The students were assigned an access code number that was used on questionnaires, process surveys and interviews. Their names did not appear on any of research documents.

**Questionnaire.** Students were asked to fill out the questionnaire before they began their research project (Appendix 10). The questionnaire included questions about students' demographic information, country of birth, length of time living in the United States or other countries, language(s) spoken at home, self-rated language proficiency in

their native language and English, and English proficiency of those with whom they were living. It took about 15 minutes for students to complete the questionnaire.

**Process surveys.** The process surveys were conducted at three points (initiation, mid-point and completion) during the research project. They were based on the Student Learning through Inquiry Measure (SLIM) toolkit which was developed by the Center for International Scholarship in School Libraries (CISSL) to track the process by which students learn during inquiry-based research (Todd, Kuhlthau & Heinström, 2005).

In this study, an emoticon was presented to each feeling question to facilitate ELL students' understanding, and additional questions were added to the SLIM toolkit in order to examine students' concerns caused by their limited English language proficiency as follows.

6. Are you worried about your English for doing this project?  
 1 (not at all) 2 (a little) 3 (some) 4 (a lot)
  - 6.1 What concerns, if any, do you have with reading in English for the project?
  - 6.2 What concerns, if any, do you have with writing in English for the project?
  - 6.3. What concerns, if any, do you have with listening in English for the project?
  - 6.4 What concerns, if any, do you have with speaking in English for the project?

A complete list of questions in process surveys are attached in Appendix 11.

**Observations.** The researcher closely observed the students' research process while taking field notes as a participant observer from the initiation to the completion of the project. Field notes were recorded on site at the time and supplemented with more detailed comments and questions afterwards. In addition to keeping track of the curricular lessons and the research tasks of students, observations mainly focused on students'

individual research activities (e.g., difficulties in searching), their interactions with classmates, and interventions of teachers during the project.

**Interviews.** The students, ESL teacher, biology teacher, and school librarian were interviewed after the research project. The purpose of the semi-structured interviews were to further understand ELL students' information seeking and use behavior, the challenges they faced and when interventions would be most effectively promote the learning process. The interview guidelines for students and for teachers are attached in Appendix 12 and Appendix 13, respectively.

Students were asked about the hardest/easiest part of the research project, problems caused by limited English proficiency, language(s) they used for thinking and searching, their search process (e.g., information sources, search terms, and information evaluation), emotional changes during the research project, prior research experience, and computer experience. In the ESL theme class, interviews were conducted individually in the library media center or conference room during the lunch period. Students signed up for their available time. Each interview took 20 to 25 minutes. In the LEP biology class, focus group interviews, instead of individual interviews, were conducted because of a large number of students and their limited class schedule. Three groups of 3 to 8 students in each LEP biology class were interviewed in the annex room of their laboratory while the others were doing class activities in the laboratory. Each focus group interview took 15 to 25 minutes.

The teachers and school librarian were asked about what they thought was the hardest/easiest part of the research project for ELL students, patterns of students' thoughts, actions and feelings, students' needed help, considerations in designing a

research project for ELL students, differences across ELLs of varying English proficiency, and their overall comments on impacts of ELL students' linguistic and cultural backgrounds on their learning process. Individual interviews with teachers were scheduled in their available periods, and each interview was conducted in the teacher's office or classroom for about 25 to 30 minutes. Besides formal interviews, interactions with the teachers and the researcher often occurred via emails or brief conversations on site.

A list of questions was provided to the participants, and a few minutes were given for ELL students to read through the questions in advance before the interviews were started. Interviews were digitally recorded.

The interviews were conducted in clear and plain English so that students of all abilities could understand. While answering questions, participants were encouraged to respond with questions of their own, directing them to the researcher or their teachers.

### **3.4 Data Analysis**

**Questionnaire and process surveys.** Answers on the questionnaire and three process surveys from the participating students were typed in Excel spreadsheets and organized both by individual student and by individual instrument. Categorical answers were coded into number, and open-ended answers were analyzed with content analysis according to the coding schemes of the SLIM tool kit. For the four point scales, '1=not at all' was coded into 0, '2=a little' was coded into 1, '3=some' was coded into 2, and '4=a lot' was coded into 3. All manipulated data were entered in SPSS and analyzed to produce descriptive statistics and to use T-tests, ANOVA, and chi-square tests to

determine for whether students' learning experience varied significantly by class, ELL level, ethnicity, and gender. Repeated-measures ANOVA was used for examining the changes of learning experience over time.

**Observations and interviews.** Field notes were documented in word files and organized in the order of dates. Interviews were transcribed by the researcher with the assistance of *Express Scribe*, transcription software which enabled the researcher to easily manage the audio files and control audio playback using function keys while transcribing. The following information was stored regarding each transcript: the length of the interview; its date, time and location; and the access code number of the interviewee.

Field notes were used to clarify the research tasks of the students. Both field notes and transcripts were analyzed to corroborate the findings from the analysis of the questionnaires and process surveys. Transcripts were analyzed by a combination of meaning condensation and meaning categorization (Kvale, 1996).

### **3.5 Limitations of the Study**

Since this study was conducted with the limited number of ELL students in one high school in New Jersey, the results of this study cannot be generalized. However, the findings of this study contribute to understanding of how linguistically and culturally diverse students experience information search and knowledge building through a research project in English and what factors of ELL students interact with the primary patterns in their information seeking behavior, and understanding of the efficient and appropriate instructional intervention.

### **3.6 Pilot Study**

As a pilot study for the dissertation, this study was conducted for the following purposes prior to the main dissertation study: 1) to test research design and research instruments, 2) to train the researcher in implementing research instruments in a school setting, and 3) to identify if potential patterns and interactions exist between the characteristics of ELL students and their information behaviors.

#### **3.6.1 Methods**

##### **3.6.1.1 Participants**

As a pilot study, this research centered on an in-depth analysis of the information-to-knowledge experience of two Korean 11<sup>th</sup> grade students (17-year-old boys) of a high school in New Jersey. Their experience was tracked from the initiation stage to the completion stage of a Guided Inquiry project. Among the two participating students (S1 and S2), S1 took both biology and psychology classes and S2 took only the biology class. Both participants were born in South Korea. S1 had lived in China for 3 years (from 4<sup>th</sup> to 6<sup>th</sup> grade) to learn the Chinese language and came to the United States 5 years ago (from 7<sup>th</sup> grade to current). S2 had lived in South Korea until he came to the United States 3.5 years ago (from 8<sup>th</sup> grade to current). They came to the United States separately from their parents for studying. The students were living in the same house with a Korean family consisting of married couple and their two sons, who were 2 years older and 3 years older than them. No one in the house could speak English very well (linguistically isolated household) and they spoke only in Korean at home.

### 3.6.1.2 Research Task

The high school chosen for this pilot study had a 10-year-old collaboration history, and had a well-developed instructional collaboration for the Grade 11 project titled Scientific Literature Review. It required students to conduct a scientific literature review of existing research about a topic in biology or psychology which was chosen by the student and approved by the school librarian or science teacher. The school librarian provided up to eighteen workshops as instructional interventions for students within the biology or psychology class time for nine weeks (Table 10). The science teacher, as a content expert, guided students in building scientific knowledge of their chosen topic.

Table 10  
Workshops for Scientific Literature Review Project

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Workshop 1:	The benefits of a scientific literature review
Workshop 2:	The student's assignment begins
Workshop 3:	Making it meaningful: Browsing databases
Workshop 4:	Creating and organizing the research folder
Workshop 5:	Researching the introduction
Workshop 6:	How to take notes from a general press article
Workshop 7:	How to write an introduction
Workshop 8:	Searching for peer reviewed studies
Workshop 9:	How to read and make notes from a peer reviewed journal study
Workshop 10:	How to write the methodology
Workshop 11:	How to write the results of research
Workshop 12:	How to use and create a table, chart, or graph for the research
Workshop 13:	How to write the analysis of research
Workshop 14:	How to write the conclusion
Workshop 15:	How to write the abstract
Workshop 16:	How to write the reference list
Workshop 17:	Creating a title and completing the cover page
Workshop 18:	Putting it all together to turn the Scientific Literature Review in to the teacher

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Students produced a research paper which contained a cover page with abstract, introduction, methodology, results of research, analysis of research, conclusion and

references. They were required to use at least 12-16 sources (at least 6-8 introductory sources and at least 6-8 peer-reviewed articles). Introductory sources, including textbooks, encyclopedia, newspapers, non-fiction works, and articles in reputable magazines, enabled students to build their background knowledge and vocabulary needed to search for scholarly journals. They also enabled them to formulate the specific focus of their research. Peer-reviewed articles should be full text studies which were accessed in online databases in the school library or other research libraries. Students submitted their first draft paper to get the school librarians' and science teacher's feedback on it and complete the project by producing the final paper with revisions and corrections. During the research process, students closely interacted with the school librarians and science teacher. After the completion of research, the school librarian gave them a research grade and the teacher gave them a science content grade on their final paper.

### **3.6.1.3 Data Collection**

Before the data collection, an authorization letter from the school principal, consent forms from the students' guardian and assent forms from the students were obtained. Data were collected through questionnaire, process surveys (at the beginning, mid-point, and completion of the project), search journal, search sessions, observation, students' completed papers, and semi-structured interviews with one of the students and the school librarian.

The same procedures were conducted for the questionnaire, process surveys, observations and interviews with the main dissertation study as described in Section 3.3. The pilot study differed from the main dissertation study in that it collected search journal,

search session and students' final paper for analysis. Throughout the inquiry unit, the students were required to keep the search journal by recording the date, search words, source used, place where they got the source, information intention and usefulness of each source. However, this proved to be problematic for these students. They easily forgot to keep search journals when they searched for sources because the search journal was recognized as an additional workload throughout their research process. Therefore, when they searched for peer-reviewed articles, search journals were replaced with search sessions. Their searching was recorded by the screen capture recording software, *Morae*. In addition, the student's paper with the school librarian's comments was collected to see their information use, presentation, demonstrated knowledge outcomes. When additional explanations were needed, the participants were allowed to communicate with the researcher in Korean which is their native language.

#### **3.6.1.4 Data Analysis**

The collected data through multi-method approach was analyzed qualitatively. The researcher identified codes and categorized primary patterns through content analysis of all data collected through above-mentioned methods. Quantitative data were only reported, because there were only two cases in this study.

### **3.6.2 Findings**

#### **3.6.2.1 Characteristics of Participants**

When asked to rate their English language proficiency by themselves(1-poor, 2-okay, 3-good, 4-very good), S1 rated "okay" in writing and "good" in reading, listening

and speaking and S2 rated “poor” in reading, writing, and listening and “okay” in speaking. S2 showed lower English proficiency than S1 when he communicated with the school librarian and the researcher. While S1 tried to use and improve English, S2 was strongly attached to Korean culture and friends outside the school. As S2 dropped out of school between the mid-point and completion of the project, data about the completion process of S2 were not collected.

### **3.6.1.2 Cognitive Dimension**

**Topic selection.** Students were required to choose a topic which was related to the subject (biology or psychology) and their personal experience. When the school librarian explained the project to S1, she used ‘video game addiction’ as an example of possible topic, because there was some indication that he was extensively involved in video games. He showed interest in the topic even though he had no idea further than that at this time. S2 in contrast had a difficult time choosing a topic because he was not sure how much the topic should be related to biology. He looked for the biology textbook and the titles of the example papers which had been completed by previous students displayed in the school library for current students. When S2 decided to study ‘AIDS-HIV virus’ for the project without expressing interest in the topic, the school librarian guided him to choose a topic of greater personal interest. He chose ‘insomnia,’ which he experienced one year ago. The school librarian asked several questions to figure out the causes of his insomnia and also see his life outside school.

Topic selection is one of very critical stages in the Information Search Process (ISP). The school librarian carefully helped students decide if their chosen topics were

appropriate (subject relatedness and personal experience/or interest) for the project and also doable for their abilities. Because of the lack of English proficiency, S2 had more limitations in choosing a “doable” topic even after he found a biology related interesting topic.

**Focus formulation.** Both students needed careful help in formulating the paper’s focus, because there was limited time for the project and they quickly fell behind their planned schedule. The school librarian responded by providing some articles for them. However, both participants had difficulties in making links between the supplied articles and spent much time in understanding them. Although they were supposed to use only those related to their specific topic, the participants tried to use them all for their paper even by changing their intended approach because they had already spent too much time in reading and understanding them. However, S1 said “it was really helpful because the studies she gave me at the very beginning gave me the direction of my research. At that time, I didn’t have specific things I wanted to research. I just wanted something about game addiction and she gave me the direction.”

Reading (and understanding), summarizing and analyzing were considered very difficult by the participants during the project. The lack of English proficiency made the students read articles very slowly and sometimes misunderstand them. Using an electronic dictionary made the process even slower. The difficulties in reading caused by the lack of English proficiency hindered the students in formulating a more specific focus as they interacted with the information.

The lack of English proficiency made the students have difficulties in summarizing. S1 said, “It’s hard to read, highlight and take notes at the same time for

summarizing.” He preferred to do one thing at once, so he had to repeatedly read the articles to summarize them. S2 tended to read a whole article very carefully and summarized the all content of the article, which took lots of time. He highlighted every important sentence and took many notes although the school librarian suggested he highlight only what he was interested in. In addition to the lack of English proficiency, the broad topic without a specific focus made it hard for him to highlight a few key sentences. However, S2 said, “I want to cover as many things on insomnia as possible in my paper, because there should be many things to write. I had a hard time when I was doing a similar project on humanities one year ago, because there were not enough things to write.” He was relying on the text rather than his understanding when he wrote a paper. That might be why he needed a broader topic to write a long enough paper for the project.

**Knowledge building.** As shown in Figure 3, although the estimated knowledge of S1 increased during the project (1-not at all, 2-a little, 3-some, 4-a lot), his knowledge, expressed in the surveys in the mid-point and completion, dealt with similar content which he got to know from the introductory sources. They were mostly facts rather than explanations or synthesis. Even though S2 changed his topic between the initiation and the mid-point, the survey was conducted with both students when they had finished summarizing the introductory sources. Nevertheless, S2 answered he knew “2-a little” about his topic, while S1 answered “3-some.” At the initiation of the project, the students rated their interest in their topic as “3-some” of the participants, because it was self-chosen topics, and they rated their interest as “4- a lot” after summarizing the introductory sources on the topics (Figure 4).

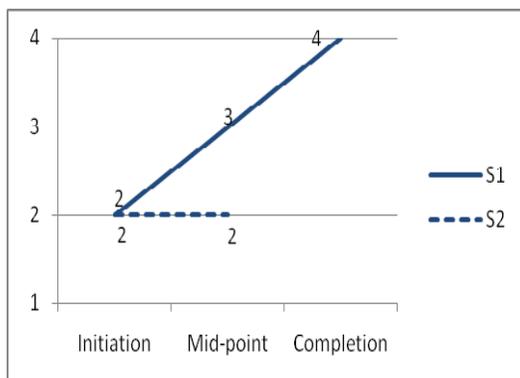


Figure 3 Estimated Knowledge

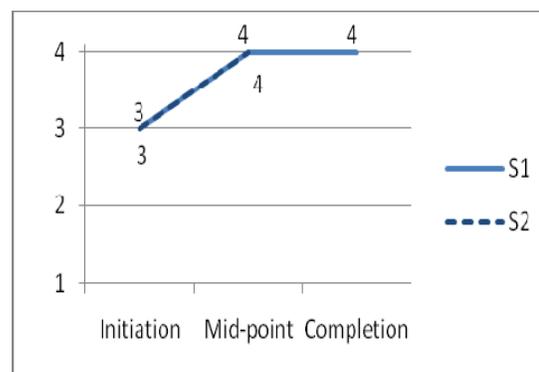


Figure 4 Interest

**Knowledge labeling (title).** The titles, which the students had given to their papers, changed through the research process and were analyzed according to the categories developed by Todd (2006) as follows:

1. General title (GT): A title that describes the project on a general, overall level.
2. Specific title (ST): The title brings forward a specific aspect of the project.
3. Artistic title (AT): The title is expressed in a creative or artistic way.

In the initiation of the project, S1 named his paper as *Psychology scientific literature* (GT), which was not his topic, but the project title. In the mid-point, he named it as *Is overuse of internet addiction or disorder?* (AT), because he wanted to demonstrate that he was not game-addicted through his research. However, after failing to find enough research to support his argument, his project focused on the characteristics of game addicted adolescents and he called it as *Gaming addiction* (GT). Although S2 changed his topic from HIV virus to insomnia after the initiation, he also showed the general title, *HIV virus*, in the initiation. Later, after getting background knowledge from introductory sources, he stated his title as *Causes and treatments for insomnia* (ST). Both participants established a more specific topic in the mid-point than in the initiation; however, S1 went

back to his general topic as he could not keep his intended focus because of the lack of research on it. According to Todd (2006), S1 showed *hourglass phenomenon* where a title is general in the initiation and completion, but specific in the mid-point; however, its relationship with language proficiency was not clear yet in this study.

**Knowledge presentation.** Students in the class were introduced to several ways to organize their knowledge in the paper, in the instructional session called ‘How to write the results of research section.’ The ways included: topicality, chronological, group characteristics, and research questions asked. Most of the displayed examples of previous students’ papers were organized by topicality or by group studied, with sub-titles. The school librarian said, “Students’ ways to organize their knowledge in the paper show how deeply they know and understand the topic.” However, both participants of this study organized the summaries of the peer-reviewed articles in a chronologically order without using sub-titles. Although they knew that it was a better approach to organize topically or by group studied, they were in a hurry to finalize the project because they had already fallen behind, and as a result they simply summarized the articles individually and did not have a big picture about them. Even after the completion, S1 did not have any synthesized knowledge from the peer-reviewed articles. This could be a common phenomenon in the ISP even with native English speaking students. However, it seemed clear that time delays and difficulties in understanding, through the lack of English proficiency, prevented the participants from even trying to organize their ideas and understandings in a more sophisticated way.

In terms of writing, grammar was a big concern to both participants. S1 said, “When I handed in the paper, there were so many comments on the grammatical errors, which requires a long time effort to fix them.”

### 3.6.2.3 Behavioral Dimension

**Search terms and operators.** Both participants used the same simple search terms through all information stages. Their search terms did not become more specific once they had established their focus. S1 mainly used ‘game addiction,’ ‘video game addiction,’ ‘internet addiction’ as search terms and S2 kept using only ‘insomnia’ and browsed the retrieved sources to select those dealing with causes, symptoms or treatments of insomnia. With the same search terms, they only marked the checkbox for *magazine* when they searched for introductory sources and marked the one for *scholarly* when they needed peer-reviewed articles. This appeared to be the result of limited meta-language, knowledge of the specific technical vocabulary related to their topics. As they did not have enough vocabulary, they searched for the articles with a broader search term so that they could select appropriate ones among those retrieved. This search pattern did not change over the stages. Their lack of English proficiency made them prefer high recall to high precision through the project process. Moreover, they did not use any related terms from the articles, which they already found and read, for the next search. S1 explained, “I don’t have to change search terms because I could get enough number of articles in various online databases provided by the school with only a few search terms.” They rarely used Boolean operators in searching. S1 said, “There will be no result with Boolean operators because it’s too specific.” The school librarian said, “Librarians were

very active in helping the student locate articles. This might represent difficulty with finding the correct keywords and building upon those words.”

**Selection criteria.** The participating students’ selection criteria included title, length of an article and vocabulary level. When selecting articles from those retrieved, they checked the title first to see if an article was pertinent to their topic. Among those pertinent sources, they chose the short articles with easy vocabularies. Although, at the initiation, S1 answered that finding sources was generally easy to do in the research project, he mentioned that searching was hard at the mid-point of the project. He said, “Because English is not my mother language but a third language, the search process is harder. I need to find short articles with easy vocabularies about the topic... if I could do the research in Korean, I don’t need to try to find short articles or easy vocabularies. I will only see if an article is interesting to me or not.”

#### **3.6.2.4 Affective Dimension**

**Emotional changes.** The students showed emotional changes throughout the research process (Table 11). In the initiation of the project, S1 felt confused, uncertain and worried because he did not know much about his topic and he was worried about the quality of his performance on this project and S2 felt uncertain because he really did not have any idea what to do for this project. In the mid-point of the project, S1 felt optimistic because he had finished finding and summarizing the introductory sources and he only needed to write the introduction part of the paper and find peer-reviewed articles. However, at the same point, S2 felt anxious about this project because he could not find

appropriate introductory sources about his topic. In the completion of the project, S1 was confident that he knew about what he had researched, but at the same time, he felt disappointed that few researchers argued over-playing games was not “addiction” but only “disorder” or “out of control,” which was what he wanted to demonstrate through his project.

When asked if they were worried about their English for doing this project (1-not at all, 2-a little, 3-some, 4-a lot), S1 answered “2-a little” over the stages (Figure 5). S2, who had lower English proficiency than S1, started the project with a lot of worries about his English. However, after summarizing the introductory sources, he said, “it was less hard than I thought.” It seems that the students who have lower self-rated English proficiency might have more concerns or pressure on their lack of English proficiency at the initiation stage of the research.

As to the ELL students’ affective patterns, during the project, compared with native English speaking students, the school librarian mentioned, “The ELL student seemed to mature somewhat through the process and seemed satisfied with his ability to handle this rather arduous task.” This will be explored further in the dissertation study.

Table 11  
Emotional Changes during the Research Project

	Initiation	Mid-point	Completion
S1	confused, uncertain, worried	optimistic	confident, disappointed
S2	uncertain	anxious	-

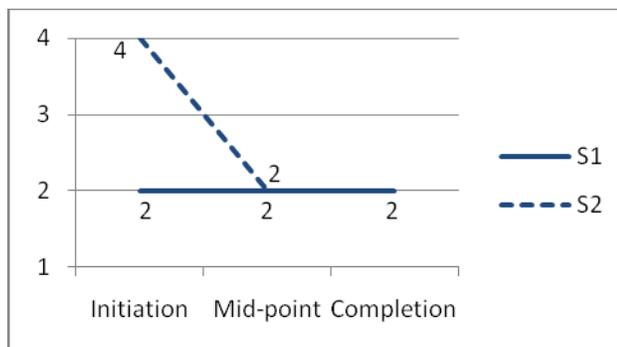


Figure 5 Concern about English Language Proficiency

### 3.6.2.5 Summary

The students had help from three school librarians and the researcher for the project. They needed someone who could stay by them and explain what they could not understand and what an article was generally about during the project. Especially, they wanted to get help when they were working on the project at home. However, they did not have anyone who could fluently speak English. The summary of the findings in this study includes:

#### 1) Cognitive dimension

- *Topic selection*: The lack of English proficiency limited ELL students in choosing a “doable” topic even after they found a subject related to their interests.
- *Focus formulation*: The supplied sources by the school librarian, at the initiation stage, gave ELL students a more specific direction in their research, however as they formulated their own focus, intervention needed to be more careful. Difficulties in reading hindered the ELL students in formulating a focus and the lack of focus, in addition to the limited English proficiency, made it harder to summarize sources and establish key ideas that they understood.

- *Knowledge building*: Although ELL students became more interested in their topic over the stages, lower English proficiency hindered ELL students in developing their knowledge beyond descriptive and superficial levels.
- *Knowledge labeling*: ELL students established more specific titles in the mid-point than in the initiation, however its relationship with English proficiency was not clear.
- *Knowledge presentation*: ELL students tended to list the peer-reviewed articles in a chronologically order in their papers. They were in a hurry to finalize the project because they had already fallen behind, and as a result they simply summarized the articles individually and did not have a big picture about them.

## 2) Behavioral dimension

- *Search terms and operators*: The lack of English proficiency made ELL students prefer high recall to high precision through the project process. Moreover, they did not use any related terms from the articles, which they already found and read, for the next search. They rarely used Boolean operators.
- *Selection criteria*: ELL students needed to consider the length and vocabulary level of articles as well as topic relatedness in searching.

## 3) Affective dimension

- *Emotional changes*: ELL students appeared to have more concerns or pressures because of their lack of English proficiency at the initiation stage of the research.

### 3.6.3 Conclusion

As a pilot study designed for a more extensive dissertation study, this study indicates that language proficiency may indeed influence the information-to knowledge

experience of students when they undertake inquiry units of work. It shows that their lack of English proficiency limited ELL students in choosing a doable topic, made it harder to summarize sources and hindered them in developing their knowledge beyond descriptive and superficial levels. In searching, ELL students preferred high recall to high precision through the project process and rarely used Boolean operators. In addition, it appeared that they had more concerns or pressure because of their lack of English proficiency at the initiation stage of the research.

The pilot study also shows that potentially future studies about ELL students' information search process can shed light on how different linguistic and cultural background influence people's information seeking and use and contribute to enriching the existing ISP model by considering the individual's linguistic and cultural contexts.

## CHAPTER 4 FINDINGS

### 4.1 Characteristics of Participants

The participants of the study were 48 ELL students from one ESL theme class with 10 students and two LEP biology classes with 18 and 20 students, respectively. These classes consisted only of ELL students. As described in Section 3.1.3, the school makes the distinction between two kinds of curriculum for ELL students: language and literature curriculum for ELL students are called *ESL classes*, and subject curriculum for ELL students taught by mainstream teachers are called *LEP classes*. And students in ESL classes or LEP classes are called *ELLs*. In this study, they are simply called *theme class*, and *biology classes* (biology 1 and biology 2) without ESL or LEP to reduce redundancy. The theme class with ELL level 5 students (11<sup>th</sup> grade) covered contemporary themes in various content areas. The biology classes with ELL level 2 through ELL level 5 (9<sup>th</sup> through 12<sup>th</sup> grade) were taught by a mainstream biology teacher in collaboration with the bilingual/ESL supervisor.

Students were asked to complete a questionnaire before they started the research project. The questionnaire included questions about their age, gender, ethnicity, ELL level, country of birth, length of stay in the United States, language(s) spoken at home, self-rated proficiency in their native language and English, and the English language proficiency of those with whom they were living.

#### 4.1.1 Demographic Information

Age of the students ranged from 14 to 19 across three classes and the average age

was 16.37 years ( $SD=1.436$ ). The average age of students in the theme class was 17.30 years ( $SD=0.675$ ) while those of students in the biology classes were 16.00 years ( $SD=1.455$ ) and 16.20 years ( $SD=1.542$ ), respectively (Table 12). The two biology classes had similar student age distributions from 14 years-old to 19 years-old as shown in Figure 6.

Table 12  
Participants' Age x Class

	Classes			Total (n=48) Frequency (%)
	Theme (n=10)	Biology 1 (n=18)	Biology 2 (n=20)	
14 years-old	0	3	3	6 (12.5)
15 years-old	0	4	4	8 (16.7)
16 years-old	1	5	5	11 (22.9)
17 years-old	5	3	4	12 (25.0)
18 years-old	4	2	2	8 (16.7)
19 years-old	0	1	2	3 (6.3)
<i>M (SD)</i>	17.30 (.675)	16.00 (1.455)	16.20 (1.542)	16.37 (1.436)

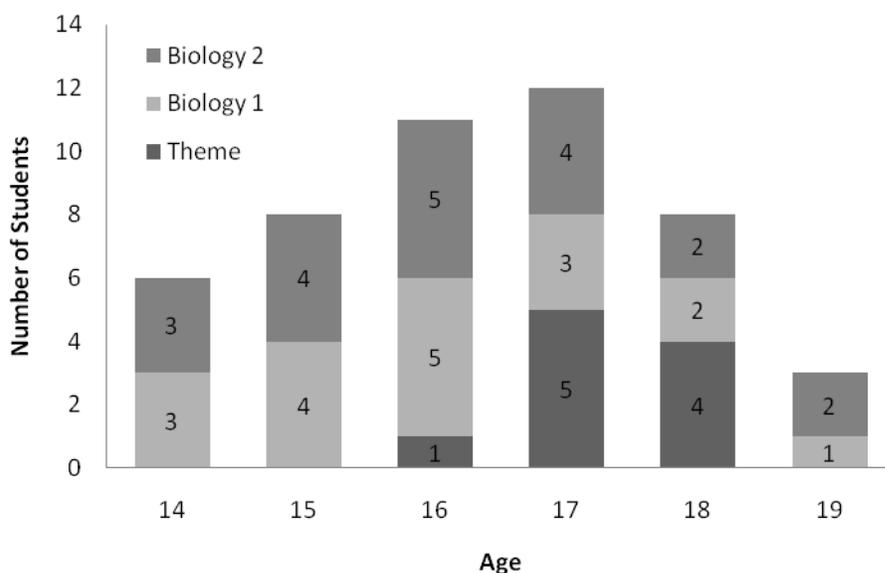


Figure 6 Participants' Age Distribution

As shown in Table 13, among the total participants, 47.9% (n=23) were boys and 52.1% (n=25) were girls. In the theme class, there were 5 boys and 5 girls. Biology 1 had 6 boys and 12 girls while Biology 2 had 12 boys and 8 girls. Figure 7 shows the distribution of the participants' gender.

Table 13  
Participants' Gender x Class

	Classes			Total Frequency (%)
	Theme	Biology 1	Biology 2	
Boys	5	6	12	23 (47.9)
Girls	5	12	8	25 (52.1)
Total	10	18	20	48 (100.0)

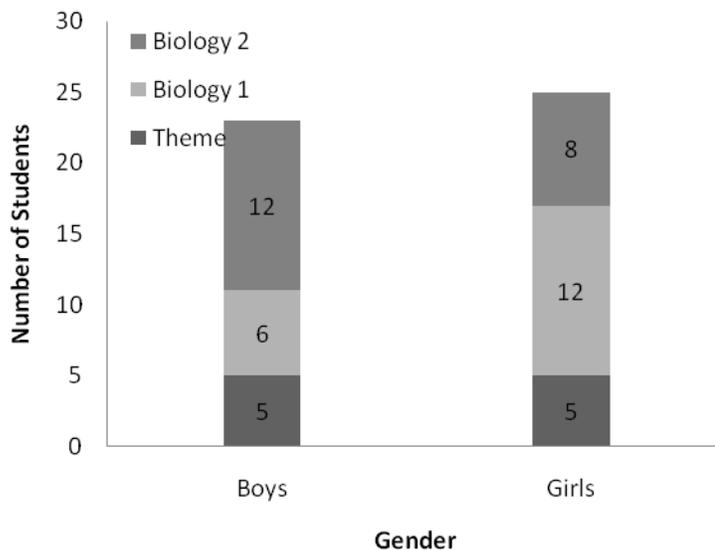


Figure 7 Participants' Gender Distribution

Of the total participants, 12.5% (n=6) were Asian, 29.2% (n=14) were Black and 58.3% (n=28) were Hispanic or Latino. Table 14 shows detailed information on the ethnicity of participants in each class. Hispanic or Latino students comprised at least half of the number of students in all classes which participated in the study. Figure 8 shows the distribution of the participants' ethnicity.

Table 14  
Participants' Ethnicity x Class

	Classes			Total Frequency (%)
	Theme	Biology 1	Biology 2	
Asian	2	3	1	6 (12.5)
Black	1	6	7	14 (29.2)
Hispanic or Latino	7	9	12	28 (58.3)
<b>Total</b>	<b>10</b>	<b>18</b>	<b>20</b>	<b>48 (100.0)</b>

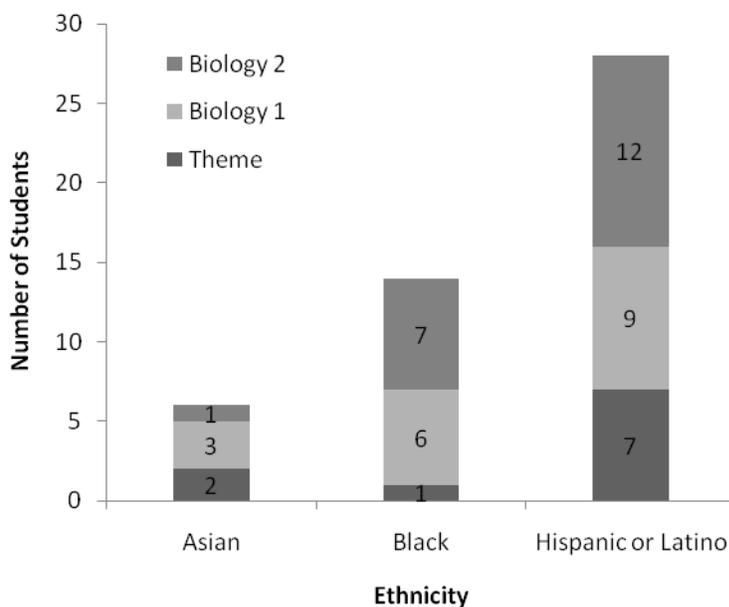


Figure 8 Participants' Ethnicity Distribution

ELL students participating in this study were born in 14 different countries (Table 15). Of the total number of students, 72.9% were born in Peru (n=14), Haiti (n=10), El Salvador (n=6) or Ecuador (n=5). Each of the three classes had at least one person from Ecuador, Haiti and Peru, and the students in each class came from 7 to 9 different countries. Two students, among 48 students, were born in the United States and Canada. However, they were ELLs because one student moved to Honduras after she was born and returned to the U.S. two years ago, and the other student was French Canadian. Figure 9 shows the distribution of participants' country of birth.

Table 15  
Participants' Country of Birth x Class

	Classes			Total Frequency (%)
	Theme	Biology 1	Biology 2	
Canada	0	0	1	1 (2.1)
China	1	1	0	2 (4.2)
Ecuador	1	2	2	5 (10.4)
El Salvador	2	0	4	6 (12.5)
Haiti	1	5	4	10 (20.8)
India	0	1	0	1 (2.1)
Liberia	0	0	2	2 (4.2)
Mexico	0	1	0	1 (2.1)
Nigeria	0	1	0	1 (2.1)
Pakistan	1	0	1	2 (4.2)
Peru	3	5	6	14 (29.2)
Taiwan	0	1	0	1 (2.1)
Uruguay	1	0	0	1 (2.1)
USA	0	1	0	1 (2.1)
<b>Total</b>	<b>10</b>	<b>18</b>	<b>20</b>	<b>48 (100.0)</b>

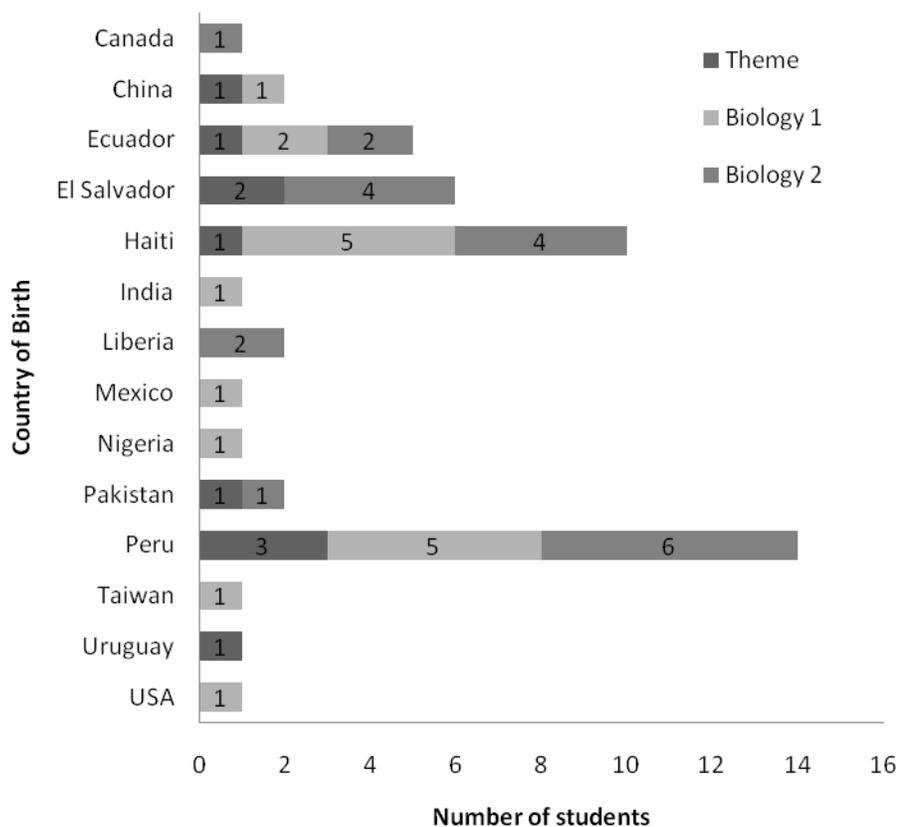


Figure 9 Participants' Country of Birth Distribution

Table 16 shows the participants' length of stay in the United States. Of the total participants, 29.2% (n=14) had stayed in the U.S. for one year or less than one year, 33.3% (n=16) for more than one year up to two years, 25% (n=12) for more than two years up to three years, 8.3% (n=4) for more than three years up to four years, 4.2% (n=2) for more than five years up to six years. That is, 87.5% (n=42) of the participants came to the U.S. at most three years ago, and 95.8% (n=46) came to the U.S. at most four years ago. Figure 10 shows the distribution of participants' length of stay in the U.S.

Table 16  
Participants' Length of Stay in the U.S. x Class

	Classes			Total Frequency (%)	Cumulative Frequency (%)
	Theme	Biology 1	Biology 2		
0 yr < $\alpha$ ≤ 1 yr	3	4	7	14 (29.2)	14 (29.2)
1 yr < $\alpha$ ≤ 2yrs	1	9	6	16 (33.3)	30 (62.5)
2 yrs < $\alpha$ ≤ 3 yrs	5	4	3	12 (25.0)	42 (87.5)
3 yrs < $\alpha$ ≤ 4 yrs	1	1	2	4 (8.3)	46 (95.8)
4 yrs < $\alpha$ ≤ 5 yrs	0	0	0	0 (0.0)	46 (95.8)
5 yrs < $\alpha$ ≤ 6 yrs	0	0	2	2 (4.2)	48 (100.0)
Total	10	18	20	48 (100.0)	48 (100.0)

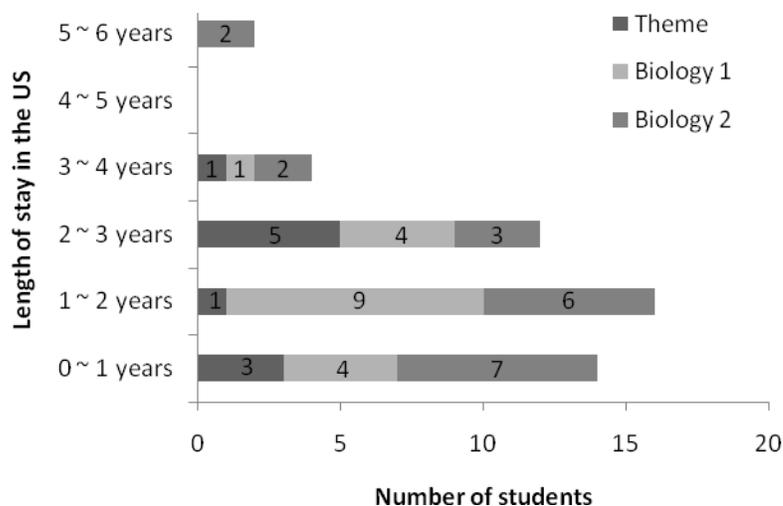


Figure 10 Participants' Length of Stay in the U.S. Distribution

Table 17 shows the language that students in each class use at home. Of the total participants, 43.8% (n=21) speak only their native language at home and 56.3% (n=27) speak their native language(s) with some English. More specifically, 31.3% (n=15) of the total participants speak only Spanish and 27.1% (n=13) speak Spanish and English at home. Twenty-one percent (n=10) speak Creole and English with or without French at home. The majority portion of Spanish or Creole speakers represented a large number of students from Peru, Haiti, El Salvador and Ecuador. Six percent (6.3%, n=3) speak Chinese and 4.2% (n=2) speak Liberian English at home. Figure 11 shows the distribution of students' home language(s).

Table 17  
Participants' Home Language(s) x Class

	Classes			Total Frequency (%)
	Theme	Biology 1	Biology 2	
Chinese	1	2	0	3 (6.3)
Liberian English	0	0	2	2 (4.2)
Spanish	3	4	8	15 (31.3)
Urdu	1	0	0	1 (2.1)
Creole & English	0	1	1	2 (4.2)
Creole, French & English	1	4	3	8 (16.7)
French & English	0	0	1	1 (2.1)
Gujarati & English	0	1	0	1 (2.1)
Igbo & English	0	1	0	1 (2.1)
Spanish & English	4	5	4	13 (27.1)
Urdu, Punjabi & English	0	0	1	1 (2.1)
Total	10	18	20	48 (100.0)

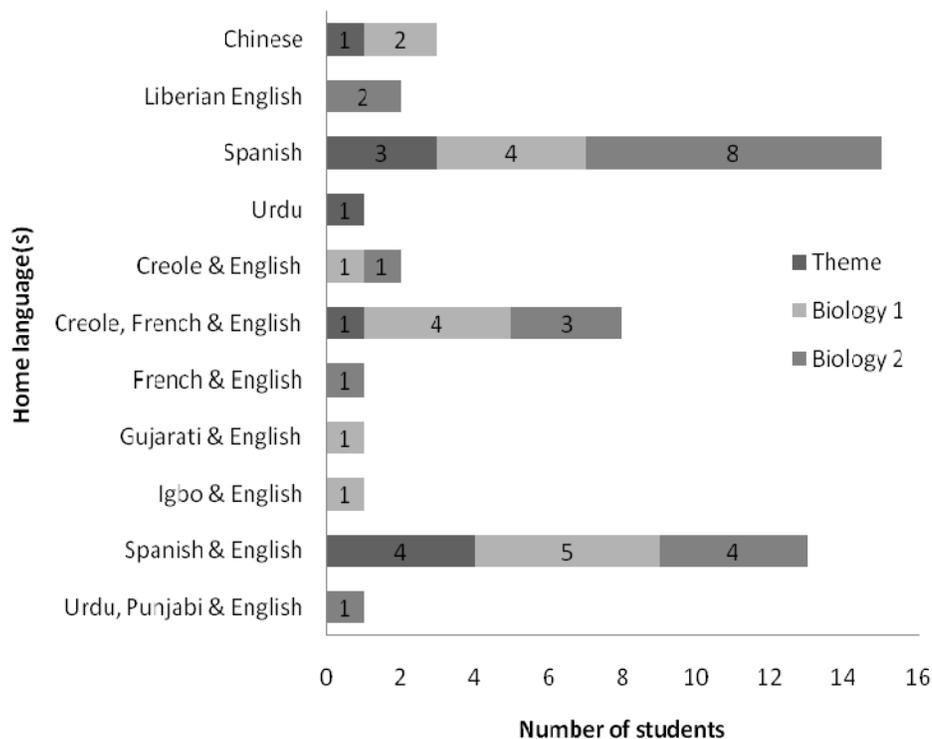


Figure 11 Students' Home Language(s) Distribution

The ELL level of participants ranged from level 2 to level 5. According to the terms used in the recruited school, this study uses *Beginning level* for level 2, *Intermediate level* for level 3 and level 4, and *Advanced level* for level 5. Table 18 shows the participants' ELL level by class. Of the total participants, 29.2% (n=14) were Beginning level, 33.3% (n=16) were Intermediate level, and 37.5% (n=18) were Advanced level (Table 18). The theme class had only Advanced ELL students, and the biology classes had three different ELL level groups. The distribution of students' ELL level is presented in Figure 12.

Table 18  
Participants' ELL Level x Class

	Classes			Total Frequency (%)
	Theme	Biology 1	Biology 2	
Beginning	0	6	8	14 (29.2)
Intermediate	0	8	8	16 (33.3)
Advanced	10	4	4	18 (37.5)
<b>Total</b>	<b>10</b>	<b>18</b>	<b>20</b>	<b>48 (100.0)</b>

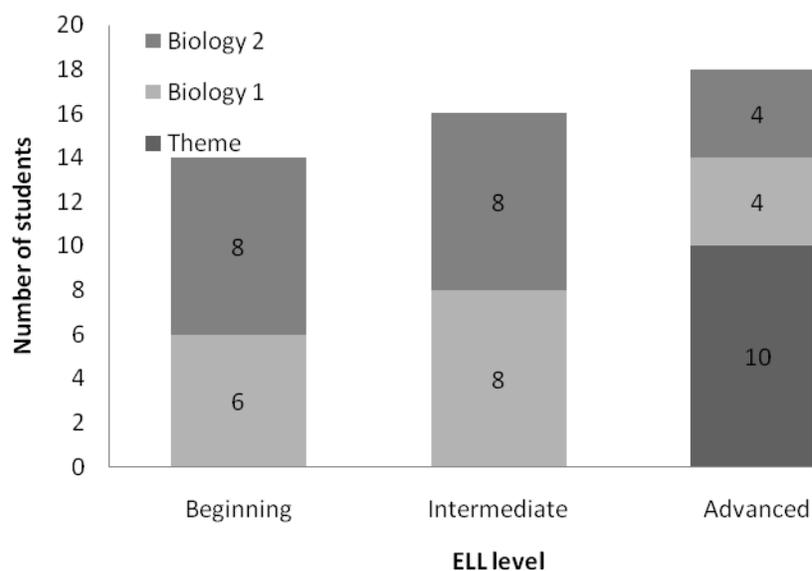


Figure 12 Students' ELL Level Distribution

In the questionnaire, students were asked to list the ages and English language proficiency of those with whom they were living. Table 19 shows the participants' linguistic isolation by class. Of the total participants, 56.3% (n=27) were living in a linguistically isolated household (LIH) where all members aged 14 years and older spoke a non-English language and also spoke English less than very well. Eight of 10 students in the theme class and 19 of 38 students in the biology classes were linguistically isolated. The distribution of the participants' LIH is presented in Figure 13.

Table 19  
Participants' Linguistic Isolation x Class

	Classes			Total Frequency (%)
	Theme	Biology 1	Biology 2	
LIH	8	8	11	27 (56.3)
Non-LIH	1	10	8	19 (39.6)
Don't Know	1	0	1	2 (4.2)
<b>Total</b>	<b>10</b>	<b>18</b>	<b>20</b>	<b>48 (100.0)</b>

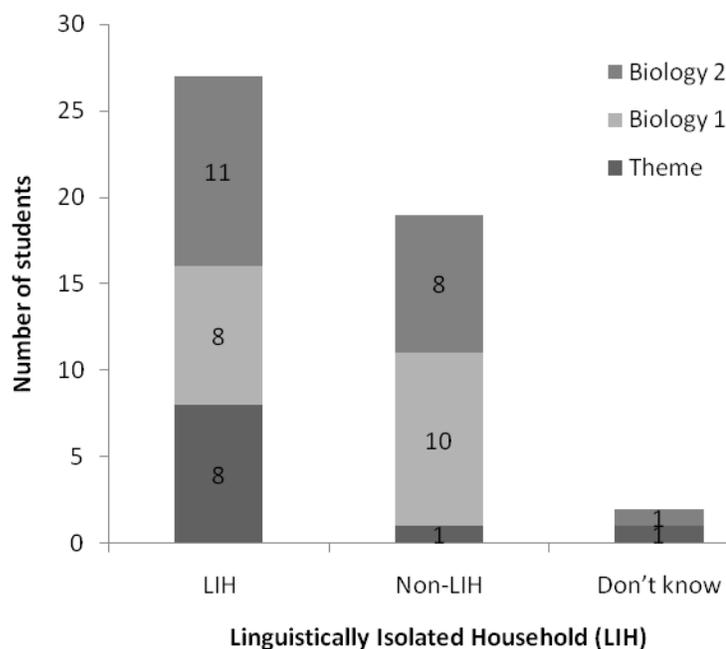


Figure 13 Students' LIH Distribution

Table 20 shows the participants' linguistic isolation and their home languages. Of the 27 students who were living in LIHs, 14 students spoke only their native language and 13 students spoke their native language and English at home. These 13 students spoke English at home with younger siblings under 14 years or with friends on the phone or through online chatting software. Of the 19 students who were living in Non-LIHs, 6 students spoke only their native language and 13 students spoke their native language and English. Chi-square tests show that speaking some English at home does not have a relationship with whether students live in LIHs or not.

Table 20  
Participants' Linguistic Isolation x Home Language(s)

	Home language(s)		Total Frequency (%)
	Only native language	Native language and some English	
LIH	14	13	27 (56.3)
Non-LIH	6	13	19 (39.6)
Don't Know	1	1	2 (4.2)
Total	21	27	48 (100.0)

#### 4.1.2 Self-rated Language Proficiency

The participants were asked to rate their native language proficiency and English language proficiency in the questionnaire. Four scales (1=poor, 2=okay, 3=good, and 4=very good) were given to each language skill of reading, writing, listening and speaking in their native language and English.

As shown in Table 21, students showed higher levels of self-rated proficiency in their native language than in English in all four language skills and average across them. The differences were significant ( $p < .001$ ).

In their native language, listening ( $M=3.88$ ) had the highest self-rating, followed by speaking ( $M=3.81$ ), reading ( $M=3.42$ ), and writing ( $M=3.31$ ). Students rated their English language listening skills highest ( $M=3.02$ ), followed by reading ( $M=2.80$ ), writing ( $M=2.70$ ), and speaking ( $M=2.59$ ). Speaking showed the greatest mean difference between self-rated language proficiency in their native language and English (1.22), followed by listening (0.86), reading (0.62) and writing (0.61). Figure 14 compares participants' self-rated proficiency in their native language and English.

Table 21  
Self-rated Proficiency in Native Language and English

	Language Skills								Average	
	Reading		Writing		Listening		Speaking			
	M	SD	M	SD	M	SD	M	SD	M	SD
Native language (n=48)	3.42	.846	3.31	.854	3.88	.334	3.81	.491	3.60	.494
English (n=46)	2.80	.687	2.70	.622	3.02	.745	2.59	.805	2.78	.597

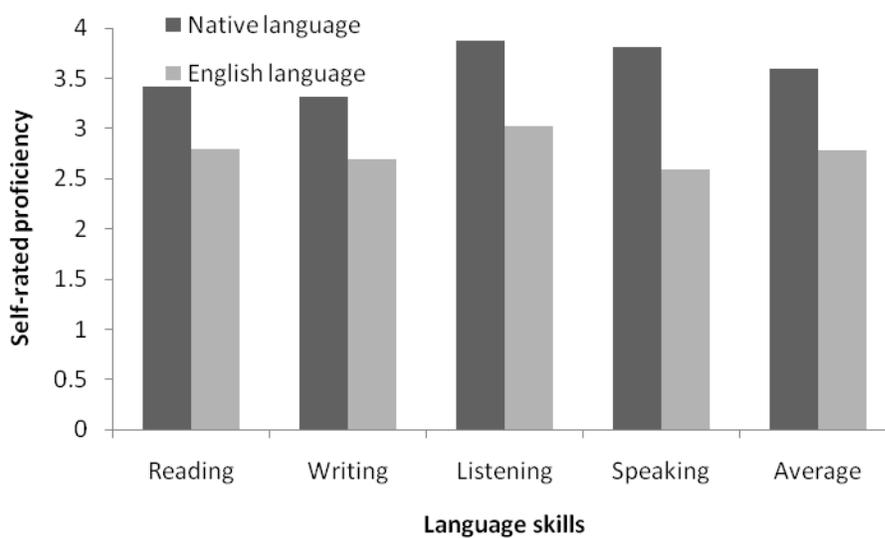


Figure 14 Self-rated Proficiency in Native Language and English

In order to explain the variation in students' self-rated proficiency in native language and English, their responses were crosstabulated with the following variables: ELL level, linguistically isolated household (LIH), home language(s), and gender.

Table 22  
Self-rated Proficiency in Native Language x ELL Level

		ELL Level					
		Beginning (n=14)		Intermediate (n=16)		Advanced (n=18)	
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Native Language	Reading	3.36	1.008	3.50	.894	3.39	.698
	Writing	3.43	.852	3.19	.981	3.33	.767
	Listening	3.86	.363	4.00	.000	3.78	.428
	Speaking	3.86	.363	3.94	.250	3.67	.686
	Average	3.63	.526	3.66	.446	3.54	.530

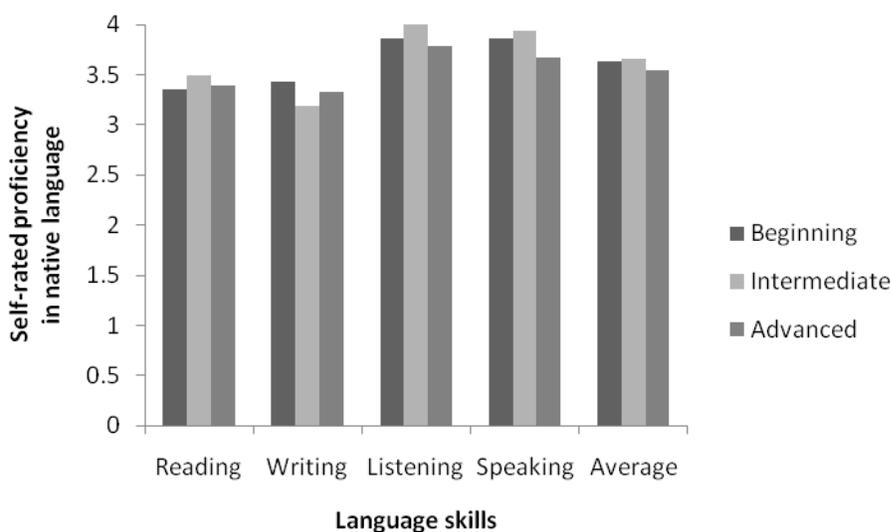


Figure 15 Self-rated Proficiency in Native Language and ELL Level

As shown in Table 22, the intermediate ELL group rated their proficiency in their native language higher than the other ELL groups in reading, listening, speaking and average across four language skills. And the beginning ELL group rated their writing proficiency in their native language higher than the other groups. The advanced ELL group rated their native language proficiency in listening, speaking and average across four language skills lower than the other groups. The comparison among the ELL level groups is presented in Figure 15. However, there were no significant differences in self-rated proficiency in native language among the ELL level groups. In other words, all ELL

level groups viewed themselves as proficient in their native language, regardless of their level of English language proficiency.

Table 23  
Self-rated Proficiency in English x ELL Level

		ELL Level					
		Beginning (n=13)		Intermediate (n=15)		Advanced (n=18)	
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
English	Reading	2.77	.725	3.13	.640	2.56	.616
	Writing	2.62	.768	2.93	.594	2.56	.616
	Listening	3.00	.816	3.13	.834	2.94	.639
	Speaking	2.62	.506	3.00	.926	2.22	.732
	Average	2.75	.604	3.05	.599	2.57	.527

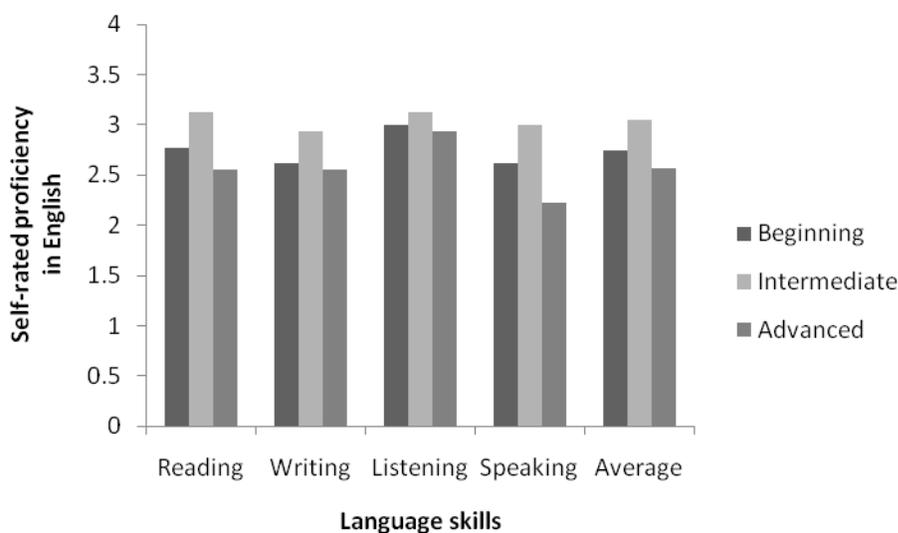


Figure 16 Self-rated Proficiency in English and ELL Level

Table 23 shows the students' self-rated proficiency in English and their ELL level. The intermediate ELL group showed higher levels than the other ELL groups in all four language skills, whereas the advanced ELL group showed lower levels than the other ELL groups. The intermediate ELL group has a significantly higher level ( $p < .05$ ) than the

advanced group in self-rated proficiency of speaking in English. The comparison among the ELL groups in each language skill is presented in Figure 16.

Table 24  
Self-rated Proficiency in Native Language x LIH

		Linguistically Isolated Household			
		LIH (n=27)		Non-LIH (n=19)	
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Native Language	Reading	3.48	.643	3.47	1.020
	Writing	3.26	.813	3.47	.905
	Listening	3.81	.396	3.95	.229
	Speaking	3.70	.609	3.95	.229
	Average	3.56	.517	3.71	.458

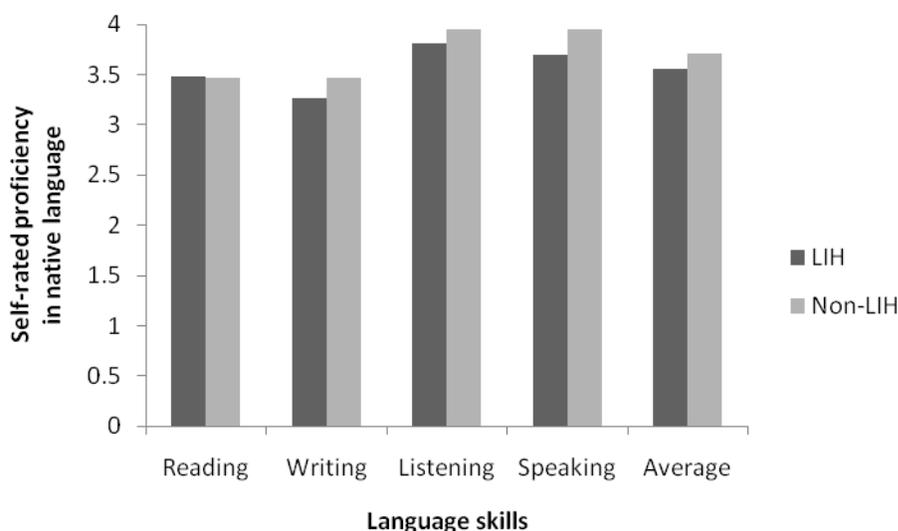


Figure 17 Self-rated Proficiency in Native Language x LIH

Table 24 shows the students' self-rated proficiency in native language and their linguistic isolation. Students who were living in LIHs had a lower level of self-rated proficiency in their native language than those in Non-LIHs in writing, listening, speaking and average across four language skills. However, the differences between the LIH and the non-LIH groups were not significant. The comparison between the LIH group

and the Non-LIH group in self-rated native language proficiency is presented in Figure 17. In other words, students viewed themselves as proficient in their native language regardless of whether or not they were linguistically isolated.

Table 25  
Self-rated Proficiency in English x LIH

		Linguistically Isolated Household			
		LIH (n=27)		Non-LIH (n=17)	
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
English	Reading	2.67	.679	3.06	.659
	Writing	2.59	.572	2.94	.748
	Listening	2.85	.662	3.18	.809
	Speaking	2.37	.792	2.88	.781
	Average	2.62	.556	3.01	.628

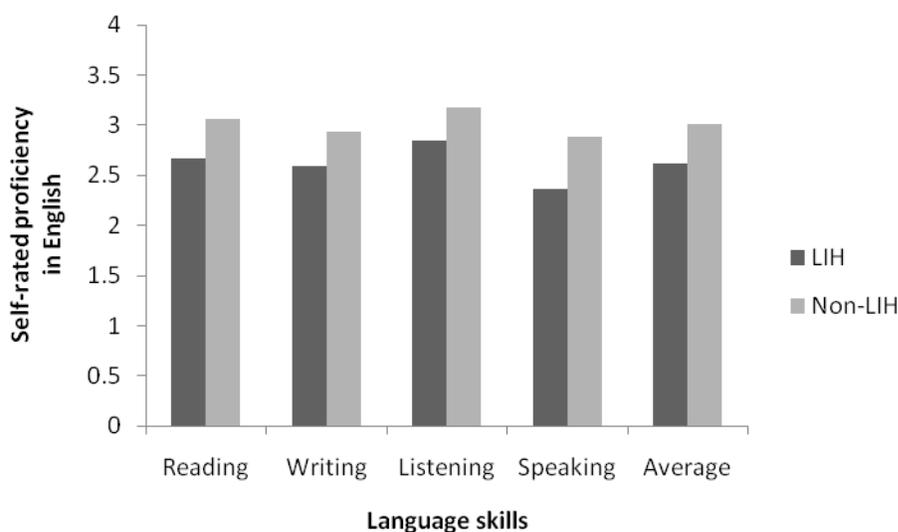


Figure 18 Self-rated Proficiency in English x LIH

Table 25 shows the students' self-rated proficiency in English and their linguistic isolation. Students who were living in LIHs rated their English proficiency lower than the non-LIH group in all language skills. The LIH group showed significantly lower self-rated proficiency in English than the Non-LIH group in speaking ( $p < .05$ ) and average

across four language skills ( $p < .05$ ). The comparison between the LIH group and the Non-LIH group in self-rated English language proficiency is presented in Figure 18. In short, linguistic isolation was related to students' self-rated English language proficiency. Students who were living with proficient English speakers at home showed significantly higher levels of self-rated English language proficiency in speaking and average across four language skills than those who were linguistically isolated.

Table 26  
Self-rated Proficiency in Native Language x Home Language(s)

		Home language(s)			
		Only native language (n=21)		Native language and some English (n=27)	
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Native Language	Reading	3.48	.680	3.37	.967
	Writing	3.24	.831	3.37	.884
	Listening	3.81	.402	3.93	.267
	Speaking	3.71	.644	3.89	.320
	Average	3.56	.524	3.64	.477

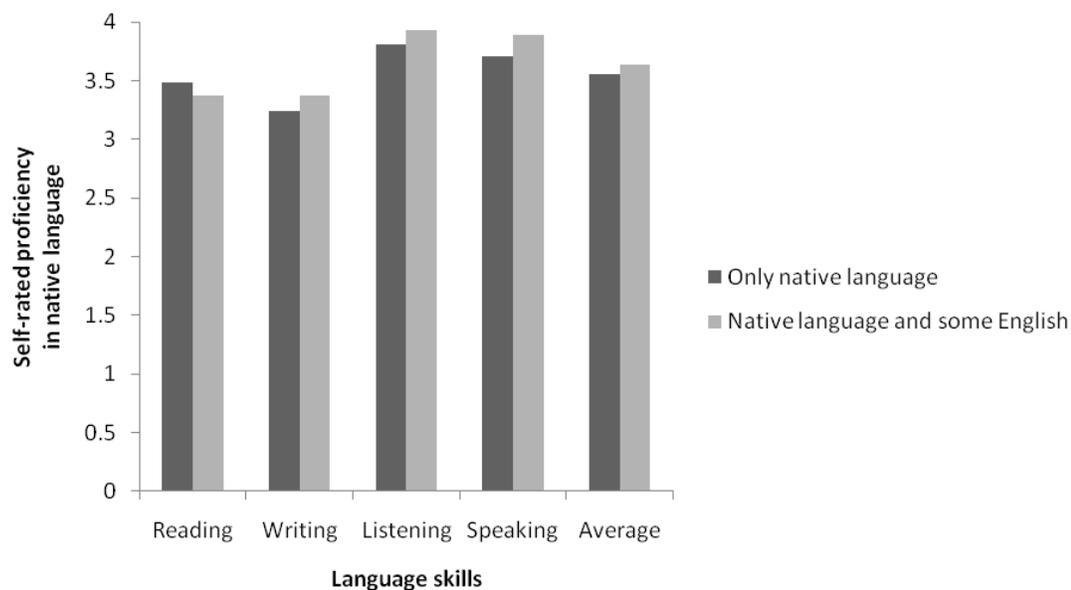


Figure 19 Self-rated Proficiency in Native Language x Home Language(s)

Table 26 shows the students' self-rated proficiency in native language and their home language(s). Students who spoke some English at home rated their native language skills in writing, listening and speaking higher than those who spoke only their native language at home. The comparison between these groups in self-rated native language proficiency is presented in Figure 19. However, the differences between these groups were not significant. In other words, students viewed themselves as proficient in their native language regardless of whether or not they spoke some English at home.

Table 27  
Self-rated Proficiency in English x Home Language(s)

		Home language(s)			
		Only native language (n=19)		Native language and some English (n=27)	
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
English	Reading	2.58	.607	2.96	.706
	Writing	2.37	.496	2.93	.675
	Listening	2.68	.671	3.26	.712
	Speaking	2.11	.658	2.93	.730
	Average	2.43	.440	3.02	.580

Table 27 shows the students' self-rated proficiency in English and their home language(s). Students who spoke some English at home rated their English language proficiency higher than those who spoke only their native language at home in all language skills. The differences were significant in writing ( $p < .01$ ), listening ( $p < .01$ ), speaking ( $p < .001$ ), and average across four language skills ( $p < .001$ ). The comparison between these groups is presented in Figure 20. In other words, whether or not to use English at home was significantly related to students' self-rated English language proficiency. Students speaking some English at home had a significantly higher level of

self-rated English language proficiency in writing, listening and speaking than those speaking only their native language(s) at home.

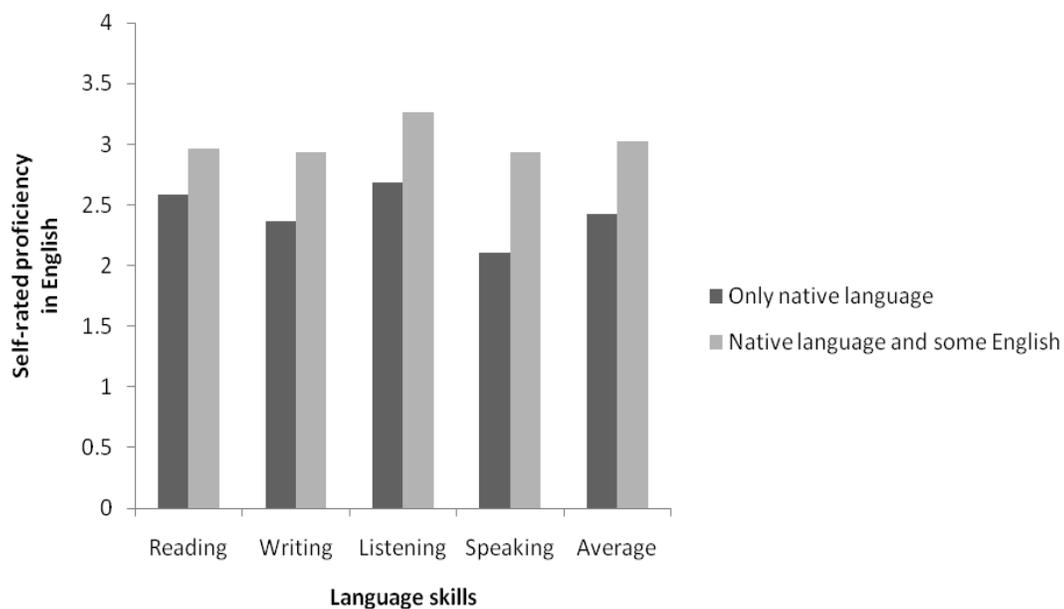


Figure 20 Self-rated Proficiency in English x Home Language(s)

Table 28

Self-rated Proficiency in Native Language x Gender

		Gender			
		Boys (n=23)		Girls (n=25)	
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Native language	Reading	3.22	.902	3.60	.764
	Writing	3.04	.928	3.56	.712
	Listening	3.83	.388	3.92	.277
	Speaking	3.65	.647	3.96	.200
	Average	3.43	.575	3.76	.350

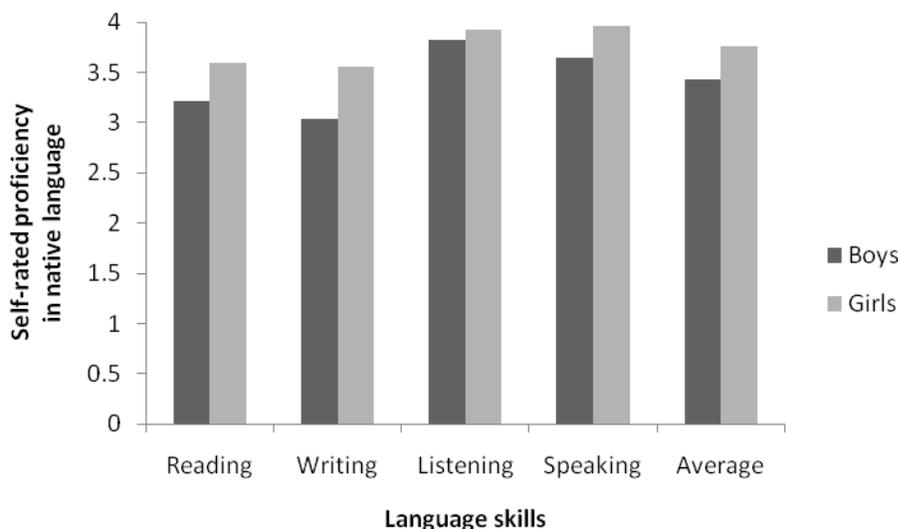


Figure 21 Self-rated Proficiency in Native Language x Gender

Table 28 shows the students' self-rated proficiency in native language by gender. Girls rated their native language proficiency higher than boys in all language skills. Significant differences in self-rated native language proficiency between boys and girls were found in writing ( $p < .05$ ), and speaking ( $p < .05$ ). Also, the averages of the four language skills differed significantly ( $p < .05$ ). The comparison between the gender groups in self-rated native language proficiency is presented in Figure 21. In other words, there existed gender differences in self-rated native language proficiency. Girls rated their native language proficiency significantly higher than boys in writing and speaking.

Table 29  
Self-rated Proficiency in English x Gender

		Gender			
		Boys (n=23)		Girls (n=25)	
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
English	Reading	2.57	.662	3.04	.638
	Writing	2.35	.573	3.04	.562
	Listening	2.96	.825	3.09	.668
	Speaking	2.48	.846	2.70	.765
	Average	2.59	.606	2.97	.535

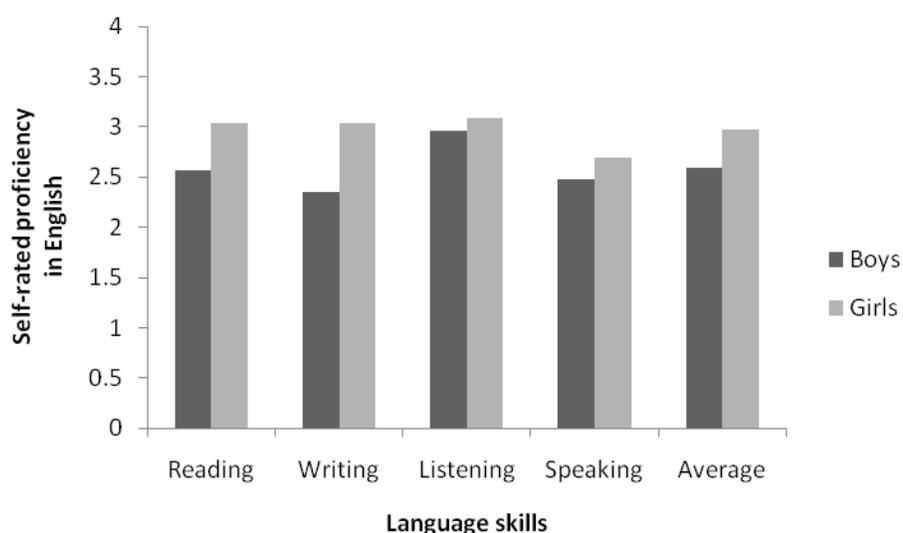


Figure 22 Self-rated Proficiency in English x Gender

Table 29 shows the students' self-rated proficiency in English by gender. Girls rated their English language proficiency higher than boys in all four language skills. They showed significant differences in rating their own English proficiency in reading ( $p < .05$ ) and writing ( $p < .001$ ). The averages of the four language skills differed significantly ( $p < .05$ ). The comparison between the gender groups in self-rated English language proficiency is presented in Figure 22. In other words, there existed gender differences in

self-rated English language proficiency. Girls rated their English language proficiency significantly higher than boys in reading and writing.

In sum, ELL students exhibited higher levels of self-rated proficiency in their native language than in English in four language skills – reading, writing, listening, and speaking. All ELL groups viewed themselves as proficient in their native language, regardless of their level of English language proficiency. The intermediate ELL group showed a significantly higher level of self-rated English language proficiency in speaking than the advanced ELL group. Although linguistic isolation did not affect whether students viewed themselves as proficient in their native language, it was related to students' self-rated English language proficiency. Students who were living with proficient English speakers at home showed a significantly higher level of self-rated English language proficiency in speaking and average ability across the four language skills than those who were linguistically isolated. Regarding home language(s), students viewed themselves as proficient in their native language regardless of whether or not they spoke some English at home. However, students speaking some English at home had a significantly higher level of self-rated English language proficiency in writing, listening and speaking than those speaking only their native language(s) at home. In addition, there were gender differences in self-rated language proficiency. Girls rated their native language proficiency in writing and speaking and their English language proficiency in reading and writing significantly higher than boys.

## 4.2 Cognitive Dimension

*RQ1. What primary patterns, if any, do ELL students have in terms of cognitive dimension (substance and amount of knowledge, labeling of knowledge, estimated knowledge, interest, and learning outcome), as they engage in the research task?*

### 4.2.1 Substance and Amount of Knowledge

Students were asked to answer the question, “Take some time to think about your topic. Now write down what you know about it” through the process surveys in the initiation, mid-point and completion stages of their research. Students were required to answer this question from memory without seeing any resources. Content analysis was conducted on the statements written by the students. Total statements were divided into topical statements and non-topical statements. Topical statements include students’ knowledge about their research topic: career plan for students in the theme class and genetic disorder for those in the biology classes. Non-topical statements include students’ evaluative words about their own knowledge, expected knowledge, research process, and value of the project.

According to the Student Learning through Inquiry Measure (SLIM ) handbook and scoring sheet, students’ topical knowledge was categorized as facts, explanations and conclusions (Todd, 2006). The examples of each type of topical knowledge were given from the data of this study.

1. *Facts* are statements that describe characteristics, processes, styles, actions, and class inclusion. For example: *In computer science you have to create*

*software that helps people to make their life easier, e.g. Microsoft Office; Red-Green color blind is a color vision deficiency.*

2. *Explanations* are statements that explain how and why, provide end results, and articulate some causality. For example: *I also know that babies who are born with PKU have no symptoms at first; The people who have this disease their bones are much shorter than normal people.*
3. *A conclusion* is a statement that formulates synthesis and expresses opinions, positions and evaluations. The examples are: *but if I try the best I can maybe I can be engineer; It can be very dangerous to health.*

The amount of topical knowledge was measured by counting the number of statements written by students at each data collection stage. The process surveys that were administered in the initiation, mid-point, and completion stages of the students' research are hereafter referred to as PS1, PS2, and PS3, respectively.

Table 30  
Number of Statements in Topical and Non-topical Knowledge (N=28)

	Type of Knowledge				Total	
	Topical		Non-topical		<i>M (Range)</i>	<i>SD</i>
	<i>M (Range)</i>	<i>SD</i>	<i>M (Range)</i>	<i>SD</i>		
PS1	1.39 (0-4)	1.286	.79 (0-6)	1.258	2.18 (0-6)	1.219
PS2	2.89 (0-6)	1.618	.32 (0-4)	.819	3.21 (1-6)	1.424
PS3	4.29 (0-14)	2.904	.46 (0-2)	.744	4.75 (1-14)	2.717

Table 30 shows the number of statements written by students at each stage by topicality. There were significant differences in the number of total statements between:

- PS1 and PS2  $t(27) = 3.841, p < .01$
- PS2 and PS3  $t(27) = 3.370, p < .01$
- PS1 and PS3  $t(27) = 5.507, p < .001$

The number of topical statements at each stage showed that the students' knowledge of their research topics gradually increased. There were significant differences in the number of topical statements between:

- PS1 and PS2  $t(27) = 3.781, p < .01$
- PS2 and PS3  $t(27) = 2.788, p < .05$
- PS1 and PS3  $t(27) = 5.085, p < .001$

The students showed significant growth of their topical knowledge throughout the research process, whereas there were no significant differences in the number of non-topical statements. Regardless of their level of English language proficiency and the type of research task, students expressed their lack of knowledge on the topic in the beginning stage. While students in the biology classes mainly focused on their factual and explanatory knowledge on the topic, those in the theme class valued their research experience on career plan and recognized how important it was to learn about their career options. For example, in the beginning stage, students in the theme class said:

“I like this project because this project helps me a lot to find a college and the important information that I need.”

“I think about my topic is interesting and you get to have experience in the things that you do.”

Also, when the project was completed, a student in the theme class said:

“Now I think that having to search about your career and college you want to go to is very, very important.”

Table 31  
Number of Topical Statements by Class and ELL Level (N=28)

	Biology Classes						Theme Class	
	Beginning (n=5)		Intermediate (n=12)		Advanced (n=5)		Advanced (n=6)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	.60	.894	1.92	1.084	1.20	1.643	1.17	1.472
PS2	3.20	1.095	2.75	1.865	2.60	1.673	3.17	1.722
PS3	2.60	2.608	4.58	3.260	3.00	2.121	6.17	2.041

Table 31 shows the number of topical statements by class and ELL level. In the biology classes, the intermediate ELL group exhibited more topical knowledge statements than the other ELL level groups throughout the research process; however, there were no significant differences in the number of topical statements among the ELL level groups. The beginning ELL group showed a significant difference in the number of topical statements between:

- PS1 and PS2  $t(4) = 3.833, p < .05$

Then, they showed a decreased number of topical statements in PS3. The intermediate ELL group showed a significant difference in the number of topical statements between:

- PS1 and PS3  $t(11) = 2.789, p < .05$

In spite of continuous increases in topical knowledge, the advanced ELL group in the biology classes showed no significant differences in the number of topical statements between stages. However, the advanced ELL group in the theme class showed significant differences in the number of topical statements between:

- PS2 and PS3  $t(5) = 8.216, p < .01$
- PS1 and PS3  $t(5) = 4.564, p < .01$

Moreover, the advanced ELL group in the theme class showed a significantly greater number of topical statements ( $p < .05$ ) than the advanced ELL group in the biology classes

in PS3. It seemed the advanced ELL level students in the theme class were more motivated to learn and show their knowledge of the topic than those in the biology classes for the following reasons. Firstly, they were examining their own life matters, namely, career decision and college preparation, whereas those in the biology classes were researching genetic disorder diseases. Secondly, the theme class had students take more structured steps, such as using a particular database and making note cards, outlines, and drafts, with a longer research period than the biology classes.

Thus, students' levels of English language proficiency did not influence amount of their topical knowledge. However, students reported more topical knowledge when they were involved in a more structured research project with a more personal topic.

Table 32  
Number of Topical Statements by Type (N=28)

	Type of Topical Statement					
	Fact		Explanation		Conclusion	
	<i>M (Range)</i>	<i>SD</i>	<i>M (Range)</i>	<i>SD</i>	<i>M (Range)</i>	<i>SD</i>
PS1	.71 (0-3)	.854	.61 (0-4)	.875	.07 (0-1)	.262
PS2	1.46 (0-4)	1.105	1.36 (0-4)	1.339	.07 (0-1)	.262
PS3	2.21 (0-8)	2.558	2.00 (0-6)	1.785	.07 (0-2)	.378

Table 32 shows the number of statements that focus on different types of topical knowledge. The data showed that the students reported their knowledge of the topic mostly by factual statements and explanatory statements. There were significant increases in the number of factual statements between:

- PS1 and PS2  $t(27) = 3.689, p < .01$
- PS1 and PS3  $t(27) = 3.271, p < .01$

There were significant increases in the number of explanatory statements between:

- PS1 and PS2  $t(27) = 2.635, p < .05$
- PS1 and PS3  $t(27) = 4.916, p < .001$

The number of conclusion statements did not show any significant differences between stages.

Table 33  
Number of Factual Statements by Class and ELL Level (N=28)

	Biology Classes						Theme Class	
	Beginning (n=5)		Intermediate (n=12)		Advanced (n=5)		Advanced (n=6)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	.40	.548	.75	.622	.40	.548	1.17	1.472
PS2	1.00	.707	1.33	.985	.80	.837	2.67	1.033
PS3	1.20	1.643	1.42	2.193	.80	.837	5.83	1.329

Table 33 shows the number of factual statements by class and ELL level. In the biology classes, the intermediate ELL group made a greater number of factual statements than the other ELL level groups throughout the research process; however, there were no significant differences among the ELL level groups at each stage. Moreover, there were no significant changes in the number of factual statements in each ELL level group of the biology classes.

The advanced ELL group in the theme class showed significant increases in the number of fact statements between:

- PS1 and PS2  $t(5) = 3.503$ ,  $p < .05$
- PS2 and PS3  $t(5) = 6.635$ ,  $p < .01$
- PS1 and PS3  $t(5) = 5.813$ ,  $p < .01$

Moreover, the advanced ELL group in the theme class made a significantly greater number of fact statements than the advanced ELL group in the biology classes in PS2 ( $p < .05$ ) and PS3 ( $p < .001$ ). Thus, students who were involved in a more structured research project with a more personal topic exhibited substantial increases of their factual statements as they progressed. And the number of factual statements written by students

in the theme class was significantly greater at PS2 and PS3 than the number written by those in the biology classes.

Table 34  
Number of Explanatory Statements by Class and ELL Level (N=28)

	Biology Classes						Theme Class	
	Beginning (n=5)		Intermediate (n=12)		Advanced (n=5)		Advanced (n=6)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	.20	.447	1.08	.996	.60	.894	.00	.000
PS2	2.20	1.304	1.33	1.231	1.80	1.643	.33	.816
PS3	1.40	1.342	3.17	1.403	2.20	1.924	.00	.000

Table 34 shows the number of explanatory statements by class and ELL level. In the biology classes, although there were no significant differences in the number of explanatory statements among the ELL level groups in each stage, each ELL level group showed significant changes between stages. The beginning ELL group showed a significant increase in the number of explanatory statements between:

- PS1 and PS2  $t(4) = 3.651, p < .05$
- PS2 and PS3  $t(4) = 4.000, p < .05$

The intermediate ELL group showed significant increases in the number of explanatory statements between:

- PS2 and PS3  $t(11) = 3.630, p < .01$
- PS1 and PS3  $t(11) = 5.503, p < .001$

The advanced ELL group in the biology classes showed a significant difference in the number of explanatory statements between:

- PS1 and PS2  $t(4) = 3.207, p < .05$

However, the advanced ELL group in the theme class did not issue any explanatory statements in PS1 and PS3. There was a significant difference in the number of explanatory statements between the advanced ELL group in the biology classes and in the

theme class at PS3 ( $p < .05$ ). The lack of explanatory statements in the theme class may be attributed to the requirement to search factual information about careers and colleges. On the contrary, the students in the biology classes were required to search the inherited process, causes and symptoms as well as the characteristics of their topic disease for the research.

Thus, students exhibited significant increases in the number of explanatory statements during their research process, regardless of their level of English language proficiency. In addition, the nature of the research task impacted the substance of knowledge students had built as they progressed. For example, students in the theme class were required to find information about their career goals, colleges, payment plans, and the application process, which were likely to have students mainly present factual statements. However, students in the biology classes were required to find the information about the general description, inherited process, symptoms, treatments, and pictures of their chosen disease, which were likely to have students present explanatory statements as well as factual statements. Regardless of their ELL level and the type of research task, students rarely reported their synthesized knowledge beyond facts or explanations.

Table 35  
Number of Topical Statements by Ethnicity (N=28)

	Asian (n=6)		Black (n=9)		Hispanic or Latino (n=13)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	2.83	.753	.67	1.118	1.23	1.092
PS2	3.50	1.871	2.89	1.691	2.62	1.502
PS3	6.83	3.764	2.89	2.028	4.08	2.362

Table 35 shows the number of topical statements by students' ethnicity. Asian students made more topical statements than the other ethnic groups throughout the research process. In PS1, they showed a significantly greater number of topical statements than Black students ( $p < .01$ ) and Hispanic or Latino students ( $p < .05$ ). In PS3, they showed a significantly greater number of topical statements than Black students ( $p < .05$ ). Although Asian students exhibited gradual increases of their topical knowledge, the changes were not significant. Black students and Hispanic or Latino students exhibited significant changes between stages. Black students exhibited significant increases in their topical knowledge between:

- PS1 and PS2  $t(8) = 2.925, p < .05$
- PS1 and PS3  $t(8) = 2.734, p < .05$

Hispanic or Latino students exhibited significant increases in their topical knowledge between:

- PS1 and PS2  $t(12) = p < .05$
- PS2 and PS3  $t(12) = p < .01$
- PS1 and PS3  $t(12) = p < .01$

Thus, there were ethnicity differences in the number of topical statements. Asian students tended to exhibit more topical knowledge than the others in PS1 and PS3 although the increases in the number of topical statements of Asian students were not significant. Black students and Hispanic students exhibited significant increases in the number of topical statements as they progressed.

Table 36  
Number of Topical Statements by Ethnicity within the Intermediate ELL Group (N=12)

	Asian (n=3)		Black (n=4)		Hispanic or Latino (n=5)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	2.67	1.155	1.50	1.291	1.80	.837
PS2	3.33	2.887	3.00	2.160	2.20	1.095
PS3	8.67	4.619	2.75	.500	3.60	1.140

Table 36 presents ethnic differences while controlling for students' ELL level and class. The intermediate ELL group in the biology classes was chosen because it had the largest number of students which allowed comparisons among the ethnic groups when controlling for ELL level and class. Within the intermediate ELL group in the biology classes, Asian students made significantly more topical statements than Black students ( $p < .05$ ) and Hispanic or Latino students ( $p < .05$ ) in PS3. There were no significant differences between stages in each ethnic group.

Thus, no ethnic groups with the intermediate ELL level showed substantial increases in the number of topical statements. However, Asian students tended to make significantly more topical statements than the other groups in PS3.

Table 37  
Number of Topical Statements by Gender (N=28)

	Boys (n=14)		Girls (n=14)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	1.43	1.284	1.36	1.336
PS2	2.64	1.393	3.14	1.834
PS3	4.07	1.817	4.50	3.757

Table 37 shows the number of topical statements by gender. Both gender groups exhibited gradual increases in topical knowledge. Boys showed significant increases in the number of topical statements between:

- PS1 and PS2  $t(13) = 2.973, p < .05$
- PS2 and PS3  $t(13) = 3.069, p < .01$
- PS1 and PS3  $t(13) = 4.714, p < .001$

Girls showed significant increases in the number of topical statements between:

- PS1 and PS2  $t(13) = 2.592, p < .05$
- PS1 and PS3  $t(13) = 3.111, p < .01$

There were no significant differences in the number of topical statements between the gender groups. Thus, regardless of gender, students made substantially more topical statements as they progressed.

Table 38  
Number of Topical Statements by Gender within the Intermediate ELL Group (N=12)

	Boys (n=5)		Girls (n=7)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	2.00	.707	1.86	1.345
PS2	2.40	1.140	3.00	2.309
PS3	3.60	1.140	5.29	4.152

Table 38 shows the number of topical statements by gender within the intermediate ELL group. Although both gender groups exhibited continuous increases in the number of topical statements, there were no significant differences between stages in each group. Moreover, there were no significant differences between the gender groups.

In summary, ELL students' topical knowledge progressively increased during the research project. The students expressed their topical knowledge predominantly by factual and explanatory statements. There were no significant differences in amount of topical knowledge among the ELL level groups. Regardless of their level of English language proficiency, they rarely stated synthesized knowledge or personal viewpoints on the topic. Students exhibited a greater amount of topical knowledge when they were involved in a more intensive research project with a personal topic. Students in the theme class had significantly greater number of factual statements than those in the biology classes, whereas they had less number of explanatory statements than those in the biology classes. This result shows that nature of research task impacted what type of knowledge students had built as they progressed. Regarding ethnicity, Asian students showed a significantly greater amount of topical knowledge than the other ethnic groups in the

completion stage, even when controlling for ELL level and class. There were no gender differences in substance and amount of knowledge.

#### 4.2.2 Labeling of Knowledge

Students were asked to answer the question, “What is the name you have given to your paper at this time?” through the process surveys in the initiation, mid-point and completion stage of their research. The titles, which the students had given to their research, were analyzed according to the categories developed by Todd (2006). The examples of each category were given from the data of this study.

1. *General title*: A title that describes the project on a general, overall level. An example is *Disease*.
2. *Specific title*: The title brings forward a specific aspect of the project. The examples are *Computer Hardware Engineering*; *Angelman syndrome*.
3. *Creative or artistic title*: The title is expressed in a creative or artistic way. The examples are *My choice for the future: 'Going to College'*; *Higher education to Become an Astronomer*; *Deeply into a Dwarf*.

Table 39  
Frequency and Percentage for Labeling of Knowledge (N=28)

	Haven't titled yet	General title	Specific title	Creative or artistic title
	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)
PS1	8 (28.6)	1 (3.6)	18 (64.3)	1 (3.6)
PS2	0 (0.0)	0 (0.0)	27 (96.4)	1 (3.6)
PS3	0 (0.0)	0 (0.0)	27 (96.4)	1 (3.6)

As shown in Table 39, of 28 students who provided a complete sequence of titles at the three stages, 8 students (28.6%) had not titled their research yet in PS1. One

student (3.6%) had a general title, 18 students (64.3%) have a specific title, and 1 student (3.6%) had a creative or artistic title in PS1. In PS2 and PS3, 27 students (96.4%) had a specific title and 1 student (3.6%) had a creative or artistic title.

Table 40  
Distribution of Title Development

	Classes		Total Frequency (%)
	Biology Frequency (%)	Theme Frequency (%)	
None → Specific → Specific	3 (13.6)	4 (66.7)	7 (25.0)
None → Creative → Creative	0 (0.0)	1 (16.7)	1 (3.6)
General → Specific → Specific	1 (4.5)	0 (0.0)	1 (3.6)
Specific → Specific → Specific	17 (77.3)	1 (16.7)	18 (64.3)
Creative → Specific → Specific	1 (4.5)	0 (0.0)	1 (3.6)
Total	22 (100.0)	6 (100.0)	28 (100.0)

Table 40 shows that 17 (77.3%) of 22 students in the biology classes gave a specific title to their research project from PS1 to PS3. An example is *Hemophilia* → *Hemophilia* → *Hemophilia*. The specific titles given by students in the biology classes were mostly names of genetic disorder disease. Three students (13.6%) in the biology classes had not titled their research in PS1, and had a specific title in PS2 and PS3. An example is *None* → *Angelman Syndrome* → *Angelman Syndrome*. One student (4.5%) in the biology classes had a general topic in PS1 and developed it further to a specific title: *Disease* → *Alzheimer Disease* → *Alzheimer Disease*. Another student (4.5%) in the biology classes had a creative or artistic title in PS1, and had a specific title in PS2 and PS3: *Deeply into a Dwarf* → *Achondroplasia* → *Achondroplasia*.

Four (66.7%) of 6 students in the theme class had not titled their research in PS1, and had a specific title in PS2 and PS3. An examples is *None* → *Human Resource Management* → *Human Resource Management*. One student in the theme class had not

titled his/her research in PS1, and had a creative or artistic title in PS2 and PS3: *None* → *My Choice for the Future: 'Going to College'* → *Higher Education to Become an Astronomer*. Another student had a specific title from PS1 to PS3: *Computer Science* → *Computer Hardware Engineer* → *Computer Hardware Engineer*.

Students in the biology classes chose their topic from a list of genetic disorder diseases, which had been prepared by the biology teacher, on the first day of their research project. Therefore, most of them had a specific title for their research even in the beginning stage. However, since students in the theme class needed time to browse the information and choose their career goals, they did not title their research project yet in the beginning stage.

Teachers often provide a list of possible topics for ELLs because they know which topics are easier and doable for the students' level of English proficiency. The ESL teacher mentioned that she narrowed down the topics to be simpler to her students with lower level of English proficiency. She said, "Like they do the whole entire solar system for ESL 2. That's too much. But if they just do a planet, they can handle that. So you can choose one planet, not the whole solar system. You can choose one astronaut, not like all the astronauts. You can choose one space station or one satellite." The school librarian said that without this instructional intervention, ELLs would have difficulties in choosing a topic and narrowing down the topic.

In summary, regardless of their level of English language proficiency, most ELL students in the biology classes had a specific title from the beginning stage of their research process, because they started the research project with a chosen topic from the list of possible topics prepared by teachers. Most students in the theme class had not titled

their research in the beginning stage, because they needed time to browse the information and choose their career goals by themselves. All students in the theme class had a specific or an artistic title in the mid-point and the completion stages.

### 4.2.3 Interest

At each stage, students were asked to answer the question, “How interested are you in your topic? Check (✓) one that best matches your interest.” using a four point scale: “0=not at all,” “1=a little,” “2=some” and “3=a lot.”

Table 41  
Means and Standard Deviations for Interest (N=28)

Research process	<i>M</i>	<i>SD</i>
PS1	2.18	.670
PS2	2.32	.723
PS3	2.57	.573

Table 41 shows the students’ interest at each stage. There were significant increases in interest between:

- PS2 and PS3  $t(27) = 2.260, p < .05$
- PS1 and PS3  $t(27) = 3.034, p < .01$

Table 42  
Interest by Class and ELL Level (N=28)

	Biology Classes (n=22)						Theme Class (n=6)	
	Beginning (n=5)		Intermediate (n=12)		Advanced (n=5)		Advanced (n=6)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	2.40	.894	2.08	.669	2.20	.837	2.17	.408
PS2	2.40	.548	2.33	.985	2.40	.548	2.17	.408
PS3	2.80	.447	2.58	.669	2.60	.548	2.33	.516

Table 42 shows the students' interest at each stage by class and ELL level. Students rated their interest higher than "2=some" throughout the research process, regardless of their level of English language proficiency and the type of research task. Throughout the research process, the intermediate ELL group showed a lower level of interest than the other ELL level groups. The beginning ELL group showed a higher level of interest in PS1 and PS3. However, there were no significant differences in interest among the ELL level groups. Moreover, changes in each ELL level group over the stages were not significant.

The advanced ELL group in the theme class showed no significant differences in interest between stages as they progressed. And, their differences with the advanced ELL group in the biology classes were not significant.

Teachers who were working with ELL students recognized the importance of students' constant interest during the research project. The ESL teacher in the theme class said, "I believe that for students to stay focused on a research assignment, you have to pick a topic that is interesting to them or that's important to them. If you give them topics that they are not interested in or that's not important to them, they will lose their focus. But because the topic was about them, their future and their life, of course you are going to be more focused on it." The biology teacher said, "It is important to design a research project for ELL students that will interest them and support the content we are covering in a way that relates to real life." The school librarian said, "I think, in general, the ELL kids are a little bit more interested. Maybe that's because the topic is kind of geared to them, you know. They want to learn a little bit more and have a little bit more motivation."

Table 43  
Interest by Ethnicity (N=28)

	Asian (n=6)		Black (n=9)		Hispanic or Latino (n=13)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	2.50	.548	1.89	.782	2.23	.599
PS2	2.50	.548	2.44	.527	2.15	.899
PS3	2.50	.548	2.56	.527	2.62	.650

Table 43 shows the students' interest by ethnicity. There were no significant differences in interest among the ethnic groups at each stage. Asian students maintained the same level of interest throughout the research process. Black students showed a significant increase of interest between:

- PS1 and PS3  $t(8) = 2.828, p < .05$

Hispanic or Latino students had no significant changes in interest during the research process.

Thus, ethnic groups showed no differences in interest with each others. Asian students maintained the same high level of interest throughout the research process, whereas Black students showed significant increases in their interest between PS1 and PS3.

Table 44  
Interest by Ethnicity within the Intermediate ELL Group (N=12)

	Asian (n=3)		Black (n=4)		Hispanic or Latino (n=5)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	2.67	.577	2.00	.816	1.80	.447
PS2	3.00	.000	2.75	.500	1.60	1.140
PS3	3.00	.000	2.75	.500	2.20	.837

Table 44 shows the students' interest by ethnicity within the intermediate ELL group. Even when controlling for class and ELL level, there were no significant

differences found in interest among the ethnic groups. Moreover, there were no significant differences between stages in each ethnic group of the intermediate ELL level students.

Table 45  
Interest by Gender (N=28)

	Boys (n=14)		Girls (n=14)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	2.14	.535	2.21	.802
PS2	2.21	.579	2.43	.852
PS3	2.36	.633	2.79	.426

Table 45 shows the students' interest by gender. Both gender groups showed continuous increases in interest. Boys showed no significant differences between stages, whereas girls showed a significant increase in interest between:

- PS1 and PS3  $t(13) = 3.309, p < .01$

Girls showed a higher level of interest than boys throughout the research process, and they showed a significantly higher level of interest than boys in PS3 ( $p < .05$ ).

Thus, there were gender differences in interest. Girls showed significant increases in their interest, and had a significantly higher level of interest than boys in the completion stage.

Table 46  
Interest by Gender within the Intermediate ELL Group (N=12)

	Boys (n=5)		Girls (n=7)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	2.00	.000	2.14	.900
PS2	2.00	.707	2.57	1.134
PS3	2.20	.837	2.86	.378

Table 46 shows the students' interest by gender within the intermediate ELL group. Boys showed no significant differences in interest between stages, whereas girls showed a significant increase in interest between:

- PS1 and PS3  $t(6) = 2.500, p < .05$

Although girls showed a higher level of interest than boys throughout the research process, there were no significant differences in interest between the gender groups.

In summary, ELL students became more interested in their topic as they progressed. They showed substantial increases of interest in the later part of research process when they understood and used the information they had collected for the project. Regardless of their level of English language proficiency and the type of research task, they rated their interest higher than “2=some” throughout the research process. There were no differences in interest among the ethnic groups. Girls showed significant increases in their interest, and had a significant higher level of interest than boys in the completion stage.

#### 4.2.4 Estimate of Knowledge

At each stage, students were asked to answer the question, “How much do you know about your topic? Check (✓) one that best matches how much you know.” using a four point scale: “0=not at all,” “1=a little,” “2=some” and “3=a lot.”

Table 47  
Means and Standard Deviations for Estimated Knowledge (N=28)

Research process	<i>M</i>	<i>SD</i>
PS1	1.14	.891
PS2	1.64	.678
PS3	2.39	.737

Table 47 shows the students' estimated knowledge. The estimated knowledge continuously increased throughout the research process. There were significant increases in estimated knowledge between:

- PS1 and PS2  $t(27) = 2.553, p < .05$
- PS2 and PS3  $t(27) = 5.281, p < .001$
- PS1 and PS3  $t(27) = 5.960, p < .001$

Table 48  
Estimated Knowledge by Class and ELL Level (N=28)

	Biology Classes						Theme Class	
	Beginning (n=5)		Intermediate (n=12)		Advanced (n=5)		Advanced (n=6)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	1.40	1.140	.92	.793	1.20	1.304	1.33	.516
PS2	1.60	.548	1.67	.651	1.40	.894	1.83	.753
PS3	2.00	.707	2.75	.452	1.80	1.095	2.50	.548

Table 48 shows the students' estimated knowledge by class and ELL level. In the biology classes, the intermediate ELL group exhibited significant increases in estimated knowledge between:

- PS1 and PS2  $t(11) = 3.000, p < .05$
- PS2 and PS3  $t(11) = 5.613, p < .001$
- PS1 and PS3  $t(11) = 7.607, p < .001$

The advanced ELL group in the theme class exhibited a significant increase in estimated knowledge between:

- PS1 and PS3  $t(5) = 2.907, p < .05$

There were no significant differences in estimated knowledge of the beginning and advanced ELL groups in the biology classes during the research process.

Thus, there were no significant differences in estimated knowledge among the ELL level groups and between the types of research project.

Table 49  
Estimated Knowledge by Ethnicity (N=28)

	Asian (n=6)		Black (n=9)		Hispanic or Latino (n=13)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	1.50	.548	1.00	1.118	1.08	.862
PS2	1.83	.408	1.89	.601	1.38	.768
PS3	2.67	.516	2.44	.527	2.23	.927

Table 49 shows the students' estimated knowledge by ethnicity. There are no significant differences in estimated knowledge among the ethnic groups in each stage. All ethnic groups showed continuous increases of estimated knowledge throughout the research process. Asian students exhibited significant increases in their estimated knowledge between:

- PS2 and PS3  $t(5) = 5.000, p < .01$
- PS1 and PS3  $t(5) = 2.907, p < .05$

Black students exhibited a significant increase in estimated knowledge between:

- PS1 and PS3  $t(8) = 3.043, p < .05$

Hispanic or Latino students exhibited significant increases in estimated knowledge between:

- PS2 and PS3  $t(12) = 3.395, p < .01$
- PS1 and PS3  $t(12) = 4.215, p < .01$

Thus, regardless of ethnicity, students estimated their knowledge on the topic greater as they progressed. The significant increases in estimated knowledge were more likely to occur in the later stage of research process (between PS2 and PS3) when they used the information they had found than between PS1 and PS2 when they searched information.

Table 50  
Estimated Knowledge by Ethnicity within the Intermediate ELL Group (N=12)

	Asian (n=3)		Black (n=4)		Hispanic or Latino (n=5)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	1.33	.577	.75	.957	.80	.837
PS2	2.00	.000	1.75	.957	1.40	.548
PS3	3.00	.000	2.75	.500	2.60	.548

Table 50 shows the students' estimated knowledge by ethnicity within the intermediate ELL group. All ethnic groups of the intermediate ELL level students showed continuous increases in estimated knowledge throughout the research process.

Asian students exhibited a significant increase between:

- PS1 and PS3  $t(2) = 5.000, p < .05$

Black students exhibited a significant increase between:

- PS1 and PS3  $t(3) = 3.464, p < .05$

Hispanic or Latino students exhibited significant increases between:

- PS2 and PS3  $t(4) = 3.207, p < .05$
- PS1 and PS3  $t(4) = 4.811, p < .01$

Asian students showed a higher level of estimated knowledge than the other ethnic groups throughout the research process.

Thus, regardless of ethnicity, students within the intermediate ELL group estimated their knowledge on the topic greater as they progressed. And, when controlling for ELL level and class there were no significant differences in estimated knowledge among the ethnic groups.

Table 51  
Estimated Knowledge by Gender (N=28)

	Boys (n=14)		Girls (n=14)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	1.07	.917	1.21	.893
PS2	1.43	.646	1.86	.663
PS3	2.21	.893	2.57	.514

Table 51 shows the students' estimated knowledge by gender. Both gender groups showed continuous increases in estimated knowledge. Boys exhibited significant increases in estimated knowledge between:

- PS2 and PS3  $t(13) = 3.667, p < .01$
- PS1 and PS3  $t(13) = 3.889, p < .01$

Girls exhibited significant increases in estimated knowledge between:

- PS1 and PS2  $t(13) = 2.386, p < .05$
- PS2 and PS3  $t(13) = 3.680, p < .01$
- PS1 and PS3  $t(13) = 4.413, p < .01$

Girls exhibited higher levels of estimated knowledge than boys; however, the differences between the gender groups were not significant.

Table 52  
Estimated Knowledge by Gender within the Intermediate ELL Group (N=12)

	Boys (n=5)		Girls (n=7)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	1.00	.707	.86	.900
PS2	1.40	.548	1.86	.690
PS3	2.60	.548	2.86	.378

Table 52 shows the students' estimated knowledge by gender within the intermediate ELL group. Both gender groups exhibited continuous increases in estimated knowledge. Boys exhibited significant increases in estimated knowledge between:

- PS2 and PS3  $t(4) = 3.207, p < .05$
- PS1 and PS3  $t(4) = 4.000, p < .05$

Girls exhibited significant increases in estimated knowledge between:

- PS1 and PS2  $t(6) = 2.646, p < .05$
- PS2 and PS3  $t(6) = 4.583, p < .01$
- PS1 and PS3  $t(6) = 6.481, p < .01$

There were no significant differences in estimated knowledge between the gender groups.

In summary, ELL students exhibited significant increases in estimated knowledge throughout the research process. Regardless of their level of English language proficiency and the type of research task, the students' estimated knowledge increased. And significant increases were found in the intermediate ELL group in the biology classes and the advanced ELL group in the theme class. Regardless of ethnicity and gender, students estimated their knowledge on the topic greater as they progressed. The significant increases in estimated knowledge of each ethnic group were more likely to occur in the later stage of research process when they used the information they had found than in the beginning stage when they searched information.

#### **4.2.5 Substance and Amount of Learning Outcome**

At the completion stage, students were asked to answer the question, "What did you learn in doing this research project? Please list as many as you like." The five kinds of learning through the inquiry process that Kuhlthau et al. (2007) outlined were used for content analysis of students' answers: curriculum content, information literacy, learning how to learn, literacy competence, and social skills (see Table 3). When the answers did not fit any of the five kinds of learning, they were categorized as "others."

Table 53  
Substance and Amount of Learning Outcome (N=42)

	Number of Statements	
	<i>M</i>	<i>SD</i>
Curriculum Content	1.76	1.226
Information Literacy	.14	.521
Learning How to Learn	.00	.000
Literacy Competence	.10	.297
Social Skills	.00	.000
Others	.10	.297
Total	2.10	1.265

Table 53 shows that students stated 2.10 statements on average as what they learned during the research project. Among five types of learning, ‘Curriculum Content’ was most often stated, followed by ‘Information Literacy’ and ‘Literacy Competence.’ No one learned ‘How to Learn’ or acquired any ‘Social Skills.’

Table 54  
Number of Learning Outcome Statements by Class and ELL Level

	Biology Classes						Theme Class	
	Beginning (n=12)		Intermediate (n=15)		Advanced (n=7)		Advanced (n=8)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Curriculum Content	1.25	.622	2.07	1.387	1.71	1.254	2.00	1.512
Information Literacy	.00	.000	.13	.352	.00	.000	.50	1.069
Literacy Competence	.00	.000	.13	.352	.29	.488	.00	.000
Others	.17	.389	.13	.352	.00	.000	.00	.000
Total	1.42	.515	2.47	1.457	2.00	1.291	2.50	1.414

Table 54 shows the number of learning outcome statements by ELL level and class. Regarding ELL level, the intermediate level group exhibited more learning outcome statements than the other groups in total ( $M=2.47$ ) and in curriculum content ( $M=2.07$ ) in the biology classes. However, there were no significant differences in learning outcome among the ELL level groups. The Advanced level groups in the biology

classes and theme class were compared; however, T-test shows that there were no differences between the classes.

Thus, regardless of their ELL level and the type of research task, students reported having learned curriculum content as their learning outcome.

Table 55  
Number of Learning Outcome Statements by Ethnicity (N=42)

	Asian (n=6)		Black (n=14)		Hispanic or Latino (n=22)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Curriculum Content	2.83	1.602	1.36	.842	1.73	1.202
Information Literacy	.50	.548	.00	.000	.14	.640
Literacy Competence	.33	.516	.00	.000	.09	.294
Others	.00	.000	.14	.363	.09	.294
Total	3.67	1.366	1.50	.760	2.05	1.174

Table 55 shows the number of learning outcome statements by ethnicity. Asian students related significantly more learning outcome statements about curriculum content than Black students ( $p < .05$ ). Also, they recorded significantly more statements than Black students ( $p < .01$ ) and Hispanic or Latino students ( $p < .01$ ).

Therefore, there were ethnicity differences in learning outcomes. Asian students tended to report significantly more learning outcome statements than other students; in particular, they generated significantly more statements about the content of the curriculum that they had learned.

Table 56  
Number of Learning Outcome Statements by Ethnicity within the Intermediate ELL Group (N=15)

	Asian (n=3)		Black (n=5)		Hispanic or Latino (n=7)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Curriculum Content	2.33	2.309	1.80	1.095	2.14	1.345
Information Literacy	.67	.577	.00	.000	.00	.000
Literacy Competence	.67	.577	.00	.000	.00	.000
Others	.00	.000	.00	.000	.29	.488
Total	3.67	2.082	1.80	1.095	2.43	1.272

Table 56 shows the number of statements that students within the intermediate ELL group made regarding learning outcomes by ethnicity. Asian students with the intermediate ELL level recorded a significantly greater number of learning outcome statements in information literacy than Black students ( $p < .01$ ) and Hispanic or Latino students ( $p < .01$ ). Also, they described a significantly greater number of learning outcome statements in literacy competence than Black students ( $p < .01$ ) and Hispanic or Latino students ( $p < .01$ ).

Thus, there were ethnicity differences in learning outcomes within the intermediate ELL group. Asian students reported significantly more learning outcome statements on information literacy and literary competence than the other groups.

Table 57  
Number of Learning Outcome Statements by Gender (N=42)

	Boys (n=20)		Girls (n=22)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Curriculum Content	2.00	1.257	1.55	1.184
Information Literacy	.05	.224	.23	.685
Literacy Competence	.00	.000	.18	.395
Others	.10	.308	.09	.294
Total	2.15	1.309	2.05	1.253

Table 57 shows the number of learning outcome statements by gender. Girls showed a significantly greater number of learning outcome statements in literacy competence ( $p < .05$ ) than boys.

Table 58  
Number of Learning Outcome Statements by Gender within the Intermediate ELL Group (N=15)

	Boys (n=5)		Girls (n=10)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Curriculum Content	2.20	1.643	2.00	1.333
Information Literacy	.00	.000	.20	.422
Literacy Competence	.00	.000	.20	.422
Others	.40	.548	.00	.000
Total	2.60	1.517	2.40	1.506

Table 58 shows the number of learning outcome statements by gender within the intermediate ELL group. Boys reported more learning outcome statements in curriculum content, whereas girls reported more statements in information literacy and literacy competence. There was a significant difference between boys and girls in literacy competence ( $p < .05$ ).

Therefore, both genders reported learning curriculum content, but girls tended to describe significantly more learning outcome statements in literacy competence than boys.

In summary, Regardless of their ELL level and the type of research task, students presented substantial knowledge on the curriculum as their learning outcome. Asian students tended to represent more learning outcome than the other ethnic groups. Even when controlling for ELL level, girls showed a significantly greater amount of learning outcome in literacy competence than boys.

### 4.3 Affective Dimension

*RQ2. What primary patterns, if any, do ELL students have in terms of affective dimension, with particular focus on positive affect (confidence, relief, optimism, and satisfaction), negative affect (disappointment, frustration, confusion, uncertainty, and anxiety) and concern about their English proficiency?*

Students were presented with four positive feelings (confidence, relief, optimism, and satisfaction) and five negative feelings (disappointment, frustration, confusion, uncertainty, and anxiety) which were identified and tracked in Information Search Process studies (Kuhlthau, 2004; Kuhlthau, et al. 2008). For each of the nine feelings, students were asked to quantify their affective status as “0=not at all,” “1=a little,” “2=some,” or “3=a lot” at three points of their research process.

With individual feelings, the averages of positive and negative feelings and their sum at each stage was produced and analyzed. The average positive affect was produced from adding up each student’s levels of the four measured positive feelings and dividing the sum by four. The average negative affect was produced from adding up each student’s levels of the five measured negative feelings and dividing them by five. Finally, net affect was produced by subtracting the average negative affect from the average positive affect.

In addition to the nine feelings, students were asked to rate their concern about English proficiency as “0=not at all,” “1=a little,” “2=some,” or “3=a lot” at three points in the research process.

Of the 48 total participants, 28 students who submitted the process surveys at all three times were included in the analysis of affective dimension. The students' feelings during the research process were asked during the interviews as well.

### 4.3.1 Positive Affect

#### 4.3.1.1 Confidence

Of the 28 students who submitted the process surveys at all three times, three students (s4, s23, s49) neglected to rate their level of confidence in one or more of the three process surveys and were excluded from the analysis of confidence.

Table 59  
Means and Standard Deviations for Confidence (N=25)

Research process	<i>M</i>	<i>SD</i>
PS1	2.00	.913
PS2	1.80	.816
PS3	1.96	1.060

As shown in Table 59, the students' confidence decreased from PS1 to PS2, and increased from PS2 to PS3. However, the changes in confidence between stages were not significant. The level of the students' confidence was compared to their interest and estimated knowledge of their topic at each stage. The results showed that the more students had learned about the topic, the more confident they felt at PS3,  $r(26) = .417$ ,  $p < .05$ . There were no relationships found between the students' confidence and their interest.

Table 60  
Confidence by Class and ELL Level (N=25)

	Biology Classes (n=20)						Theme Class (n=5)	
	Beginning (n=3)		Intermediate (n=12)		Advanced (n=5)		Advanced (n=5)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	1.33	.577	2.17	.835	2.60	.548	1.40	1.140
PS2	1.00	.000	2.00	.953	1.60	.548	2.00	.707
PS3	1.67	.577	2.08	1.165	1.80	1.095	2.00	1.225

Table 60 shows the level of confidence at each stage by class and ELL level. In the biology classes, the beginning ELL group were less confident than the other ELL level groups throughout the research process; however, there were no significant differences in confidence among the ELL level groups. In all ELL level groups of the biology classes, the students' confidence decreased from PS1 to PS2 and increased from PS2 to PS3 although the confidence of each ELL level group during the research process did not change significantly. The difficulty caused from finding information between PS1 and PS2 seemed to make students feel less confident in PS2 than in PS1. After the research project was completed, they felt more confident than in PS2.

There were no significant differences in confidence between stages in the advanced ELL group in the theme class. However, whereas the advanced ELL group in the biology classes became less confident, the advanced ELL group in the theme class became more confident between PS1 and PS2. The theme class had one main database, called *Family Connection*, which the students were expected to use, and students expressed positive affect about searching the database. A student in the theme class said, "Family Connection is a pretty good Website. So basically I found most of the information I needed. Yeah, that's a good Website. Because I didn't use that before, you

know, I didn't know this Website before I started this project." Another student in the theme class said, "It [making note cards] was easy, because on every topic, we had to make a note card and I found a lot of topics in Family Connection and that was easy for me to do." The ESL teacher in the theme class said that she was surprised to see how quickly the students learned how to navigate the Family Connection. Yet, she explained their quick adaptation by noting that 1) it was very similar to Facebook and Myspace which the students were familiar with, 2) it provided options to be selected not by typing but by clicking for searching and 3) it utilized a lot of visuals and videos even in non-English languages.

Table 61  
Confidence by Ethnicity (N=25)

	Asian (n=6)		Black (n=7)		Hispanic or Latino (n=12)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	2.17	.983	2.29	.756	1.75	.965
PS2	2.33	.516	2.00	1.000	1.42	.669
PS3	2.50	.548	2.00	1.000	1.67	1.231

Table 61 shows the students' confidence at each stage by ethnicity. Hispanic or Latino students were less confident than the other ethnic groups throughout the research process. Asian students showed continuous growth in confidence throughout the research process, whereas Black and Hispanic or Latino students showed decreases in confidence from PS1 and PS2. However, there were no significant differences among the ethnic groups at each stage or between stages within each ethnic group.

Table 62  
Confidence by Ethnicity within the Intermediate ELL Group (N=12)

	Asian (n=3)		Black (n=4)		Hispanic or Latino (n=5)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	2.00	1.000	2.75	.500	1.80	.837
PS2	2.33	.577	2.75	.500	1.20	.837
PS3	3.00	.000	2.00	1.414	1.60	1.140

To see ethnic differences while controlling for ELL level and class, the confidence levels of the intermediate ELL group in the biology classes were analyzed. The intermediate ELL group in the biology classes was chosen because it had the largest number of students which allowed comparisons among the ethnic groups when controlling for ELL level and class. As shown in Table 62, Hispanic or Latino students were less confident than the other ethnic groups throughout the research process. Black students showed significantly greater confidence ( $p < .05$ ) than Hispanic or Latino students in PS2. There were no significant differences between stages within each ethnic group.

Thus, within the intermediate ELL group, Hispanic or Latino students tended to be less confident than the other groups throughout the research process, and exhibited a significantly lower level of confidence than Black students in the mid-point stage.

Table 63  
Confidence by Gender (N=25)

	Boys (n=13)		Girls (n=12)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	2.08	.760	1.92	1.084
PS2	1.69	.947	1.92	.669
PS3	1.77	.927	2.17	1.193

Table 63 shows the students' confidence by gender. Boys became less confident, whereas girls maintained the same level of confidence from PS1 to PS2. Both gender groups became more confident from PS2 to PS3. However, the differences in confidence

between boys and girls in each stage were not significant. In addition, changes over the stages in each gender group were not significant.

Table 64  
Confidence by Gender within the Intermediate ELL Group (N=12)

	Boys (n=5)		Girls (n=7)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	2.00	.707	2.29	.951
PS2	1.80	1.304	2.14	.690
PS3	1.80	1.095	2.29	1.254

Table 64 shows the students' confidence by gender within the intermediate ELL group. Both gender groups showed a decreased confidence between PS1 and PS2; however, the difference between the stages was not significant. Girls tended to be more confident than boys throughout the research process; however, the differences were not significant.

In summary, the more students had learned about their topic, the more confident they felt in the completion stage. Although the beginning ELL group was less confident than the other ELL level groups throughout the research process, the differences were not significant. Regardless of students' level of English language proficiency, difficulties in finding information made the level of the students' confidence decrease in the mid-point. Within the intermediate ELL group, Hispanic or Latino students were less confident than the other ethnic groups throughout the research process. They exhibited significantly less confidence than Black students in the mid-point stage. When controlling for ELL level and class, girls tended to be more confident than boys throughout the research process; however, the differences were not significant.

### 4.3.1.2 Relief

Of the 28 students who submitted the process surveys at all three times, three students (s3, s4, s38) neglected to rate their level of relief in one or more of the three process surveys and were excluded from the analysis of relief.

Table 65  
Means and Standard Deviations for Relief (N=25)

Research process	<i>M</i>	<i>SD</i>
PS1	1.12	.726
PS2	1.68	.627
PS3	1.84	1.028

Students expressed more relief as their research projects progressed (Table 65). The level of students' relief stayed between "1=a little" and "2=some." There were significant differences in relief between:

- PS1 and PS2  $t(24) = 3.219, p < .01$
- PS1 and PS3  $t(24) = 3.392, p < .01$

The level of the students' relief was compared to their estimated knowledge and interest in their topic at each stage. The results showed that the more students had learned about their topic, the more relieved they felt at PS3,  $r(25) = .421, p < .05$ . There were no relationships found between the students' relief and their interest.

Table 66  
Relief by Class and ELL Level (N=25)

	Biology Classes (n=21)						Theme Class (n=4)	
	Beginning (n=4)		Intermediate (n=12)		Advanced (n=5)		Advanced (n=4)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	1.00	.816	1.08	.669	1.40	.894	1.00	.816
PS2	1.50	.577	1.58	.669	2.00	.707	1.75	.500
PS3	1.25	1.258	1.92	.996	1.60	1.140	2.50	.577

Table 66 shows the students' relief at each stage by class and ELL level. In the biology classes, the beginning ELL group and the advanced ELL group showed an increase in relief between PS1 and PS2, and showed a decrease between PS2 and PS3. However, the differences were not significant. The intermediate ELL group expressed progressively more relief throughout the research project and a significant difference in relief between:

- PS1 and PS3  $t(11) = 3.079, p < .05$

The beginning ELL group was less relieved than the other ELL level groups throughout the research process; however, there were no significant differences in relief among the ELL level groups.

The advanced ELL level in the theme class expressed progressively more relief throughout the research project; however, there were no significant differences between stages. The advanced ELL groups in the biology classes and theme class did not show a significant difference in relief at each stage.

Therefore, only the intermediate ELL group in the biology classes showed a significant increase in relief from the beginning to the completion stage. No significant differences in relief were found among the ELL level groups or between the types of research project.

Table 67  
Relief by Ethnicity (N=25)

	Asian (n=6)		Black (n=7)		Hispanic or Latino (n=12)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	1.17	.753	.57	.535	1.42	.669
PS2	2.17	.753	1.43	.535	1.58	.515
PS3	2.00	.632	1.43	1.272	2.00	1.044

Table 67 shows the students' relief at each stage by ethnicity. Black students were less relieved than the other ethnic groups throughout the research process, and had a significantly lower level of relief than Hispanic or Latino students in PS1 ( $p < .05$ ). No other significant differences in relief among the ethnic groups were found in the other stages. Regarding each ethnic group, Asian students became less relieved between PS2 and PS3, but exhibited a significant increase in relief between:

- PS1 and PS3  $t(5) = 2.712, p < .05$

Black students expressed significant increases in relief between:

- PS1 and PS2  $t(6) = 6.000, p < .01$
- PS1 and PS3  $t(6) = 2.521, p < .05$

Hispanic or Latino students showed a continuous increase in relief throughout the research process; however, the differences between stages were not significant.

Thus, an ethnic difference in relief level was found in the beginning stage; Black students had a significantly lower level of relief than Hispanic or Latino students.

Table 68  
Relief by Ethnicity within the Intermediate ELL Group (N=12)

	Asian (n=3)		Black (n=4)		Hispanic or Latino (n=5)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	1.00	1.000	.75	.500	1.40	.548
PS2	2.33	.577	1.50	.577	1.20	.447
PS3	2.00	1.000	2.00	1.414	1.80	.837

To see ethnic differences while controlling for ELL level and class, the relief levels of the intermediate ELL group in the biology classes were analyzed. As shown in Table 68, Black students were less relieved than the other ethnic groups in PS1. Hispanic or Latino students became less relieved between PS1 and PS2, and exhibited a

significantly less level of relief than Asian students at PS2 ( $p < .05$ ). Asian students became less relieved between PS2 and PS3. However, there were no significant differences between stages within each ethnic group of the intermediate ELL group.

In sum, within the intermediate ELL group, Hispanic or Latino students were significantly less relieved than Asian students in the mid-point stage.

Table 69  
Relief by Gender (N=25)

	Boys (n=12)		Girls (n=13)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	1.25	.622	1.00	.816
PS2	1.58	.669	1.77	.599
PS3	1.67	.888	2.00	1.155

Table 69 shows the students' relief at each stage by gender. Both gender groups became more relieved as they progressed in the research project. However, there were significant increases in relief only in the girl group between:

- PS1 and PS2  $t(12) = 3.333, p < .01$
- PS1 and PS3  $t(12) = 3.606, p < .01$

There were no significant changes in relief between stages in the boy group. Boys were more relieved than girls in PS1, and less relieved in PS2 and PS3. The difference in relief between boys and girls at each stage was not significant.

Table 70  
Relief by Gender within the Intermediate ELL Group (N=12)

	Boys (n=5)		Girls (n=7)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	1.20	.447	1.00	.816
PS2	1.40	.548	1.71	.756
PS3	1.80	.837	2.00	1.155

Table 70 shows the students' relief by gender when controlling for ELL level and class. Both gender groups with the intermediate ELL level exhibited continuous increases

in relief between stages; however, a significant difference was found only in the girl group between:

- PS1 and PS3  $t(6) = 3.240, p < .05$

Boys were more relieved than girls in PS1 and less relieved in PS2 and PS3. This is the same pattern as found with students in overall ELL level groups and classes (Table 69); however, there were no significant differences in relief between the gender groups.

In summary, students became more relieved as they progressed. They became substantially more relieved between the beginning stage and the mid-point stage. The more students had learned about their topic, the more relieved they felt in the completion stage. Although the beginning ELL group was less relieved than the other ELL level groups throughout the research process, the differences were not significant. When controlling for ELL level and class, Hispanic or Latino students felt significantly less relieved than Asian students in the mid-point stage. There were no gender differences in relief.

#### 4.3.1.3 Optimism

Of the 28 students who submitted the process surveys at all three times, two students (s8, s38) neglected to rate their level of optimism in one or more of the three process surveys and were excluded from the analysis of optimism.

Table 71  
Means and Standard Deviations for Optimism (N=26)

Research process	<i>M</i>	<i>SD</i>
PS1	2.00	.693
PS2	2.04	.774
PS3	2.19	.939

Students felt more optimistic as they progressed in the research project. As shown in Table 71, the level of the students' optimism stayed between "2=a little" and "3=some." And the changes between stages were not significant.

Students' optimism was compared to their estimated knowledge and interest in their topic. The results showed that the more students had learned about their topic, the more optimistic they felt at PS2,  $r(25) = .470, p < .05$ , and PS3,  $r(26) = .555, p < .01$ . Also, the more interested students were in their topic, the more optimistic they felt at PS2,  $r(25) = .469, p < .05$ .

Students became optimistic when they found the information they needed, when they became more familiar with the research process, and when they completed their project. Students in the theme class said,

"[I felt optimistic] when I found the information, all the information, and when we finished the project."

"In the middle, because I was like, 'Oh, I know how to do the note cards and this is easy,' you know. I feel good."

"When I completed my essay, that's a pretty happy moment."

Students in the theme class felt optimistic when they found that their career decision seemed to be a good fit for their future. A student in the theme class said:

"I liked it, because when I read the job description, I liked everything in the job description."

Table 72  
Optimism by Class and ELL Level (N=26)

	Biology Classes (n=21)						Theme Class (n=5)	
	Beginning (n=4)		Intermediate (n=12)		Advanced (n=5)		Advanced (n=5)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	2.00	.816	1.83	.577	2.60	.548	1.80	.837
PS2	1.50	.577	2.17	.937	2.20	.447	2.00	.707
PS3	2.00	1.155	2.33	.888	2.00	1.225	2.20	.837

Table 72 shows the students' optimism at each stage by class and ELL level. In the biology classes, the advanced ELL group became less optimistic throughout the research process, and the beginning ELL group became less optimistic between PS1 and PS2. Only the intermediate ELL group in the biology classes showed continuous increases of optimism during their research process; however, the changes between stages within each ELL level group were not significant.

The beginning ELL group was less optimistic than the other groups in PS2. The advanced ELL group was more optimistic than the other ELL level groups in PS1 and PS2, and the intermediate ELL group showed more optimism than the other groups in PS3. However, there were no significant differences in optimism at each stage among the ELL level groups.

The advanced ELL group in the theme class differed from the advanced ELL group in the biology classes in that they showed continuous increases in optimism; however, there were no significant differences between stages. Moreover, no significant differences in optimism were found between the advanced ELL groups in the biology classes and in the theme class.

Table 73  
Optimism by Ethnicity (N=26)

	Asian (n=6)		Black (n=8)		Hispanic or Latino (n=12)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	1.67	.516	1.88	.641	2.25	.754
PS2	2.17	.753	2.00	.756	2.00	.853
PS3	2.50	.837	2.00	1.069	2.17	.937

Table 73 shows the students' optimism at each stage by ethnicity. Asian students showed less optimism than the other ethnic groups in PS1; however, they showed continuous increases of optimism and were more optimistic than the other groups in PS2 and PS3. Black students showed more optimism than the other groups in PS3. Hispanic or Latino students were more optimistic than the other groups in PS1; however, they showed a decrease of optimism from PS1 to PS2. There were no significant differences in optimism among the ethnic groups or between stages within each ethnic group.

Table 74  
Optimism by Ethnicity within the Intermediate ELL Group (N=12)

	Asian (n=3)		Black (n=4)		Hispanic or Latino (n=5)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	1.67	.577	1.75	.500	2.00	.707
PS2	2.67	.577	2.25	.957	1.80	1.095
PS3	3.00	.000	2.00	1.414	2.20	.447

Table 74 shows the students' optimism at each stage by ethnicity within the intermediate ELL group. Similar to the aggregate pattern (Table 73), Asian students in the intermediate ELL group showed less optimism than the other groups in PS1; however, they had continuous increases of optimism throughout the research process and showed higher levels of optimism than the others in PS2 and PS3. Black students were less optimistic than the others in PS3. Hispanic or Latino students were more optimistic in

PS1 than the others, and showed a decrease of optimism between PS1 and PS2 in the same pattern as was evidenced in the aggregate (Table 73). However, there were no significant differences in optimism among the ethnic groups or between stages within each ethnic group of the intermediate ELL level students.

Table 75  
Optimism by Gender (N=26)

	Boys (n=13)		Girls (n=13)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	1.92	.641	2.08	.760
PS2	2.00	.577	2.08	.954
PS3	1.92	.862	2.46	.967

Table 75 shows the students' optimism at each stage by gender. Girls were more optimistic than boys throughout the research process. While girls maintained the same level of optimism between PS1 and PS2, boys became more optimistic. Thereafter, girls showed an increase of optimism, but boys had a decrease of optimism. However, the differences in optimism between stages in each gender group were not significant. Moreover, there were no significant differences in optimism between the gender groups.

Table 76  
Optimism by Gender within the Intermediate ELL Group (N=12)

	Boys (n=5)		Girls (n=7)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	2.00	.000	1.71	.756
PS2	2.20	.447	2.14	1.215
PS3	2.20	.447	2.43	1.134

Table 76 shows the students' optimism at each stage by gender within the intermediate ELL group. While girls exhibited continuous increases of optimism, boys had an increase of optimism from PS1 to PS2 and maintained the same level of optimism from PS2 to PS3. Boys showed more optimism than girls in PS1 and PS2, and girls

showed less optimism than boys in PS3. However, there were no significant differences in optimism among the gender groups or between stages in each gender group.

In summary, students felt more optimistic as they progressed, and optimism was related to with their estimated knowledge and interest. The more students had learned about the topic, the more optimistic they felt in the mid-point and the completion stages. Also, the more students were interested in their topic, the more optimistic they felt in the mid-point stage. They felt optimistic when they found the information they needed, when they became more familiar with the research process, and when they completed the project. Students who were researching their career plan felt optimistic when they found that their career decision met their expectations. There were no significant differences in optimism among the ELL level groups, among the ethnic groups, or between the gender groups.

#### 4.3.1.4 Satisfaction

Of the 28 students who submitted the process surveys at all three times, two students (s4, s33) neglected to rate their level of satisfaction in one or more of the three process surveys and were excluded from the analysis of satisfaction.

Table 77  
Means and Standard Deviations for Satisfaction (N=26)

Research process	<i>M</i>	<i>SD</i>
PS1	1.88	.864
PS2	2.04	.871
PS3	2.42	.758

Table 77 showed the students' satisfaction at each stage. Students became more satisfied as they progressed in the research project. There were significant differences in satisfaction between:

- PS2 and PS3  $t(25) = 2.184, p < .05$
- PS1 and PS3  $t(25) = 2.273, p < .05$

The students' satisfaction was compared to their estimated knowledge and interest in the topic. The results showed that the more students had learned about the topic, the more satisfied they felt at PS2,  $r(24) = .423, p < .05$ , and PS3,  $r(26) = .810, p < .001$ . Also, the more interest students were in their topic, the more satisfied they felt at PS2,  $r(24) = .605, p < .01$ .

Students felt satisfied with their own authorship of the research, completion of the research project, and good grades:

“I felt satisfied because it was my work. I believed in my stuff. I loved my stuff. So pretty much I was very, very satisfied.”

“I felt satisfied when I saw my project done.”

“After I got it back, I feel good, because I got a good grade.”

Table 78  
Satisfaction by Class and ELL Level (N=26)

	Biology Classes (n=21)						Theme Class (n=5)	
	Beginning (n=5)		Intermediate (n=11)		Advanced (n=5)		Advanced (n=5)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	2.20	.447	1.91	.944	2.20	.837	1.20	.837
PS2	2.20	.837	2.09	1.044	2.00	.707	1.80	.837
PS3	2.20	.837	2.73	.467	1.80	1.095	2.60	.548

Table 78 shows the students' satisfaction at each stage by class and ELL level. In the biology classes, the beginning ELL group maintained the same level of satisfaction throughout the research process. Throughout the research process, the advanced ELL group in the biology classes showed continuous decreases in satisfaction, whereas the intermediate ELL group showed continuous increases. There were significant increases in satisfaction of the intermediate ELL level students between:

- PS2 and PS3  $t(10) = 2.609, p < .05$
- PS1 and PS3  $t(10) = 3.105, p < .05$

The advanced ELL group in the theme class exhibited continuous increases of satisfaction; however, the increases were not significant. They had no significant differences in satisfaction from the advanced ELL group in the biology classes.

Table 79  
Satisfaction by Ethnicity (N=26)

	Asian (n=6)		Black (n=7)		Hispanic or Latino (n=13)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	1.83	.408	2.14	.900	1.77	1.013
PS2	2.17	.753	2.43	.787	1.77	.927
PS3	2.67	.516	2.57	.535	2.23	.927

Table 79 shows the students' satisfaction at each stage by ethnicity. Asian students and Black students exhibited continuous increases of satisfaction throughout the research process. There was a significant increase in satisfaction of Asian students between:

- PS1 and PS3  $t(5) = 2.712, p < .05$

There were no significant differences between stages in the other ethnic groups. Hispanic students were less satisfied than the other ethnic groups throughout the research process; however, there were no significant differences in satisfaction among the ethnic groups.

Table 80  
Satisfaction by Ethnicity within the Intermediate ELL Group (N=11)

	Asian (n=3)		Black (n=3)		Hispanic or Latino (n=5)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	2.00	.000	2.33	1.155	1.60	1.140
PS2	2.67	.577	3.00	.000	1.20	.837
PS3	3.00	.000	3.00	.000	2.40	.548

Table 80 shows the students' satisfaction by ethnicity within the intermediate ELL group. In the same pattern as found with students in overall ELL level groups and classes (Table 79), Hispanic or Latino students with the intermediate ELL level were less satisfied than the other ethnic groups throughout the research process. In PS2, they were significantly less satisfied than Asian students ( $p < .05$ ) and Black students ( $p < .05$ ). Hispanic or Latino students within the intermediate ELL group became less satisfied from PS1 to PS2 and exhibited a significant increase of satisfaction between:

- PS2 and PS3  $t(4) = 3.207, p < .05$

There were no significant differences between stages in the other ethnic groups.

Table 81  
Satisfaction by Gender (N=26)

	Boys (n=13)		Girls (n=13)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	1.85	.689	1.92	1.038
PS2	1.92	.862	2.15	.899
PS3	2.15	.899	2.69	.480

Table 81 shows the students' satisfaction at each stage by gender. Both gender groups became more satisfied as they progressed in the research project. Girls exhibited significant increases in satisfaction between:

- PS2 and PS3  $t(12) = 2.501, p < .05$
- PS1 and PS3  $t(12) = 2.739, p < .05$

The increases of satisfaction among boys were not significant. Girls were more satisfied than boys throughout the research process; however, the differences between the gender groups were not significant.

Table 82  
Satisfaction by Gender within the Intermediate ELL Group (N=11)

	Boys (n=5)		Girls (n=6)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	1.80	.837	2.00	1.095
PS2	2.00	1.000	2.17	1.169
PS3	2.60	.548	2.83	.408

Table 82 shows the students' satisfaction by gender within the intermediate ELL group. In the same pattern as found with students in overall ELL level groups and classes (Table 81), both gender groups exhibited continuous increases of satisfaction and girls were more satisfied than boys throughout the research process. Girls exhibited a significant increase of satisfaction between:

- PS1 and PS3  $t(5) = 2.712, p < .05$

The increases of satisfaction among boys were not significant. Moreover, there were no significant differences in satisfaction between the gender groups.

In summary, students became more satisfied as they progressed. Their satisfaction substantially increased between the mid-point stage and the completion stage. Students felt satisfied with their own authorship of the research, completion of the research project, and earning good grades. Students' satisfaction was related to their estimated knowledge and interest: the more students had learned about their topic, the more satisfied they felt in the mid-point and the completion stages; also, the more students were interested in their topic, the more satisfied they felt in the mid-point stage. There were no differences in satisfaction among the ELL level groups. When controlling for ELL level and class,

Hispanic or Latino students were less satisfied than the other ethnic groups throughout the research process. In the mid-point stage, they were significantly less satisfied than Asian students and Black students. There were no gender differences in satisfaction.

#### 4.3.1.5 Average Positive Affect

In order to understand the students' general positive feelings, the levels of all four measured positive feelings (confidence, relief, optimism, and satisfaction) were averaged.

Table 83  
Means and Standard Deviations for Average Positive Affect (N=28)

Research process	<i>M</i>	<i>SD</i>
PS1	1.74	.619
PS2	1.89	.565
PS3	2.14	.773

As shown in Table 83, the average positive affect increased during the course of the research project. There was a significant increase in average positive affect between:

- PS1 and PS3  $t(27) = 2.171, p < .05$

The average positive affect was compared to their estimated knowledge and interest in their topic. The results showed that the more students had learned about their topic, the more positive affect they had at PS2,  $r(26) = .382, p < .05$ , and PS3,  $r(26) = .651, p < .001$ . Also, the more students were interested in their topic, the more positive affect they had at PS2,  $r(26) = .509, p < .01$ .

Table 84  
Average Positive Affect by Class and ELL Level (N=28)

	Biology Classes (n=22)						Theme Class (n=6)	
	Beginning (n=5)		Intermediate (n=12)		Advanced (n=5)		Advanced (n=6)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	1.73	.397	1.77	.559	2.20	.622	1.31	.709
PS2	1.63	.451	1.95	.747	1.95	.411	1.92	.342
PS3	1.98	.776	2.28	.745	1.81	1.109	2.28	.580

Table 84 shows the average positive affect at each stage by class and ELL level. In the biology classes, the average positive affect of the beginning ELL group decreased from PS1 to PS2 and increased from PS2 to PS3. The intermediate ELL group exhibited continuous increases in average positive affect and there was a significant increase between:

- PS1 and PS3  $t(11) = 2.238, p < .05$

The advanced ELL group in the biology classes exhibited continuous decreases in average positive affect throughout the research process. However, there were no significant differences between stages.

The advanced ELL group in the theme class had continuous increases in average positive affect. However, they exhibited no significant differences between stages, and their positive affect did not differ significantly from the advanced ELL group in the biology classes.

Table 85  
Average Positive Affect by Ethnicity (N=28)

	Asian (n=6)		Black (n=9)		Hispanic or Latino (n=13)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	1.71	.579	1.74	.396	1.76	.785
PS2	2.21	.510	1.93	.490	1.71	.602
PS3	2.43	.471	2.02	.713	2.09	.927

Table 85 shows the average positive affect at each stage by ethnicity. Asian and Black students showed continuous increases in average positive affect. Hispanic or Latino students showed a decrease in average positive affect from PS1 to PS2, and an increase from PS2 to PS3. Asian students exhibited a lower average positive affect than the other ethnic groups in PS1 and a higher average positive affect than the others in PS3. However, there were no significant differences in average positive affect among the ethnic groups or between stages in each ethnic group.

Table 86  
Average Positive Affect by Ethnicity within the Intermediate ELL Group (N=12)

	Asian (n=3)		Black (n=4)		Hispanic or Latino (n=5)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	1.67	.629	1.94	.315	1.70	.737
PS2	2.50	.500	2.29	.462	1.35	.675
PS3	2.78	.202	2.25	1.021	2.00	.661

Table 86 shows the average positive affect by ethnicity within the intermediate ELL group. Similar to the aggregate pattern (Table 85), Asian students with the intermediate ELL level showed a lower degree of positive affect than the other ethnic groups in PS1, but their overall positive affect increased continuously throughout the study, causing their average to be higher than the others in PS3. Black students showed a slight decrease of the average positive affect in PS3. However, these changes between stages were not significant. Hispanic or Latino students with the intermediate ELL level exhibited significant differences in average positive affect between:

- PS1 and PS2  $t(4) = 5.715, p < .01$
- PS2 and PS3  $t(4) = 2.804, p < .05$

There were no significant differences in average positive affect among the ethnic groups of the intermediate ELL level students.

Table 87  
Average Positive Affect by Gender (N=28)

	Boys (n=14)		Girls (n=14)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	1.74	.510	1.74	.731
PS2	1.80	.549	1.98	.587
PS3	1.86	.776	2.43	.685

Table 87 shows the students' average positive affect by gender. Both gender groups showed continuous increases in average positive affect throughout the research process. Girls exhibited significant increases in average positive affect between:

- PS2 and PS3  $t(13) = 2.279, p < .05$
- PS1 and PS3  $t(13) = 2.835, p < .05$

Boys showed no significant changes between stages. Girls showed higher overall positive affect than boys in PS2 and PS3; however, the differences between the gender groups were not significant.

Table 88  
Average Positive Affect by Gender within the Intermediate ELL Group (N=12)

	Boys (n=5)		Girls (n=7)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	1.75	.354	1.79	.699
PS2	1.85	.762	2.02	.788
PS3	2.10	.602	2.41	.855

Table 88 shows the students' average positive affect by gender within the intermediate ELL group. Although the differences between stages were not significant, both gender groups showed continuous increases. Girls exhibited more positive affect than boys throughout the research process; however, there were no significant differences between the gender groups.

In summary, the students' average positive affect increased as they progressed. The more students had learned about their topic, the more positive feelings they had in

the mid-point and the completion stages. Also, the more students were interested in their topic, the more positive feelings they had in the mid-point stage. There were no significant differences in average positive affect among the ELL level groups, among the ethnic groups, or between the gender groups.

### 4.3.2 Negative Affect

#### 4.3.2.1 Disappointment

Of the 28 students who submitted the process surveys at all three times, one student (s4) neglected to rate his or her level of disappointment in one or more of the three process surveys and was excluded from the analysis of disappointment.

Table 89  
Means and Standard Deviations for Disappointment (N=27)

Research process	<i>M</i>	<i>SD</i>
PS1	.58	.744
PS2	.52	.753
PS3	.48	.643

As shown in Table 89, students became less disappointed as they progressed in the research project. Throughout the research process, students stayed between “0=not at all” and “1=a little” in terms of their disappointment. However, the changes in the students’ disappointment between stages were not significant.

The students’ disappointment was compared to their estimated knowledge and interest in the topic at each stage. The results showed that the more students had learned about the topic, the less disappointed they felt at PS2,  $r(25) = -.432, p < .05$ . Also, the more interested students were in their topic, the less disappointed they felt at PS2,  $r(25) = -.534, p < .01$ .

Students felt disappointed at poor results of searching, complexity of the research process, and challenging vocabulary during their research process. They said:

“I felt very disappointed because Ms. F gave me a list of Websites and I searched my disease I was supposed to do, but I cannot find anything about it. I think it’s because my disease is kind of weird. So I used the parenthood.com.”

“I was disappointed because part of the project, it was like crazy, the vocabulary I have never seen before. The words were so long.”

Table 90  
Disappointment by Class and ELL Level (N=27)

	Biology Classes (n=22)						Theme Class (n=5)	
	Beginning (n=5)		Intermediate (n=12)		Advanced (n=5)		Advanced (n=5)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	1.00	1.000	.31	.466	.60	.894	.80	.837
PS2	.60	.894	.42	.900	.60	.548	.60	.548
PS3	.60	.894	.42	.669	.40	.548	.60	.548

Table 90 shows the students’ disappointment at each stage by class and ELL level. In the biology classes, the beginning ELL group was more disappointed than the other ELL level groups in PS1 and PS3, and the advanced ELL group was less disappointed than the others in PS3. While the other groups showed the same or a decreased level of disappointment between stages, the intermediate ELL group was less disappointed than the others in PS1 and became more disappointed from PS1 to PS2. There were no significant differences among the ELL level groups at each stage or between stages within each ELL level group in the biology classes. The advanced ELL group in the theme class did not exhibit a significant difference in disappointment when compared with the advanced ELL level in the biology classes at each stage.

Table 91  
Disappointment by Ethnicity (N=27)

	Asian (n=6)		Black (n=8)		Hispanic or Latino (n=13)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	.83	.983	.50	.756	.52	.649
PS2	.50	.548	.38	.518	.62	.961
PS3	.50	.548	.63	.744	.38	.650

Table 91 shows the students' disappointment by ethnicity. Black students became more disappointed from PS2 to PS3, and Hispanic or Latino students became more disappointed from PS1 to PS2. Asian students were more disappointed than the other groups in PS1, Hispanic or Latino students in PS2, and Black students in PS3. There were no significant differences among the ethnic groups at each stage or between stages within each ethnic level group.

Table 92  
Disappointment by Ethnicity within the Intermediate ELL Group (N=12)

	Asian (n=3)		Black (n=4)		Hispanic or Latino (n=5)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	.33	.577	.25	.500	.35	.487
PS2	.00	.000	.25	.500	.80	1.304
PS3	.00	.000	.75	.957	.40	.548

Ethnic differences in disappointment were analyzed within the intermediate ELL group in the biology classes while controlling for ELL level and class (Table 92). Black students were more disappointed from PS2 to PS3, and Hispanic or Latino students were more disappointed from PS1 to PS2, which resulted in these groups having higher levels of disappointment than the other ethnic groups in that stage. This is the same pattern as found with students in overall ELL level groups and classes (Table 91).

Table 93  
Disappointment by Gender (N=27)

	Boys (n=13)		Girls (n=14)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	.62	.870	.55	.637
PS2	.69	.630	.36	.842
PS3	.62	.768	.36	.497

Table 93 shows the students' disappointment by gender. Boys tended to be more disappointed than girls throughout the research process, and they became more disappointed from PS1 to PS2. However, there were no significant differences in disappointment between the gender groups or between stages in each gender group.

Table 94  
Disappointment by Gender within the Intermediate ELL Group (N=12)

	Boys (n=5)		Girls (n=7)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	.00	.000	.54	.509
PS2	.40	.548	.43	1.134
PS3	.40	.894	.43	.535

Table 94 shows the students' disappointment by gender within the intermediate ELL group. Similar to the aggregate pattern (Table 93), boys became more disappointed from PS1 to PS2. However, there were no significant changes in disappointment in each gender of the intermediate ELL group. Girls were significantly more disappointed than boys in PS1,  $t(10) = 2.321, p < .05$ .

In summary, students became less disappointed as they progressed in the research project; however, the decreases were not significant. Students felt disappointed at poor results of searching, complexity of the research process, and hard vocabulary. The more students had learned about their topic and the more interested they were in their topic, the less disappointed they felt in the mid-point stage. When controlling for ELL level and

class, girls were significantly more disappointed than boys in the beginning stage. There were no significant differences in disappointment found among the ELL level groups or among the ethnic groups.

#### 4.3.2.2 Frustration

Of the 28 students who submitted the process surveys at all three times, four students (s4, s8, s38, s44) neglected to rate their level of frustration in one or more of the process surveys and were excluded from the analysis of frustration.

Table 95  
Means and Standard Deviations for Frustration (N=24)

Research process	<i>M</i>	<i>SD</i>
PS1	.63	.875
PS2	.38	.711
PS3	.25	.532

Students became less frustrated as they progressed in the research project (Table 95). The students' frustration stayed between "0=not at all" and "1=a little" throughout the research process. There was a significant decrease in frustration between:

- PS1 and PS3  $t(23) = 2.387, p < .05$

The students' frustration was compared to their estimated knowledge and interest in their topic at each stage. The results showed that the more interested students were in their topic, the less frustrated they felt at PS1,  $r(25) = -.424, p < .05$ , and PS3,  $r(26) = -.438, p < .05$ . There were no relationships found between the students' frustration and estimated knowledge.

Most students felt frustrated in the beginning of their research project. They said:

“[I felt frustrated] at the beginning, because I didn’t know how to use Family Connection and the cards. I thought this is hard!”

“... you feel frustrated because you don’t know nothing about that disease and you don’t know how to look for information for that.”

Students felt frustrated when they had difficulties in finding information. They said:

“I didn’t find the information about the financial aid, and then Ms. A gave me the magazine, so I found it there. I was so frustrated.”

“[I was frustrated] when I couldn’t find information and had to give up.”

“The first disease I chose, I couldn’t find enough information, so I had to change the disease. I was frustrating.”

Even after finding information, some students felt frustrated with incorporating it into their papers. A student in the theme class said:

“After getting a lot of information, I felt a little bit hard about how to arrange the information into the essay.”

In addition, lack of time and hard vocabulary gave them frustration during the research project. They said:

“[I was frustrated] when I didn’t have enough time to finish the whole paper and draft.”

“I was very depressed after my absence and realized I had a very short time for the project.”

Table 96  
Frustration by Class and ELL Level (N=24)

	Biology Classes (n=20)						Theme Class (n=4)	
	Beginning (n=4)		Intermediate (n=11)		Advanced (n=5)		Advanced (n=4)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	1.00	1.414	.55	.934	.40	.548	.75	.500
PS2	1.00	.816	.09	.302	.40	.894	.50	1.000
PS3	.50	1.000	.09	.302	.40	.548	.25	.500

Table 96 shows the students' frustration at each stage by class and ELL level. The beginning ELL group in the biology classes was more frustrated than the other ELL level groups throughout the research process. The advanced ELL group in the biology classes maintained the same level of frustration during the research project. There were no significant differences in frustration at each stage among the ELL level groups or between stages within each ELL level group. The advanced ELL group in the theme class became less frustrated throughout the research process. However, the decreases were not significant. At each stage, the advanced ELL groups in the biology classes and the theme class did not differ significantly in their level of frustration.

Table 97  
Frustration by Ethnicity (N=24)

	Asian (n=6)		Black (n=7)		Hispanic or Latino (n=11)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	.67	.516	1.29	1.254	.18	.405
PS2	.67	1.033	.57	.787	.09	.302
PS3	.33	.516	.43	.787	.09	.302

Table 97 shows the students' frustration at each stage by ethnicity. All ethnic groups became less frustrated or maintained the same level of frustration as they progressed in the research project. Any changes between stages were not significant.

Black students were more frustrated than the other ethnic groups in PS1 and PS3, whereas Hispanic or Latino students were less frustrated than the other groups throughout the research project. Black students were significantly more frustrated than Hispanic or Latino students in PS1 ( $p < .05$ ). However, there were no significant differences in frustration among the ethnic groups in the other stages.

Table 98

Frustration by Ethnicity within the Intermediate ELL Group (N=11)

	Asian (n=3)		Black (n=4)		Hispanic or Latino (n=4)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	.33	.577	1.25	1.258	.00	.000
PS2	.00	.000	.25	.500	.00	.000
PS3	.00	.000	.00	.000	.25	.500

Table 98 shows the students' frustration at each stage by ethnicity within the intermediate ELL group. Black students were more frustrated than the other ethnic groups in PS1 and PS2; however, there were no significant differences in frustration among the ethnic groups of the Intermediate ELL level students. Moreover, the differences in frustration between stages in each ethnic group were not significant.

Table 99

Frustration by Gender (N=24)

	Boys (n=12)		Girls (n=12)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	.67	.888	.58	.900
PS2	.50	.798	.25	.622
PS3	.25	.452	.25	.622

Table 99 shows the students' frustration at each stage by gender. Boys tended to be more frustrated than girls in PS1 and PS2, but these differences were not significant. Boys became less frustrated as they progressed in the research project, whereas girls maintained the same level of frustration between PS2 and PS3. Boys exhibited the same

level of frustration with girls in PS3. The changes in frustration between stages in each gender group were not significant.

Table 100

Frustration by Gender within the Intermediate ELL Group (N=11)

	Boys (n=5)		Girls (n=6)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	.60	1.342	.50	.548
PS2	.20	.447	.00	.000
PS3	.00	.000	.17	.408

Boys in the intermediate ELL group were more frustrated than girls in PS1 and PS2. They became less frustrated throughout the research process as shown in Table 100. This is the same pattern as found with students in overall ELL level groups and classes (Table 99). However, there were no significant differences in frustration between the gender groups or between stages in each gender group.

In summary, students became less frustrated as they progressed. Their frustration substantially decreased between the beginning and the completion stages. Students felt frustrated when they began the project, because they did not know about their topic or research process. Difficulties in finding and organizing information, lack of time, and hard vocabulary also made students feel frustrated. In terms of interest, the more interested students were in their topic, the less frustrated they felt in the beginning and completion stages. Hispanic or Latino students in overall ELL level groups and classes were less frustrated than the other ethnic groups throughout the research project. In the beginning stage, they were significantly less frustrated than Black students. There were no significant differences in frustration found among the ELL level groups or between the gender groups.

### 4.3.2.3 Confusion

Of the 28 students who submitted the process surveys at all three times, one student (s38) neglected to rate his or her level of confusion in one or more of the three process surveys and was excluded from the analysis of confusion.

Table 101  
Means and Standard Deviations for Confusion (N=27)

Research process	<i>M</i>	<i>SD</i>
PS1	1.00	.920
PS2	.93	.781
PS3	.48	.643

Students became less confused as they progressed in their research project (Table 101). On average, they began research with “1=a little” confusion and became continuously less confused until completion. There were significant decreases in confusion between:

- PS2 and PS3  $t(26) = 3.075, p < .01$
- PS1 and PS3  $t(26) = 3.017, p < .01$

The students’ confusion was compared to their estimated knowledge and interest in their topic at each stage. However, there was no relationship of the students’ confusion with estimated knowledge or interest.

Students said:

“I felt confused because I couldn’t find some information. So I tried several times to find the information.”

“When I was searching about the definitions, I had to summarize, so I got confused because many Websites say different things about the disease.”

“I was confused because I didn’t know what my topic was about.”

Table 102  
Confusion by Class and ELL Level (N=27)

	Biology Classes (n=21)						Theme Class (n=6)	
	Beginning (n=4)		Intermediate (n=12)		Advanced (n=5)		Advanced (n=6)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	1.00	1.414	.83	.835	.60	.548	1.67	.816
PS2	.75	.957	.92	.669	.80	.837	1.17	.983
PS3	.75	.957	.42	.515	.40	.894	.50	.548

Table 102 shows the students' confusion at each stage by class and ELL level. In the biology classes, the beginning ELL group was more confused than the other ELL level groups in PS1 and PS3, whereas the Advanced ELL group was less confused than the other groups in PS1 and PS3. However, there were no significant differences in confusion among the ELL level groups in the biology classes. The intermediate and the advanced ELL groups in the biology classes became more confused from PS1 to PS2. However, there were no significant differences in confusion between stages in each ELL level group of the biology classes. The advanced ELL group in the theme class became significantly less confused between:

- PS1 and PS3  $t(5) = 3.796, p < .05$

They were significantly more confused than the advanced ELL group in the biology classes in PS1,  $t(9) = 2.482, p < .05$ . In the other stages, there were no significant differences between the advanced ELL groups of the biology classes and the theme class.

Table 103  
Confusion by Ethnicity (N=27)

	Asian (n=6)		Black (n=8)		Hispanic or Latino (n=13)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	1.17	.983	1.25	1.035	.77	.832
PS2	1.33	.516	1.00	1.069	.69	.630
PS3	.83	.753	.63	.744	.23	.439

Table 103 shows the students' confusion at each stage by ethnicity. Black students were more confused than the other ethnic groups in PS1, and Asian students were more confused than the other groups in PS2 and PS3. Hispanic or Latino students were less confused than the other groups throughout the research process. However, there were no significant differences in confusion among the ELL level groups. Regarding each ethnic group, Asian students became more confused from PS1 to PS2, whereas Black students and Hispanic or Latino students became less confused throughout the research process. Hispanic or Latino students exhibited a significant decrease of confusion between:

- PS2 and PS3  $t(12) = 2.521, p < .05$

There were no significant differences in confusion between stages in the other ethnic groups.

Table 104  
Confusion by Ethnicity within the Intermediate ELL Group (N=12)

	Asian (n=3)		Black (n=4)		Hispanic or Latino (n=5)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	.67	1.155	.75	.957	1.00	.707
PS2	1.33	.577	.25	.500	1.20	.447
PS3	.33	.577	.25	.500	.60	.548

Table 104 shows the students' confusion by ethnicity within the intermediate ELL group. Black students showed significantly less confusion than Asian students ( $p < .05$ ) and Hispanic or Latino students ( $p < .05$ ) in PS2. There were no significant differences in confusion among the ethnic groups in the other stages. Asian students and Hispanic or Latino students showed increases of confusion from PS1 to PS2. However, there were no significant differences in confusion between stages within each ethnic group of the Intermediate ELL level students.

Table 105  
Confusion by Gender (N=27)

	Boys (n=13)		Girls (n=14)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	.92	.862	1.07	.997
PS2	1.08	.862	.79	.699
PS3	.54	.660	.43	.646

Table 105 shows the students' confusion at each stage by gender. Boys exhibited an increase of confusion from PS1 to PS2 and exhibited a significant decrease of confusion between:

- PS2 and PS3  $t(12) = 2.214, p < .05$

Girls continued to show decreases of confusion throughout the research process. There was a significant increase of confusion between:

- PS1 and PS3  $t(13) = 2.857, p < .05$

Girls showed a higher level of confusion than boys in PS1, and boys showed a higher level of confusion than girls in PS2 and PS3. However, there were no significant differences in confusion between the gender groups.

Table 106  
Confusion by Gender within the Intermediate ELL Group (N=12)

	Boys (n=5)		Girls (n=7)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	.60	.894	1.00	.816
PS2	1.00	.707	.86	.690
PS3	.40	.548	.43	.535

Table 106 shows the students' confusion level at each stage by gender within the intermediate ELL group. Similar to the aggregate pattern (Table 105), boys with the intermediate ELL level exhibited an increase of confusion from PS1 to PS2, whereas girls exhibited continuous decreases of confusion throughout the research process. Girls showed more confusion than boys in PS1, and boys showed more confusion than girls in PS2. This is the same pattern as found with students in overall ELL level groups and classes in Table 105. However, there were no significant differences in confusion between the gender groups or between stages within each gender group.

In summary, students became less confused as they progressed. They became significantly less confused between the mid-point and the completion stages. Students felt confused when they had difficulties in finding and evaluating information and when they realized that they lacked knowledge about their topic or the research process. Students who were involved in a more intensive research project with a personal topic were more confused than those who were undertaking a less intensive research project in biology, a difference that was significant in the beginning stage. When controlling for ELL level and class, Black students were significantly less confused than Asian students and Hispanic or Latino students in the mid-point stage. There were no significant differences in confusion among the ELL level groups or between the gender groups.

#### 4.3.2.4 Uncertainty

Of the 28 students who submitted the process surveys at all three times, four students (s4, s15, s33, s38) neglected to rate their level of uncertainty in one or more of the three process surveys and were excluded from the analysis of uncertainty.

Table 107  
Means and Standard Deviations for Uncertainty (N=24)

Research process	<i>M</i>	<i>SD</i>
PS1	.75	.737
PS2	.63	.576
PS3	.79	.721

Table 107 shows the students' uncertainty at each stage. The students' uncertainty stayed lower than "1=a little" throughout the research process, and the changes in uncertainty between stages were not significant.

The students' uncertainty was compared to their estimated knowledge and interest in their topic at each stage. The results showed that the more interested students were in their topic, the less uncertain they felt at PS3,  $r(25) = -.445$ ,  $p < .05$ . There were no relationships found between the students' uncertainty and estimated knowledge.

Table 108  
Uncertainty by Class and ELL Level (N=24)

	Biology Classes (n=19)						Theme Class (n=5)	
	Beginning (n=4)		Intermediate (n=10)		Advanced (n=5)		Advanced (n=5)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	1.00	1.155	.70	.675	.80	.837	.60	.548
PS2	.75	.500	.70	.675	.40	.548	.60	.548
PS3	.75	.957	.90	.568	.40	.894	1.00	.707

Table 108 shows the students' uncertainty at each stage by class and ELL level. In the biology classes, the beginning ELL group exhibited a higher level of uncertainty than

the other ELL level groups in PS1 and PS2, while the advanced ELL groups exhibited a lower level of uncertainty than the other groups in PS2 and PS3. The intermediate ELL group showed an increase of uncertainty in PS3. However, there were no significant differences in uncertainty among the ELL level groups or between stages within each ELL level group in the biology classes.

The advanced ELL group in the theme class maintained the same level of uncertainty from PS1 to PS2. They showed an increase of uncertainty from PS2 to PS3; however, the difference was not significant. Moreover, there were no significant differences in uncertainty between the advanced groups in the biology classes and the theme class.

The ESL teacher in the theme class stated that the students' feeling changed a lot throughout the research process because the topic was about their life decision requiring them to learn the system in the United States and consider things around them in reality. She mentioned:

“... when we start this project, a lot of them have no clue of how it is in this country to choose higher education and their options. And I think that, by the end of the project, most of them feel like they really learned something valuable and most of them, even though it was a lot of hard work, they are happy that they got the information because they were completely oblivious about the whole system and all the options that are available for them before the project.”

On the other hand, this project made them seriously think about whether they would stay in the United States or go back to their own country, which might explain why some of the students got more uncertain and anxious even after they completed the project. The

ESL teacher said, because of the topic, their specific personal lives and situation influenced what they felt during the research project.

Table 109  
Uncertainty by Ethnicity (N=24)

	Asian (n=6)		Black (n=5)		Hispanic or Latino (n=13)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	1.00	.894	.60	.894	.69	.630
PS2	1.00	.632	.60	.548	.46	.519
PS3	1.17	.983	.80	.837	.62	.506

Table 109 shows the students' uncertainty at each stage by ethnicity. Asian students and Black students maintained the same level of uncertainty in PS1 and PS2, and Hispanic or Latino student exhibited a decrease of uncertainty from PS1 to PS2. All ethnic groups showed increases of uncertainty from PS2 to PS3. Asian students showed more uncertainty than the other ethnic groups throughout the research process. However, there were no significant differences in uncertainty among the ethnic groups or between stages in each ethnic group.

Table 110  
Uncertainty by Ethnicity with the Intermediate ELL Group (N=10)

	Asian (n=3)		Black (n=2)		Hispanic or Latino (n=5)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	1.00	1.000	.50	.707	.60	.548
PS2	1.00	1.000	.50	.707	.60	.548
PS3	.67	1.155	1.00	.000	1.00	.000

Table 110 shows the students' uncertainty at each stage by ethnicity within the intermediate ELL group. All ethnic groups maintained the same level of uncertainty from PS1 to PS2. Asian students showed a decrease of uncertainty from PS2 to PS3, whereas Black students and Hispanic or Latino students showed increased uncertainty from PS2 to

PS3. Asian students showed a higher level of uncertainty than the other ethnic groups in PS1 and PS2, and showed a lower level of uncertainty than the others in PS3. However, there were no significant differences in uncertainty among the ethnic groups or between stages within each ethnic group of the intermediate ELL level students.

Table 111  
Uncertainty by Gender (N=24)

	Boys (n=12)		Girls (n=12)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	.75	.754	.75	.754
PS2	.67	.492	.58	.669
PS3	.92	.669	.67	.778

Table 111 shows the students' uncertainty at each stage by gender. The gender groups exhibited the same level of uncertainty in PS1. Both showed a decrease of uncertainty from PS1 to PS2 and an increase of uncertainty from PS2 to PS3. Boys exhibited a higher level of uncertainty than girls in PS2 and PS3. However, there were no significant differences in uncertainty among the gender groups or between stages within each gender group.

Table 112  
Uncertainty by Gender with the Intermediate ELL Group (N=10)

	Boys (n=5)		Girls (n=5)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	.60	.548	.80	.837
PS2	.60	.548	.80	.837
PS3	1.00	.000	.80	.837

As shown in Table 112, girls in the intermediate ELL group maintained the same level of uncertainty throughout the research process. Boys in the intermediate ELL group maintained the same level of uncertainty from PS1 to PS2, and had an increase of uncertainty from PS2 to PS3. There were no significant differences in uncertainty

between the gender groups or between stages in each gender group of the intermediate ELL level students.

In summary, students' uncertainty level had no substantial changes during the research process. Regarding their interest, the more interested students were in their topic, the less uncertain they felt in the completion stage. Some of students who were involved in the research project on career planning became more uncertain in the completion stage, possibly because the topic was about their life decision requiring them to learn the system in the United States and consider things about them in reality. There were no significant differences in uncertainty found among the ELL level groups, among the ethnic groups or between the gender groups.

#### 4.3.2.5 Anxiety

Of the 28 students who submitted the process surveys at all three times, six students (s3, s4, s11, s33, s38, s49) neglected to rate their level of anxiety in one or more of the three process surveys and were excluded from the analysis of anxiety.

Table 113  
Means and Standard Deviations for Anxiety (N=22)

Research process	<i>M</i>	<i>SD</i>
PS1	1.00	1.069
PS2	.86	1.082
PS3	.77	.922

The level of the students' anxiety decreased as they progressed in the research project; however, the decreases in anxiety were not significant. The students' anxiety stayed between "0=not at all" and "1=a little" throughout the research process (Table 113).

Table 114  
Anxiety by Class and ELL Level (N=22)

	Biology Classes (n=18)						Theme Class (n=4)	
	Beginning (n=3)		Intermediate (n=10)		Advanced (n=5)		Advanced (n=4)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	1.67	1.528	1.00	1.155	1.00	1.000	.50	.577
PS2	.67	.577	.80	1.317	1.00	1.225	1.00	.816
PS3	.67	.577	.90	1.197	.40	.548	1.00	.816

Table 114 shows the students' anxiety at each stage by class and ELL level. In the biology classes, the beginning ELL group exhibited a higher level of anxiety than the other ELL level groups in PS1, and the intermediate ELL group exhibited an increase of anxiety from PS2 to PS3. However, there were no significant differences in anxiety among the ELL level groups or between stages in each ELL level group of the biology classes. Students in the advanced ELL level in the theme class exhibited a non-significant increase of anxiety from PS1 to PS2. Their level of anxiety did not differ significantly from that of the advanced ELL group in the biology classes.

Table 115  
Anxiety by Ethnicity (N=22)

	Asian (n=6)		Black (n=4)		Hispanic or Latino (n=12)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	1.17	1.169	1.25	.957	.83	1.115
PS2	1.83	1.169	1.25	1.258	.25	.452
PS3	.67	.816	1.25	1.258	.67	.888

Table 115 shows the students' anxiety at each stage by ethnicity. Black students maintained the same level of anxiety throughout the research process with a higher level of anxiety than the other groups in PS1 and PS3. Asian students exhibited an increase of anxiety from PS1 to PS2, which was the highest level among ethnic groups in any stage,

but they exhibited a decrease of anxiety from PS2 to PS3. Hispanic or Latino students showed a decrease of anxiety from PS1 to PS2 and an increase of anxiety from PS2 to PS3. They had less anxiety than the other ethnic groups throughout the research process. There was a significant difference ( $p < .01$ ) in anxiety between Asian students and Hispanic or Latino students in PS2. There were no significant differences among the ethnic groups in the other stages or between stages in each ethnic group.

Table 116  
Anxiety by Ethnicity within the Intermediate ELL Group (N=10)

	Asian (n=3)		Black (n=2)		Hispanic or Latino (n=5)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	1.33	1.528	.50	.707	1.00	1.225
PS2	1.67	1.528	1.50	2.121	.00	.000
PS3	.00	.000	1.50	2.121	1.20	1.095

Table 116 shows the students' anxiety by ethnicity within the intermediate ELL group. In the same pattern as found with students in overall ELL level groups and classes (Table 115), Asian students in the intermediate ELL group showed an increase of anxiety from PS1 to PS2, which was higher level than the other ethnic groups, and a decrease of anxiety from PS2 to PS3. Hispanic or Latino students showed a decrease of anxiety from PS 1 to PS2 and an increase of anxiety from PS2 to PS3. Black students showed a higher level of anxiety than the other ethnic groups in PS3. However, there were no significant differences in anxiety among the ethnic groups or between stages in each ethnic group of the intermediate ELL level students.

Table 117  
Anxiety by Gender (N=22)

	Boys (n=11)		Girls (n=11)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	1.00	1.000	1.00	1.183
PS2	1.09	1.136	.64	1.027
PS3	1.00	1.000	.55	.820

Table 117 shows the students' anxiety at each stage by gender. Girls showed continuous decreases in anxiety throughout the research process, whereas boys showed a slight increase of anxiety from PS1 to PS2 and regained their initial level of anxiety in PS3. However, there were no significant differences in anxiety between the gender groups or between stages in each gender group.

Table 118  
Anxiety by Gender within the Intermediate ELL Group (N=10)

	Boys (n=4)		Girls (n=6)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	.75	.500	1.17	1.472
PS2	.75	1.500	.83	1.329
PS3	1.25	1.500	.67	1.033

Table 118 shows the students' anxiety by gender within the intermediate ELL group. Girls within the intermediate ELL level exhibited a higher level of anxiety than boys in PS1 and PS2; however, they exhibited continuous decreases in anxiety throughout the research process. Boys had an increase of anxiety in PS3, which was higher than girls. However, there were no significant differences in anxiety between the gender groups or between stages in each gender group.

In summary, the students' anxiety had no substantial changes during the research process. The more interested students were in their topic, the less uncertain they felt in the completion stage. Students who were involved in the research project on their career

plans became more anxious in the mid-point and the completion stages, whereas those in the research project on a biology topic became less anxious in the later part of the research process. Hispanic or Latino students in overall ELL level groups and classes were less anxious than the other ethnic groups throughout the research process, and showed significantly less anxiety than Asian students in the mid-point stage. Girls tended to show more anxiety in the beginning stage. However, there were no significant differences in anxiety among the ELL level groups or between the gender groups.

#### 4.3.2.6 Average Negative Affect

In order to understand the students' general negative feelings, the levels of all five measured negative feelings (disappointment, frustration, confusion, uncertainty, and anxiety) were averaged.

Table 119  
Means and Standard Deviations for Average Negative Affect (N=28)

Research process	<i>M</i>	<i>SD</i>
PS1	.88	.603
PS2	.74	.665
PS3	.62	.538

As shown in Table 119, the average negative affect stayed lower than “1=a little” throughout the research process, and decreased as students progressed in the research project. There was a significant decrease in average negative affect between:

- PS1 and PS3  $t(27) = 2.754, p < .05$

The average negative affect was compared to their estimated knowledge and interest in their topic at each stage. The results showed that the more interested students were in

their topic, the less negative feelings they had at PS3,  $r(26) = -.392, p < .05$ . There were no relationships found between the students' uncertainty and estimated knowledge.

Table 120  
Average Negative Affect by Class and ELL Level (N=28)

	Biology Classes (n=22)						Theme Class (n=6)	
	Beginning (n=5)		Intermediate (n=12)		Advanced (n=5)		Advanced (n=6)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	1.23	.896	.80	.598	.68	.593	.94	.271
PS2	.78	.511	.57	.415	.64	.740	1.13	1.048
PS3	.74	.581	.62	.515	.40	.616	.72	.573

Table 120 shows the average negative affect at each stage by class and ELL level. The beginning and advanced ELL groups in the biology classes exhibited continuous decreases in average negative affect, whereas the intermediate ELL group exhibited an increase in average negative feelings from PS2 to PS3. The beginning ELL group showed a higher average negative affect than the other ELL level groups throughout the research process. However, there were no significant differences in average negative affect among the ELL level groups or between stages in each ELL level group of the biology classes.

The average negative affect of the advanced ELL group in the theme class did not differ significantly from that of the advanced ELL group in the biology classes. They exhibited an increase in average negative affect from PS1 to PS2, and a decrease from PS2 to PS3, but these differences were not significant.

Table 121  
Average Negative Affect by Ethnicity (N=28)

	Asian (n=6)		Black (n=9)		Hispanic or Latino (n=13)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	.97	.686	1.10	.655	.70	.510
PS2	1.07	.484	.90	.902	.48	.458
PS3	.70	.629	.87	.470	.42	.493

Table 121 shows the average negative affect by ethnicity. The average negative affect of Asian students increased from PS1 to PS2, but decreased from PS2 to PS3, whereas those of Black students and Hispanic or Latino students continuously decreased throughout the research process. Hispanic students exhibited significant differences in average negative affect between:

- PS1 and PS2  $t(12) = 2.211, p < .05$
- PS1 and PS3  $t(12) = 2.254, p < .05$

There were no significant differences in average negative affect among the ethnic groups.

Table 122  
Average Negative Affect by Ethnicity within the Intermediate ELL Group (N=12)

	Asian (n=3)		Black (n=4)		Hispanic or Latino (n=5)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	.73	.945	.94	.665	.73	.422
PS2	.80	.346	.40	.490	.57	.406
PS3	.20	.346	.75	.500	.76	.555

Table 122 shows the average negative affect by ethnicity within the intermediate ELL group. Asian students with the intermediate ELL level exhibited an increase in average negative feelings from PS1 to PS2 and a decrease from PS2 to PS3. Black students and Hispanic or Latino students exhibited decreases from PS1 to PS2 and increases from PS2 to PS3. However, there were no significant differences in the average

negative affect among the ethnic groups or between stages within each ethnic group of the intermediate ELL level students.

Table 123  
Average Negative Affect by Gender (N=28)

	Boys (n=14)		Girls (n=14)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	.81	.499	.96	.704
PS2	.94	.739	.54	.538
PS3	.72	.489	.53	.585

Table 123 shows the average negative affect by gender. Girls showed significant decreases in average negative affect between:

- PS1 and PS2  $t(13) = 2.350, p < .05$
- PS1 and PS3  $t(13) = 3.618, p < .01$

Boys showed an increased average negative affect in PS2 and a decreased average negative affect in PS3. However, the differences between stages were not significant. Moreover, there were no significant differences in average negative affect between the gender groups.

Table 124  
Average Negative Affect by Gender within the Intermediate ELL Group (N=12)

	Boys (n=5)		Girls (n=7)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	.52	.363	1.00	.676
PS2	.60	.245	.55	.524
PS3	.64	.410	.60	.611

Table 124 shows the average negative affect by gender within the intermediate ELL group. Boys within the intermediate ELL level exhibited continuous increases in average negative affect, whereas girls exhibited a decrease from PS1 to PS2 and an increase from PS2 to PS3. However, there were no significant differences in average negative feelings between the gender groups or between stages in each gender group.

In summary, the students' average negative affect substantially decreased between the beginning and the completion stages. The more interested students were in their topic, the less negative feelings they had in the completion stage. The beginning ELL group showed a higher average negative affect than the other ELL level groups throughout the research process although the differences were not significant. There were no significant differences in average negative affect among the ethnic groups or between the gender groups.

#### 4.3.2.7 Net Affect

Table 125  
Means and Standard Deviations for Net Affect (N=28)

Research process	<i>M</i>	<i>SD</i>
PS1	.86	.998
PS2	1.15	.923
PS3	1.52	.991

The net affect, which was produced by subtracting the average negative affect from the average positive affect, continuously increased throughout the research process (Table 125). In other words, student affect became more positive as they progressed in the research project. There were significant differences in net affect between:

- PS2 and PS3  $t(27) = 2.872, p < .01$
- PS1 and PS3  $t(27) = 3.103, p < .01$

The students' net affect was compared to their estimated knowledge and interest in their topic at each stage. The results showed that the more students had learned about their topic, the greater their net affect at PS3,  $r(26) = .576, p < .01$ . Also, the more interested students were in their topic, the greater their net affect at PS2,  $r(26) = .490, p < .01$ .

Table 126  
Net Affect by Class and ELL Level (N=28)

	Biology Classes (n=22)						Theme Class (n=6)	
	Beginning (n=5)		Intermediate (n=12)		Advanced (n=5)		Advanced (n=6)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	.51	1.211	.97	.880	1.52	1.002	.37	.903
PS2	.85	.904	1.38	.854	1.31	.798	.78	1.195
PS3	1.24	1.242	1.66	.812	1.41	1.217	1.56	1.138

Table 126 shows net affect at each stage by class and ELL level. The beginning ELL group in the biology classes exhibited continuous increases in net affect, and exhibited a significant increase between:

- PS1 and PS3  $t(4) = 4.103, p < .05$

The intermediate ELL group in the biology classes also exhibited continuous increases in net affect and exhibited a significant increase between:

- PS1 and PS3  $t(11) = 2.292, p < .05$

The advanced ELL group in the biology classes showed a decrease in net affect from PS1 to PS2 and showed an increase in net affect from PS2 to PS3. However, there were no significant differences between stages.

The advanced ELL group in the theme class exhibited continuous increases in net affect, and there was a significant increase in net affect between:

- PS2 and PS3  $t(5) = 4.654, p < .01$

There were no significant differences in net affect between the advanced ELL groups in the biology classes and the theme class.

Table 127  
Net Affect by Ethnicity (N=28)

	Asian (n=6)		Black (n=9)		Hispanic or Latino (n=13)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	.74	1.053	.64	.757	1.06	1.144
PS2	1.14	.727	1.03	1.032	1.23	.984
PS3	1.73	1.070	1.15	.726	1.68	1.110

Table 127 shows net affect at each stage by ethnicity. All ethnic groups showed continuous increases of net affect throughout the research process. Asian students showed a significant increase in net affect between:

- PS2 and PS3  $t(5) = 3.278, p < .05$

Hispanic or Latino students showed a significant increase between:

- PS2 and PS3  $t(12) = 2.244, p < .05$

Black students showed no significant differences between stages.

The net affect of Black students was lower than those of the other ethnic groups throughout the research process. Hispanic or Latino students showed a higher net affect than the other groups in PS1 and PS2, and Asian students showed a higher net affect than the others in PS3. However, there were no significant differences in net affect among the ethnic groups.

Table 128  
Net Affect by Ethnicity within the Intermediate ELL Group (N=12)

	Asian (n=3)		Black (n=4)		Hispanic or Latino (n=5)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	.93	1.502	1.00	.534	.97	.886
PS2	1.70	.265	1.89	.364	.78	1.040
PS3	2.58	.425	1.50	.540	1.24	.788

Table 128 shows net affect by ethnicity within the intermediate ELL group. Asian students with the intermediate ELL level exhibited continuous increases in net affect. Hispanic or Latino students had a decrease in net affect from PS1 to PS2, and Black students had a decrease in net affect from PS2 to PS3. However, there were no significant differences between stages in each ethnic group.

Asian students exhibited a significantly higher net affect ( $p < .05$ ) than Hispanic or Latino students in PS3. There were no significant differences in net affect among the ethnic groups in the other stages.

Table 129  
Net Affect by Gender (N=28)

	Boys (n=14)		Girls (n=14)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	.93	.777	.78	1.205
PS2	.86	.859	1.43	.924
PS3	1.14	.874	1.90	.987

Table 129 shows net affect at each stage by gender. Boys had a decrease in net affect from PS1 to PS2 and an increase from PS2 to PS3. However, the differences between stages were not significant. Girls exhibited continuous increases in net affect and there were significant increases between:

- PS1 and PS2  $t(13) = 2.526, p < .05$
- PS2 and PS3  $t(13) = 2.328, p < .05$
- PS1 and PS3  $t(13) = 3.828, p < .01$

Boys showed a higher net affect than girls in PS1, and girls showed a higher net affect than boys in PS2 and PS3. However, there were no significant differences in net affect between the gender groups.

Table 130  
Net Affect by Gender within the Intermediate ELL Group (N=12)

	Boys (n=5)		Girls (n=7)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	1.23	.327	.79	1.119
PS2	1.25	.645	1.47	1.017
PS3	1.46	.605	1.81	.953

Both gender groups of the intermediate ELL students exhibited continuous increases in net affect (Table 130). Boys showed a higher net affect than girls in PS1, and girls showed a higher net affect than boys in PS2 and PS3. However, there were no significant differences in the net affect between the gender groups or between stages in each gender group.

#### 4.3.3 Concern about English Language Proficiency

Table 131  
Means and Standard Deviations for Concern about English proficiency (N=28)

Research process	<i>M</i>	<i>SD</i>
PS1	.82	.863
PS2	.89	.737
PS3	.89	.832

Table 131 shows the students' concern about their proficiency in English at each stage. Their level of concern slightly increased from PS1 to PS2, but stayed the same in PS3. The changes in their concern about their English proficiency between stages were not significant during the research process.

Students were concerned that their lack of English proficiency would affect their grades for the research project. Most students thought their lack of English proficiency impacted their research project in terms of 1) the quality of final product and 2) the research process. Students listed several reasons why they believed they could have done

better if they had completed the research project in their native language for the following reasons. Firstly, they have more knowledge about the topic in their native language. Secondly, they can produce a more detailed and precise work in their native language. A student in the theme class said, “I will have more pages and more details and it would be better. Better vocabulary used, all things like that.” Students in the biology classes said, “It would have been more precise, if we have some mistakes here in language, the mistakes will not happen,” and “we can understand more and we can put our efforts and details more.”

In addition, students listed three reasons why they believed that the research process would have been easier if they had completed the project in their native language. Firstly, their vocabulary in their native language is much larger. Secondly, it is easier for them to search for information in their native language than in English. Thirdly, the research process would have been faster. One student in the biology classes said, “In English, sometimes you have to write three times, but if I write in my native language, it would be easy for me, because I can write in one time. I can save my time in Spanish.” Another student said, “I think we can do the project very fast in our native language, faster than how I do in English. And we don’t need to translate it, so it will be much more fast.”

Some students mentioned that it would be still difficult to undertake a research project in their native language because of the complicated nature of the research process. Also, one student, who was worried about the complexity of his own native language remarked, “I think mine is going to be harder because in my language we have more punctuation. You have to have these tabs in my language.” A student in the biology

classes said, “It would be much easier, but if you do it in your native language, you are not going to be able to learn English.” She recognized her research project as a learning process for English language as well as a biology topic.

Table 132  
Concern about English Proficiency by Class and ELL Level (N=28)

	Biology Classes (n=22)						Theme Class (n=6)	
	Beginning (n=5)		Intermediate (n=12)		Advanced (n=5)		Advanced (n=6)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	1.20	.447	.50	.905	1.00	1.000	1.00	.894
PS2	1.20	.447	.42	.669	1.20	.837	1.33	.516
PS3	1.40	.548	.58	.900	1.00	1.000	1.00	.632

Table 132 shows the students’ concern about their English proficiency by class and ELL level. In the biology classes, the intermediate ELL group had less concern about their English proficiency than the other ELL level groups throughout the research process. The beginning ELL group had more concern about their English proficiency than the other ELL level groups in PS1 and PS3. However, there were no significant differences in concern about English proficiency among the ELL level groups or between stages in each ELL level group. The advanced ELL group in the theme class showed an increase in concern about English proficiency from PS1 to PS2 and showed a decrease from PS2 to PS3. However, there were no significant changes between stages, and they had no significant differences in concern about English proficiency from the advanced ELL group in the theme class.

Table 133  
Concern about English Proficiency by Ethnicity (N=28)

	Asian (n=6)		Black (n=9)		Hispanic or Latino (n=13)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	1.00	.894	.56	.726	.92	.954
PS2	1.00	.894	.67	.707	1.00	.707
PS3	1.17	.753	.56	.726	1.00	.913

Table 133 shows the students' concern about their English proficiency by ethnicity. Asian students maintained the same level of concern about their English proficiency between PS1 and PS2, and exhibited an increase from PS2 to PS3. Black students showed an increase in concern about their English proficiency from PS1 to PS2 and returned to the initial level of concern about English proficiency in PS3. Hispanic or Latino students showed an increase in concern about their English proficiency from PS1 to PS2, and maintained the same level of concern between PS2 and PS3. Black students were less concerned about their English proficiency than the other ethnic groups throughout the research process, whereas Asian students were more concerned than the others in PS1 and PS3. However, there were no significant differences in concern about English proficiency among the ethnic groups or between stages in each ethnic group.

Table 134  
Concern about English Proficiency by Ethnicity within the Intermediate ELL Group (N=12)

	Asian (n=3)		Black (n=4)		Hispanic or Latino (n=5)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	.33	.577	.00	.000	1.00	1.225
PS2	.33	.577	.00	.000	.80	.837
PS3	.67	.577	.00	.000	1.00	1.225

Table 134 shows the students' concern about their English proficiency by ethnicity within the intermediate ELL group. Black students with the intermediate ELL level had no concern about their English proficiency throughout the research process. Hispanic or Latino students with the intermediate ELL level exhibited more concern about their English proficiency than the other ethnic groups throughout the research process. However, there were no significant differences in concern about English proficiency among the ethnic groups or between stages in each ethnic group of the intermediate ELL level students.

Table 135  
Concern about English Proficiency by Gender (N=28)

	Boy (n=14)		Girl (n=14)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	1.00	.961	.64	.745
PS2	1.00	.784	.79	.699
PS3	1.00	1.038	.79	.579

Table 135 shows the students' concern about their English proficiency by gender. Boys maintained the same level of concern about their English proficiency throughout the research process, whereas girls showed an increase in concern about English proficiency from PS1 to PS2, and maintained the same level between PS2 and PS3. Throughout the research process, boys were more concerned than girls. However, there were no significant differences in concern between the gender groups or between stages in each gender group.

Table 136  
Concern about English Proficiency by Gender within the Intermediate ELL Group  
(N=12)

	Boys (n=5)		Girls (n=7)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PS1	.80	1.304	.29	.488
PS2	.60	.894	.29	.488
PS3	.60	1.342	.57	.535

Table 136 shows the students' concern about their English proficiency by gender within the intermediate ELL group. Boys showed a higher level of concern about English proficiency than girls throughout the research process. However, there were no significant differences between the gender groups. Moreover, changes in concern about English proficiency between stages within each gender group were not significant.

In summary, ELL students had persistent concern about their English proficiency while they were undertaking the research project. Most students thought their lack of English proficiency impacted the quality of their research outcome and their research process. The intermediate ELL group continued to show less concern with English language proficiency, whereas the beginning ELL group was more concerned in the beginning and the completion stages. Regardless of their ELL level, Black students were less concerned with their English language proficiency than the other ethnic groups. Boys tended to be more concerned with their lack of English language proficiency than girls.

#### 4.4 Behavioral Dimension

*RQ3. What enablers and inhibitors do ELL students encounter during the research process, with particular focus on easy or difficult tasks, the type of assistance they needed, and teachers' instructional interventions?*

Students were asked to list easy and difficult tasks for them to do during the research project through the surveys and interviews. The students were asked to answer the following questions in the process surveys:

- When you do research, what do you generally find easy/hard to do? Please list as many things as you like. (PS1)
- Thinking of your research so far, what did you find/hard easy to do? Please list as many things as you like. (PS2)
- In the completion phase of the research, what did you find hard to do? Please list as many things as you like. (PS3)

Response rates were 72.9% for PS1, 87.5% for PS2, and 93.8% for PS3. Responses were categorized through content analysis, and the frequency and percentage of responses that fell into each category were calculated.

To better understand their experience during the research project, questions about easy and difficult tasks were asked via follow-up interviews. In addition, students were asked about what they thought would be desirable interventions.

#### 4.4.1 Easy Tasks

Students were asked to list easy things for them to do during their research project through the surveys and interviews. Table 137 shows easy tasks for ELL students to do at each stage during the research process.

Table 137  
Frequency and Percentage for Easy Tasks

		PS1 (n=35)	PS2 (n=42)	PS3 (n=45)
		Frequency (%)	Frequency (%)	Frequency (%)
Information Access	Looking for information in general	5 (14.3)	6 (14.3)	16 (35.6)
	Looking for specific information	8 (22.9)	19 (45.2)	15 (33.3)
	Finding pictures	5 (14.3)	3 (7.1)	3 (6.7)
	Searching online	9 (25.7)	7 (16.7)	3 (6.7)
	Searching physical materials	4 (11.4)	1 (2.4)	0 (0.0)
	Asking people	1 (2.9)	0 (0.0)	0 (0.0)
Total		22 (62.9)	32 (76.2)	34 (75.6)
Information Comprehension	English vocabulary	0 (0.0)	0 (0.0)	0 (0.0)
	Math/Statistics/Science	0 (0.0)	0 (0.0)	0 (0.0)
	Total	0 (0.0)	0 (0.0)	0 (0.0)
Information Evaluation	Selecting	0 (0.0)	0 (0.0)	0 (0.0)
	Total	0 (0.0)	0 (0.0)	0 (0.0)
Information Use	Summarizing	0 (0.0)	4 (9.5)	4 (8.9)
	Organizing	0 (0.0)	4 (9.5)	4 (8.9)
	Writing	2 (5.7)	1 (2.4)	5 (11.1)
	Total	2 (5.7)	9 (21.4)	11 (24.4)
Others		6 (17.1)	8 (19.0)	5 (11.1)
No Response		4 (11.4)	1 (2.4)	3 (6.7)

**Information access.** In PS1, 22 students (62.9%) said ‘Information Access’ is generally easy to do in their research. Among them, 9 students (25.7%) perceived searching online as an easy task. Students said,

“For mostly projects, I search in Google and get information.”

“I like looking for information in the Internet more than looking in books.”

8 students (22.9%) found it normally easy to find specific information. Students said,

“It’s easy to look out the details sometimes.”

“[I found it easy to] answer the shortest questions.”

5 students (14.3%) considered it easy to find general information.

When they reflected on their research experience, 32 students (76.2%) and 34 students (75.6%) found it easy to access and locate information in PS2 and PS3, respectively. Among them, 19 students (45.2%) and 15 students (33.3%) said they could locate specific information without difficulty in PS2 and PS3, respectively. Students said,

“Something that I found easy it was to find the definition or the meaning of red-green color blind.”

“I could find easy an introduction of sickle cell disease and causes.”

6 students (14.3%) and 16 students (35.6%) found it easy to look for general information in PS2 and PS3, respectively. No one mentioned ‘Information Comprehension’ or ‘Information Evaluation’ as an easy task for them to do.

**Information use.** Only two students (5.7%) perceived ‘Information Use’ as an easy task before they started the research project, whereas 9 students (21.4%) and 11 students (24.4%) found it easy to use information in PS2 and PS3, respectively, when they reflected their research experience. Students who answered that ‘Information Use’ was easy were mostly from the advanced or the intermediate ELL groups except for one beginning ELL level student, who felt it easy to organize his/her foldable. Students in the theme class were required to use a database, *Family Connection*, specialized for college information and to make note cards, an outline, a draft, and a final paper. They felt it easy to make note cards and an outline and to write an essay based on the outline. It appeared

that steps of research instruction helped students find the information they needed to complete the project and gradually develop their knowledge on their topic. In the interviews, students said,

“Making note cards was easy, because on every topic, we had to make a note card, and I found a lot of topics in Family Connection, and that was easy for me to do.”

“The outline was easy because when you have the note cards, it’s easier just to organize the information.”

“The essay, because with the outline, I just have to copy the draft and put some more details.”

**Others.** Students’ answers that did not match for the four categories were classified into ‘Others.’ A few students misunderstood the question and listed their easy topics such as sports, history, and computer. Most answers in this category were about decorating the final products.

“I find easy to make the foldable, I find easy to organize it, decorate it, and make it look good.”

One beginning ELL level student said in PS2, “Nothing, because I have to think about my project I know a little because I am study so. I like because I want to know about that.” One advanced ELL level student said in PS3, “Almost everything. Doing the foldable and researching the information.”

#### 4.4.2 Difficult Tasks

Students were asked to list difficult things for them to do during their research project through the surveys and interviews. Table 138 shows difficult tasks for ELL students at each stage during the research process.

Table 138  
Frequency and Percentage for Difficult Tasks

		PS1 (n=35)	PS2 (n=42)	PS3 (n=45)
		Frequency (%)	Frequency (%)	Frequency (%)
Information Access	Looking for information in general	3 (8.6)	4 (9.5)	0 (0.0)
	Looking for specific information	9 (25.7)	12 (28.6)	18 (40.0)
	Finding pictures	1 (2.9)	3 (7.1)	2 (4.4)
	Searching online	0 (0.00)	1 (2.4)	0 (0.0)
	Searching physical materials	0 (0.00)	1 (2.4)	1 (2.2)
	Asking people	0 (0.00)	0 (0.00)	0 (0.0)
Total		13 (37.1)	18 (42.9)	20 (44.4)
Information Comprehension	English vocabulary	5 (14.3)	0 (0.0)	3 (6.7)
	Math/Statistics/Science	2 (5.7)	2 (4.8)	0 (0.0)
	Total	6 (17.1)	2 (4.8)	3 (6.7)
Information Evaluation	Selecting	7 (20.0)	1 (2.4)	3 (6.7)
	Total	7 (20.0)	1 (2.4)	3 (6.7)
Information Use	Summarizing	5 (14.3)	9 (21.4)	11 (24.4)
	Organizing	1 (2.9)	3 (7.1)	2 (4.4)
	Writing	0 (0.0)	1 (2.4)	3 (6.7)
	Total	6 (17.1)	11 (26.2)	14 (31.1)
Others		7 (20.0)	11 (26.2)	9 (20.0)
No Response		5 (14.3)	2 (4.8)	3 (6.7)

**Information access.** Of 35 respondents in PS1, 13 students (37.1%) mentioned it was generally difficult for them to access and locate information. Among them, 3 students (8.6%) considered it difficult to look for information in general. They said:

“[it’s hard] wasting time researching when I don’t really know where to find the information.”

“It’s hard to find more information about the topic which I am supposed to do.”

Nine students (25.7%) considered it generally difficult to look for specific information. A student in the biology classes said:

“When I have to look for something really specific, and it take me some time to do it.”

Of 42 respondents in PS2, 4 students (9.5%) reflected that it had been difficult to look for information in general. Twelve students (28.6%) reported experiencing difficulties in finding specific information. Students said:

“I found so many hard things like finding the institutions because I was kind of confused. And also getting the information.”

“Getting information in my language first, finding pictures to understand, then, getting information in English will be much easier.”

Of 45 respondents in PS3, no one mentioned it as a difficult task to look for information in general. However, 18 students (40.0%) had difficulties in finding specific information. Students said:

“It was hard to find information about the financial aid and how to apply for scholarships.”

“The hard thing to do was to find some specific information, like what kind of bacteria causes what kind of disease.”

Students who participated in the interview said that they had difficulties in searching when there were vocabularies they could not understand. In general, most of the participating students needed help with hard vocabulary, and they typically turned to their teacher or online dictionaries for assistance. This challenge occurred for two reasons:

lack of English vocabulary in general and lack of background knowledge on their topic. Although they had lessons about basic vocabulary and background knowledge, it was still hard for them, because beyond just English words they were required to understand the whole system in college, which is entirely different from the one of high school. In regard of this challenge, students in the theme class answered:

“Sometimes when you look at the computer, something you don’t understand, like something in college, the rule is different in college. Some of the things [in college] are different from in high school.”

“I was a little confused on the outline... [What made me confused was the] application process, what you have to do for the application process. I didn’t know what that is.”

Some students in the theme class answered that it was the hardest part of the research process to make note cards. While looking for information, they were required to make note cards for key information by filling out the white side of note card with bibliographic information and filling out the lined side of note card with a title question, all applicable W questions, and answers in their own words. They found it challenging to find specific information from the resources as answers for W questions on the note cards. They said:

“... because we had like a lot of information and we had to put who, what and all in our own words and other definition.”

“It’s hard to find while you are reading an article. It’s hard to find the answers for W questions.”

On the other hand, another student answered that making note cards was easy:

“If you really understand what they are saying, it’s easy to do. But if you don’t understand what they are saying, it’s hard.”

A student said that searching a lot about one topic was the most challenging because he had never conducted a research project before. He said:

“Finding the information on the same topic, on one topic, in the same Website was a little bit hard... because I’ve never searched a lot about one topic... I didn’t have a lot of experience.”

Students sometimes entered queries using their native language on search engines, such as Google or YouTube. Then, once they understood the information in their language, they used that knowledge to search for and understand information in English. However, they tended not to cite the materials in their native language in their final product. A student in the theme class said:

“I just saw and understood them and mentioned only English materials in my paper.”

The ESL teacher in the theme class noticed that students used their own language and looked for schools in their country, but they did not put it in their paper. It seemed to be their search strategy to searching in their native language first for easily building knowledge about their topic and later focus on the materials in English.

**Information comprehension.** Regarding information comprehension, of 35 respondents in PS1, 6 students (17.1%) answered that it was generally difficult for them to understand English vocabulary or math/statistics/science during a research project. Of 42 respondents in PS2, 2 students (4.8%) found it difficult to understand

math/statistics/science. Of 45 respondents in PS3, 3 students (6.7%) had difficulties with English vocabulary.

**Information evaluation.** Of 35 respondents in PS1, 7 students (20.0%) mentioned that it was difficult to select “the most important,” “correct,” or “appropriate” information when they found a lot of information. Among them, 6 students were from the advanced or the intermediate ELL groups, and only one was a beginning ELL student. In the interview, the biology teacher speculated that students with less English proficiency might tend to use the first site they find and/or only one site for their research without comparison or evaluation. In PS2 and PS3, one student (2.4%) and 3 students (6.7%) mentioned that they had difficulties in selecting information during the research project. They said:

“I find hard to choose the appropriate material. I have it but not sure about it.”

“Find things about hotel management because in the Website was a lot of things that I didn’t know what to put.”

In the interviews, students mentioned that when they found more than one information source for a question, it was hard to evaluate each site’s importance. When they faced this situation, they asked the ESL teacher or biology teacher for help and the teachers told them which one was more important. Therefore, students did not know what they should do by themselves the next time they encountered the same problem. Some of them had their own criteria to select information. They said:

“I am looking different Websites and they have the same things. So the repeated information is important.”

“There is like some pages, they give you information but it’s not enough. But other ones like they have a lot of information.”

“On the top of each paragraph, it said symptoms, how it’s inherited, so it’s easy to tell what the paragraphs mean.”

**Information use.** Students had difficulty putting the information into their own words. Students in the biology classes expressed more difficulty summarizing information than those in the theme class, because it was challenging for them to paraphrase the biological information they found. They often asked the biology teacher for help in summarizing the information and putting it into their own words. Some students in the biology classes felt it hard to organize information. He said:

“I think the hardest part is classify the ideas. I don’t know what to put first, what could be the order.”

One student (2.4%) and 3 students (6.7%) felt difficulties in writing in PS2 and PS3, respectively. More specifically, it was challenging for them to explain the pictures and to start writing the essay.

Writing an essay was the most challenging part to a student in the theme class because of spelling and grammar. In order to avoid plagiarism and the automatic spell checking function, the ESL teacher asked them to make a handwritten draft and then type it on the computer. The student experienced the most difficulty in developing an outline into full sentences and paragraphs. Considering that a student in the theme class answered, “Writing an essay is easy, because with the outline I just have to copy the draft and put some more details,” and another answered the outline was easy “because when you have the note cards, it’s easier just to organize the information,” it seemed students

needed two prerequisites in order to smoothly proceed to the next step of the writing process: (1) complete and well-done work from the previous research steps (i.e. note cards, an outline, and a draft paper) as well as (2) writing skills.

**Others.** Some students in the theme class answered that they had difficulty making a decision about their career plan beyond the research project. A student said, “It was hard to decide which college is better for me,” and another said, “think how I am going to pay my college.” There were some students who answered nothing was difficult to do. And a few students said that decorating was the hardest task.

Some students thought in their native language for the research project especially when they had to get ideas, when they did not understand words in English, or when they summarized and wrote. A student said, “I think in my native language because it’s easy to think in our language. And then we can get translations by any means, by computer, any means, so it’s easy to do with.” On the other hand, there were some students who thought only in English during the entire research project. A student said, “You need to think in English because in my brain, if I think, English part and Chinese part, it’s totally different. So I need to think in English.” Another student said, “I used English because between Chinese and English there are some words I really can’t translate, so I just used English. So I saved my time. That’s why I could finish my project on time.” A student in the biology classes said, “I was doing some of my project in Spanish. But most of my project I did it in English because I am used to speak in English at school and then I used a lot of Spanish at home.”

### 4.4.3 Instructional Interventions

#### 4.4.3.1 Assistance ELL Students Need

- Someone who knows about the topic
- Finding and evaluating information
- Vocabulary and pronunciation
- Background knowledge
- More time
- Sample papers

To most of the students, their teacher was the only person whom they could get help from with their research project. A student in the theme class said, “I mean it was like I was kind of confused but I mean whenever I looked for the help, there was just Ms. A.” In addition to teaching the research process, the ESL teacher in the theme class helped them to find the information on the computer and explained what certain words mean. Recognizing what information each student needed for his or her career plan, she also provided print materials, such as books, magazines, and newspapers, for individual students. The biology teacher also helped students find information and put it into their own words. Students sometimes talked to their classmates, who spoke the same native language with them, and helped each other in their native language. However, they had very limited time to talk with one another about their research, because each of them had a different class schedule and had to move to another classroom after their class. Some students sought help in another period or after school from teachers who spoke their native language.

**Someone who knows about the topic.** When they were asked to answer what help they wished to have had during the project, students answered that they needed someone who knew the project and could help them with it. One student in the theme class said he could ask questions related to the project to his parents in Spanish. Even

though his parents did not exactly know what the college system in the United States is like, they could explain how it is in their own country because they studied in college there. Also, he could ask some English words to his uncle who was studying in college in the United States. However, he was the only student of ten students in the theme class who could get help with the research project from home. To the rest of the students, although they talked to their parents and siblings about their research, there was no help available outside of the classroom. Students said,

“They can help me in Spanish, but they don’t know English and cannot help me with this kind of project.”

“They didn’t know how is the process here in the United States.”

Most students in the biology classes also could not get help from home. A student said:

“I wish I had like a, you know, a person who studies genetics. It will very help me not only in the project, but in the future, because I might become like a doctor.”

A few students said that their parents explained the genetic disorder disease to them in Spanish. It seemed that when the research topic is related not to universal topics, such as health issues, but to the system in the United States, such as career and college education, it is harder for parents to help their kids with their research project.

**Finding and evaluating information.** Students needed help in finding and evaluating information. Many students had difficulties in finding specific information. A student in the theme class said,

“I think I got most things I need to know, but sometimes, it’s very hard to find like very detail, like for example, like how the college, what does the college require from high school for example like GPA. Sometimes that’s hard to find.”

Also, they needed help with deciding which information is more appropriate to use for their project. Students in the biology classes said,

“I want somebody to teach me what information is important.”

“I wish I knew the Websites a little bit better so that I can know which one gives me the best information.”

Students in the theme class valued the orientation session on the database, *Family Connection*, offered by a school counselor in the guidance department. A student said,

“At the beginning, I needed a lot of help with the Family Connection. I didn’t know how to use Family Connection and I didn’t know how to find the career I want, so the teacher [the counselor] told me how to use it. I think that’s a lot of help because I didn’t even know how to log on with my name. And to find information is very important.”

One student in the biology classes mentioned about her previous research experience with the assistance of a school librarian.

“I wish I had the school librarian help because last time when I did the project, they really helped us how to do it online and which Website to choose because sometimes people posted some weird stuff so you cannot put it on a school project. So I wish I had the librarian, the school librarian, help me.”

Most students in this study predominantly used Web resources for their project. Although the ESL teacher in the theme class provided some print materials for her students, students did not look for print materials by themselves. Regarding this, a student in the biology classes said:

“I would like more help with the books to have more information because most information I had found was from the Internet. I didn’t use books.”

**Vocabulary and pronunciation.** Students needed help with vocabulary and pronunciation. Besides asking teachers for help, they looked up the words in online dictionaries, such as onlinedictionary.com, and used translation Websites, such as freetranslation.com. A student said,

“In school I asked Ms. A., and at home I went to dictionary.com. It’s the only way I can pronounce, I can know how to pronounce it.”

Although they used the computer to get help with vocabulary and pronunciation, they wished to get the information more quickly from someone who can help them.

**Background knowledge.** Students in the biology classes spent only two days for overviewing 28 different kinds of genetic disorders, whereas those in the theme class spent one week for building vocabulary and background knowledge. In the interviews, students in the biology classes mentioned that they wished the teacher had explained their disease in greater detail so that they started the research project with more background knowledge.

**More time.** Students wished they had had more time for the research project. A student in the biology classes said that having a partner would have helped him to finish the project on time.

**Sample papers.** A student in the theme class answered it would be really helpful if he had a sample research paper of a person who had done the same research project.

#### 4.4.3.2 Teachers' Interventions

- Complexity of the research process
- Topic selection
- Information Search
- Challenges of lower ELL level students
- Support for emotions

**Complexity of the research process.** ELL students basically had difficulty in performing a complicated research process with many steps and details. Most students were greatly challenged by the scope of the research project and had difficulty proceeding from one stage to the next. In addition, the fact that they were doing the project in English gave them another challenge.

Students in the theme class who had developed their writing skills, such as writing outlines and essays, in the previous semester were not intimidated by writing itself; however, because citation was completely new, it was hard for them. The ESL teacher emphasized that the background knowledge and language of each research step, for example what *works cited* means, should be built prior to the research project. And its practice would be helpful to reduce ELL students' load from a complexity of the research process and lack of English proficiency.

The ESL teacher explained that ELL students needed a lot of background knowledge before beginning their projects. She said,

“In my mind, I visualize like going up the staircase. You have to hit the lower levels, the foundations, in order to get to the goal. So, the way, I go about it, is I, with the idea, present the concept, then I think of every vocabulary word they might not know that has to do with that concept. And I teach them those vocabularies first. Then I teach them concepts, because culturally they might not

know the concepts. Then I teach them the language skills like reading and writing and those skills that pertain to the project, how to write paragraphs for the research project and how to do outlines for the research project. And then I leave the research part for the end, because, by having all of these, they have some background for them.”

In other words, ELL students needed to build vocabulary, develop concepts on the topic, learn the language skills, and become familiar with all the research steps. The ESL teacher emphasized that vocabulary development is one of the most important things because without that foundation students cannot understand what teachers teach them about the project. Teachers have to build up vocabulary first in order for them to teach students the skills and the research information that they need.

- Building background knowledge (vocabulary and concepts) on the topic
- Building language skills
- Practicing research steps

The biology teacher said “reading large amounts of material in English” and “putting it into their own words” would be most challenging for ELL students, whereas decorating the appearance of the end product would be easiest for them to do during the research project. She used the following instructional interventions to help students reduce their difficulties in conducting a complicated research project in English:

- Using a simple rubric so they understand the expectations and can use it as a final checklist before turning in the project,
- Showing examples of the final product done by previous students

- Following directions, restating the written directions repeatedly, and rephrasing as needed
- Assistance in summarizing the information and putting it into their own words

**Topic selection.** Due to the challenges of a complex research process and students' lack of English proficiency, teachers considered it very critical to help students maintain their interest and focus on the research project. The ESL teacher mentioned that a focused topic is a key component of the ESL research project. For students to stay focused on a research project, she chooses a topic that is interesting or important to them. She said:

“Let’s say I will tell them, okay, let’s research about sharks. You know, some of them might be interested in that topic, because they are interested in animals, and some of them might not care. Then they will lose their focus. However, I feel that to get them focused on the research, you need to give them topics that they are interested in.”

She explained that while teachers have to focus on the curriculum and have to cover certain topics in regular classes, ESL teachers focus on teaching the language skills and have more freedom on the topics and how to teach students the skills.

- Choosing a topic that is interesting or important to ELL students
- Flexibility of ESL curriculum

The biology teacher also mentioned that the stage of topic selection should be carefully designed in a research project for ELL students. She tried to assign a research project that would interest students and cover the content related to their life. During the first two days of the research project, she overviewed different kinds of genetic disorders using

Power Point slides. It was not only for building background knowledge on the topic, but for helping students be motivated and choose their own topic by showing visuals. The students in the biology classes were supposed to pick one disease as their research topic from a list of generic disorders provided by the biology teacher. The list of possible topics is often used for ELL students, especially for lower level ELL students, because teachers know which topics are easier for them.

- Assigning a research project that will interest them and be related to their real life
- Showing visuals to help students choose and be motivated by a topic
- Providing a list of possible topics

The school librarian said she experienced a very hard time when she helped native English speaking students in social classes with their research project on unemployment and working conditions. Since they were not interested in those topics, it was difficult for them to choose a topic and then find the information. From her experience working with both ELL students and native English speaking students, the school librarian said,

“Generally ELL students are more motivated and interested in their research topic, because the teacher picks up those kinds of topics, but in general in the regular classroom, the students are not that much motivated. They don’t have any reason for researching about Shakespeare.”

In addition, the school librarian reported that using a focused topic is easier for her because it allows her to lead students to particular databases on the topic.

**Information search.** All three teachers who were interviewed stated that most ELL students do not have trouble finding information on the Web. The ESL teacher said

that most of her students are used to using the computer to keep in touch with what is going on in their culture.

“They want to know what’s going on in their country. So they know how to find things. They know how to find the Chinese Website and they know how to find the Pakistani newspaper on the computer. I don’t know how they do it, but they know.”

Especially, she was surprised to see how quickly the students learned how to use Family Connection which was the main resource for the project. She explained that it seemed so because 1) it was very similar to Facebook or Myspace which the students were familiar with, 2) it provided options to be clicked for searching and 3) it had a lot of visuals and videos in non-English languages.

The biology teacher also mentioned, “One thing that seems to keep them on the same playing field as the English speaking students is many of the ELL students are adept at computer use.” However, she recognized that ELL students tend to use the first site they find without searching more or use only one site for their research. She also mentioned that ELL students have more requests than native English speaking students for one on one help during research time in library. The biology teacher said that many of the same problems the students may find acclimating to a new culture, new country, new school, and new lifestyle would extend to their information seeking abilities. She mentioned that teachers need to assist ELL students in finding or choosing research materials at a reading level appropriate for their English reading abilities, suggest sites and key words for searching, and allow them to research in their own language and then translate.

- Assisting in finding or choosing research material at their reading level
- Suggesting sites and key words for searches
- Allowing students to research in their own language and then translate

The ESL teacher had only one student who had problems with searching for information on the computer because he had never used a computer or had Internet access in his country. Although he learned how to manipulate the computer in a short amount of time, he initially needed special help in searching. Also, she pointed out that the students might experience more difficulty with print materials than the Internet sources because even when she provided them with magazines or books, most of them read them but did not cite them as much as Internet resources. She said,

“They might not be used to having library sources like that are available here in America or they might have different type of print sources in their countries, a different way of doing about it. I think they are more accustomed to using the Internet.”

- Supporting lack of technological experience from their own country
- Assisting in searching and using print materials

The school librarian said that she did not see any differences in the way that ELL students and native English speaking students searched for information. Students in general did not have much trouble navigating the Web; however, the information they found might not be exactly what they wanted. She noticed that both ELL students and native English speaking students need help in finding credible information and synthesizing it in their own words. Also, she mentioned that they need a lot of help in creating citations.

- Assisting in finding credible information

- Assisting in synthesizing the information and putting it into their own words

The school librarian said that some of ELL students who came from countries who did not have school libraries are very pleased that they can borrow books from the school library without buying them.

**Challenges of lower level ELL students.** Although the lower level class used the same research process as the higher level one, they were not expected to be able to do the same amount of work as the higher level class. The ESL teacher explained the challenges unique to the lower ELL level classes as follows. Firstly, lower level classes need to learn more vocabulary than the higher level classes for the research project. Therefore, a lower level class might take 6 weeks, whereas a higher level class might take 3-4 weeks for the whole research process. Secondly, although the ESL teacher tries to use the students' background knowledge for class activities and the research project, it is harder for her to discern what the lower level students already know because of the language barrier. Especially when the student speaks the language she does not speak, it takes longer for the ESL teacher to figure out their background knowledge. Lastly, the ESL teacher gives them a list of specific topics because she knows which topics are easier for their level. By choosing what they want to research from the prepared list, they can have a topic which they can handle and keep focused on the research with interest.

- Additional time needed for more vocabulary background
- More efforts needed to learn the students' knowledge background
- Providing a list of possible topics

The biology teacher taught students with various ELL levels in the same classroom. She assigned her students to sit with classmates who speak in the same native

language with each other so that they can help each other in their native language in class. To support lower ELL level students, she allows and encourages higher level students to assist lower level students. She sometimes asks ESL teachers about the lower level students to get a clearer sense of their abilities. Also, she considers the students' lower ELL level in grading their work.

- Allowing and encouraging higher level students to assist lower level students
- Checking with ESL teachers to get a clearer sense of the lower level students' abilities
- Flexibility in grading

**Support for emotions.** Since the students in the theme class researched about their career plans, their emotions depended not only on their research progress, but on their personal situations such as what career options were available to them. When they started the project, a lot of them had never thought of their career options, higher education, or the college admissions process. The ESL teacher said,

“I think that, by the end of the project, most of them feel like they really learn something valuable and most of them, even though it was a lot of hard work, they are happy that they got the information because they were completely oblivious about the whole system and all the options that are available for them before the project.”

She said, however, for some of them this experience would be positive, but for others it would be frustrating depending on their specific personal lives and situations.

The biology teacher stated that feeling unconfident, anxious, and overwhelmed is common among ELL students; however, emotional changes have more to do with the

individual student rather than the student being an English language learner. Also, comfort and confidence continue to build with each assignment and with group work.

#### **4.5 Summary of Key Findings**

The participants of the study were 48 ELL high school students (14 to 19 years-old) from one theme class and two biology classes: 23 boys (47.9%) and 25 girls (52.1%); 6 Asian (12.5%), 14 Black (29.2%) and 28 Hispanic or Latino students (58.3%); 14 beginning ELL level (29.2%), 16 intermediate ELL level (33.3%) and 18 advanced ELL level students (37.5%). Students hailed from 14 different countries.

Regarding their self-rated language proficiency, ELL students exhibited significantly higher levels of self-rated proficiency in their native language than in English in four language skills – reading, writing, listening, and speaking. All ELL level groups viewed themselves as proficient in their native language, regardless of their level of English language proficiency. Students in the intermediate ELL group rated their English language proficiency in speaking at a significantly higher level than those of the advanced ELL group.

In terms of linguistic isolation, students viewed themselves as proficient in their native language regardless of whether or not they were linguistically isolated. However, linguistic isolation was related to students' self-rated English language proficiency. Students who were living with proficient English speakers at home exhibited a significantly higher level of self-rated English language proficiency in speaking and average ability across four language skills than those who were linguistically isolated.

Regarding home language(s), students viewed themselves as proficient in their native language regardless of whether or not they spoke some English at home. However, students speaking some English at home exhibited a significantly higher level of self-rated English language proficiency in writing, listening and speaking than those speaking only their native language(s) at home.

In addition, there were gender differences in self-rated language proficiency. Girls rated their native language proficiency in writing and speaking and English language proficiency in reading and writing as substantially higher than boys.

#### **4.5.1 Cognitive Dimension**

*What primary patterns, if any, do ELL students have in terms of cognitive dimension (substance and amount of knowledge, labeling of knowledge, estimated knowledge, interest, and learning outcome), as they engage in the research task?*

ELL students' topical knowledge progressively increased during the research project. The students expressed their topical knowledge predominantly by factual and explanatory statements. Regardless of their level of English language proficiency, students rarely stated synthesized knowledge or personal viewpoints on their topic. Students who were involved in a more intensive research project with a personal topic exhibited a significantly greater amount of topical knowledge in the completion stage than those undertaking a less intensive research project with a biology topic. Students in the theme class made significantly more factual statements than those in the biology classes, whereas they made fewer explanatory statements than those in the biology

classes. That is, the nature of research task impacted what type of knowledge students had built as they progressed. Regarding ethnicity, Asian students showed significantly more topical knowledge than the other ethnic groups in the completion stage, even when controlling for ELL level. There were no gender differences in substance and amount of knowledge.

Regardless of students' level of English language proficiency, most ELL students in the biology classes continued to have a specific title from the beginning stage, because they started the research project with a chosen topic from the list of possible topics prepared by teachers. Students in the theme class had not titled their research in the beginning stage, because they needed time to browse the information and choose their career goals by themselves. Afterwards, all students in the theme class except for one had a specific title in the mid-point and the completion stages. A creative or artistic title was rarely used.

ELL students became more interested in their topic as they progressed. They exhibited substantial increases of interest later in the research process when they understood and used the information they had collected. Regardless of their level of English language proficiency and the type of research project, they rated their interest as higher than "2=some" throughout the research process. There were no differences in interest among the ethnic groups. Girls showed significant increases in their interest, and had a significantly higher level of interest than boys in the completion stage.

ELL students showed significant increases in estimated knowledge throughout the research process. Regardless of their level of English language proficiency and the type of research project, the students' estimated knowledge increased. Significant increases in

estimated knowledge were found in the intermediate ELL group in the biology classes and the advanced ELL group in the theme class. Regardless of ethnicity and gender, students increased their estimates of knowledge on their topic as they progressed. The significant increases in estimated knowledge of each ethnic group were more likely to occur in the later stage of the research process when they used the information they had found than in the beginning stage.

Regardless of their level of English language proficiency and the type of research project, students reported substantial knowledge on the curriculum as their learning outcome. Asian students tended to report more learning outcomes than the other ethnic groups. Girls showed a significantly greater amount of learning outcomes in literacy competence than boys, even when controlling for ELL level.

#### **4.5.2 Affective Dimension**

*What primary patterns, if any, do ELL students have in terms of affective dimension, with particular focus on positive affect (confidence, relief, optimism, and satisfaction), negative affect (disappointment, frustration, confusion, uncertainty, and anxiety) and concern about their English proficiency?*

**Positive affect.** Students became more relieved, more optimistic, and more satisfied as they progressed in the research project (Figure 23). Their level of relief substantially increased between the beginning stage and the mid-point stage, whereas their satisfaction level substantially increased between the mid-point stage and the completion stage. The more students learned about their topic, the more optimistic and

satisfied they felt in the mid-point stage and the more confident, relieved, optimistic, and satisfied they felt in the completion stage. Also, the more students were interested in their topic, the more optimistic and satisfied they felt in the mid-point stage.

Although the beginning ELL group showed a lower level of confidence and relief than the other ELL level groups throughout the research process, the difference was not significant. Regardless of their level of English proficiency, difficulties in finding information made the ELL students' confidence level decrease in the mid-point. Within the intermediate ELL group, Hispanic or Latino students exhibited a lower level of confidence and satisfaction than the other ethnic groups throughout the research process,

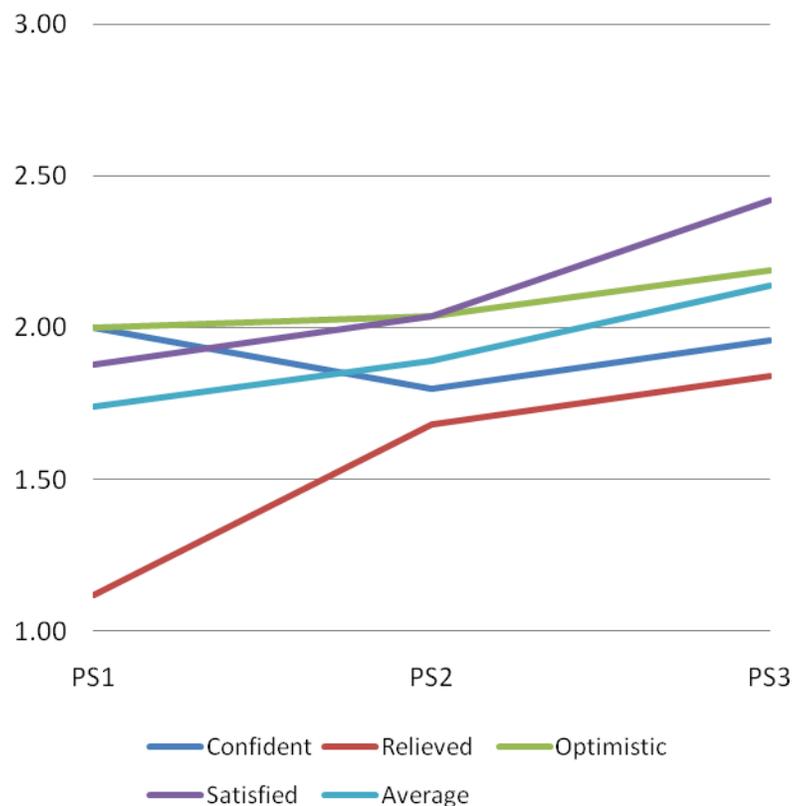


Figure 23 Positive Affect across the Process Surveys  
(0=not at all, 1=a little, 2=some and 3=a lot)

and exhibited significantly lower levels of positive feelings in the mid-point stage. They were significantly less confident than Black students, less relieved than Asian students, less satisfied than the other ethnic groups in the mid-point stage. There were no significant gender differences in positive affect.

**Negative affect.** Students became less disappointed, less frustrated, and less confused as they progressed in the research project (Figure 24). Their frustration level substantially decreased between the beginning and the completion stages, and the confusion level substantially decreased between the mid-point and the completion stages. Levels of uncertainty and anxiety remained somewhat static throughout the research process. In the initial stage, negative feelings were caused by lack of knowledge about their topic and the research process. In later stages, students exhibited negative feelings after encountering poor results from searches, information that was difficult to evaluate, complexity of the research process, challenging vocabulary, and time constraints. The more interested students were in their topic, the less disappointed, frustrated, uncertain, and anxious they felt. Moreover, the more students had learned about their topic, the less disappointed they felt in the mid-point stage. In the beginning stage, students who were involved in a more intensive research project with a personal topic were significantly more confused than those undertaking a less intensive research project with a biology topic. They experienced more anxiety and uncertainty later in the research process because they were forced to learn the system in the United States in anticipation of important real-life decisions.

Hispanic or Latino students showed a lower level of frustration and anxiety than the other ethnic groups throughout the research project. They were significantly less frustrated than Black students in the beginning stage, and significantly less anxious than Asian students in the mid-point stage. Within the intermediate ELL group, Black students were less confused than the other ethnic groups in the mid-point stage. There were no significant differences in negative affect among the ELL level groups or between the gender groups.

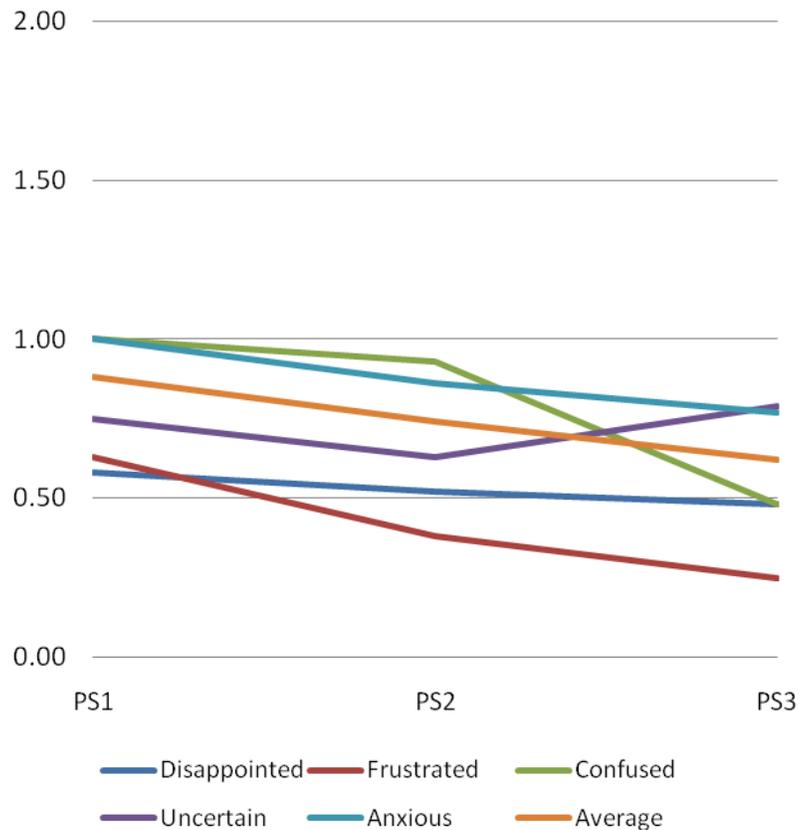


Figure 24 Negative Affect across the Process Surveys  
(0=not at all, 1=a little, 2=some and 3=a lot)

**Concern about English language proficiency.** ELL students had persistent concern about their proficiency in English throughout the research project. Students thought their lack of English proficiency impacted their research process and quality of final product. The intermediate ELL group exhibited less concern about their English language proficiency throughout the project than the other groups, whereas the beginning ELL group showed more concern than the other groups in the beginning and the completion stages. Even when controlling for ELL level and class, Black students were less concerned with their English language proficiency than the other ethnic groups.

#### **4.5.3 Behavioral Dimension**

*What enablers and inhibitors do ELL students encounter during the research process, with particular focus on easy or difficult tasks, the type of assistance they needed, and teachers' instructional interventions?*

Although students easily found some information on the Web, it often contained unfamiliar vocabulary or mathematical/statistical/scientific terminology, which made it difficult them to identify information that was sufficiently specific to their topic. Thus, when they found a lot of information, they encountered difficulty in choosing “the most important,” “correct,” or “appropriate” information. With the instant help of the teachers, they chose information for their project; however, they did not know what they needed to consider in evaluating information. In addition, a lot of them found it difficult to synthesize and summarize the information in their own words.

To most of the students, their classroom teacher was the only person who could help them with their research project. To reduce the challenges they encountered throughout the research project, they wished they had had someone who knew about their topic. They wanted assistance in finding and evaluating information. Students in the theme class valued the orientation session on a database offered by a school counselor, and one student in biology classes, who had worked with the school librarian for a previous project, wished to have had the school librarian's assistance with her research project. Students relied on online dictionaries and translation Websites to resolve their difficulties with hard vocabulary. They wished to have had more background knowledge before they started the project. In addition, they wanted to have more time and a sample research paper of a person who had done the same research project.

Teachers recognized that it is challenging for ELL students to undertake a complicated research project in English. The ESL teacher emphasized that it is important to build background knowledge such as vocabulary and concepts on the topic, and practice each research steps before the research part of the project starts. To reduce the students' load from complexity of the research process and lack of English proficiency, the biology teacher distributed a simple rubric that clearly outlined her expectations for the project, showed students examples of completed projects, restated the written directions, and assisted in summarizing the information.

In order to help ELL students focus on their research project, teachers tried to implement a research project with a topic that students would find interesting. They showed visuals, for example Power Point slides with images, to help students choose and be motivated by a topic.

To help ELL students with their information search process, teachers considered it important to assist them in choosing sites and key words for searches, finding or choosing research materials at their reading level, finding credible information, using print materials, and synthesizing the information they found. Teachers stated that students need to be allowed to research in their own language and then translate it into English later. Also, some students need special support for lack of technology experience from their own country.

Lower ELL level students need additional time to develop content-specific vocabulary. It is sometimes challenging for teachers to discern what the lower ELL level students already know because of the language barrier. To support them, it was recommended to provide a list of possible topics, and encouraging higher level students to assist them. Teachers can collaborate with ESL teachers to get a clearer sense of their abilities, and consider the students' ELL level in grading their work.

Students are more interested in conducting research when the topic is related to their personal life. However, teachers should be aware that some personal topics may leave students feeling either positive or negative in the end of the project. The biology teacher stated that it is common for anxiety and lack of confidence to overwhelm ELL students; however, emotional changes have more to do with the individual student rather than the student being an English language learner. Also, students become increasingly more confident with each assignment and with group work.

## **CHAPTER 5 DISCUSSION, IMPLICATIONS AND FUTURE STUDIES**

### **5.1 Discussion**

#### **5.1.1 Linguistic Isolation and Home Language(s)**

The findings of the study showed that linguistic isolation is unrelated to whether or not ELL students speak some English at home. Although some ELL students had no one who was 14 years-old or older and could speak English very well in their household, they used English at home with siblings under 14 years or with friends on the phone or through online chatting software.

All ELL level groups viewed themselves as proficient in their native language, regardless of whether or not they were linguistically isolated and whether or not they spoke some English at home. However, linguistic isolation and home language(s) were related to students' self-rated English language proficiency. Students who were living with proficient English speakers at home showed a higher level of self-rated English language proficiency in speaking and average across four language skills – reading, writing, listening and speaking – than those who were linguistically isolated. Those who were speaking some English at home had a higher level of self-rated English language proficiency in writing, listening, speaking and average across four language skills than those speaking only their native language(s) at home.

These results imply that having a fluent English speaker or using some English at home gives ELL students more confidence in their English language abilities, which might impact their information seeking and use behaviors. It would be worthwhile to

investigate how ELL students' linguistic isolation and their home language(s) impact their research experience in terms of thoughts, feelings and behaviors.

### **5.1.2. Impact of English Proficiency Level on Information Seeking and Use**

The intermediate ELL group showed higher levels of self-rated English proficiency than the other ELL groups in all four language skills – reading, writing, listening and speaking, whereas the advanced ELL group showed lower levels of self-rated English proficiency in them than the other ELL groups. The intermediate ELL group had a significantly higher level in self-rated proficiency of speaking in English than the advanced ELL group.

Regarding the cognitive dimension of the information seeking and use behaviors, no significant differences were found among the ELL level groups. In terms of topical knowledge, the advanced ELL group exhibited less topical knowledge than the intermediate ELL group throughout the research process, although the differences were not significant. Moreover, their topical knowledge did not significantly increase during the research project, whereas the beginning ELL group and the intermediate ELL group showed a significant increase in topical knowledge between the beginning and the mid-point stages and between the beginning and the completion stages, respectively.

Regardless of their level of English language proficiency, ELL students estimated their interest as higher than “2=some” throughout the research process. In terms of estimated knowledge, the advanced ELL group showed a higher level of estimated knowledge than the other ELL groups in the beginning stage. While the intermediate ELL group showed significant increases in estimated knowledge as they progressed, the beginning ELL

group and the advanced ELL group did not show significant increases in estimated knowledge.

Regarding the affective dimension of the information seeking and use behaviors, there were no significant differences among the ELL level groups. However, some interesting patterns were found. The advanced ELL group started the research project with a higher level in all four positive feelings – confidence, relief, optimism, and satisfaction – than the other ELL group, whereas the intermediate ELL group completed the research project with a higher level in them than the others. On average, students in the beginning ELL group exhibited less confidence and relief than students in the other ELL groups throughout the research process. Only the intermediate ELL group showed a significant increase in positive feelings, particularly in relief and satisfaction. Although the differences were not significant, it is worthwhile to remark that the advanced ELL group showed continuous decreases in optimism and satisfaction throughout the research process.

The beginning ELL group started the research project with a higher level in all five negative feelings – disappointment, frustration, confusion, uncertainty, and anxiety – than the other ELL groups. They were more concerned about their English language proficiency in the initiation stage than the other ELL groups. No ELL group showed significant differences between stages in negative feelings. The intermediate ELL group was less concerned about their English language proficiency than the other groups throughout the research process.

As shown above, it seems that students' ELL level might have something to do with self-rated English language proficiency, amount of topical knowledge, estimated

knowledge, and emotional changes during the research project. The interesting thing is that the intermediate ELL group rated their English proficiency higher than the advanced ELL group, and they were the only ELL group showing significant increases in estimated knowledge as they progressed. The intermediate ELL group completed the research project with a higher level in all positive feelings than the others and they were the only ELL group that exhibited a significant increase in positive feelings, particularly in relief and satisfaction.

One of the patterns noticed was that the advanced ELL group initiated the research project with a higher level of estimated knowledge and positive feelings than the other ELL groups. However, their increase in estimated knowledge was surpassed by the intermediate ELL group in the mid-point stage, and their positive feelings decreased or fluctuated while the intermediate ELL group showed stable increases.

### **5.1.3 Nature of Research Task**

Two different kinds of research tasks were implemented in the participating classes of this study. The theme class had students take more structured steps, such as using a particular database and making note cards, outlines, and drafts, with a more personalized topic than the biology classes. The findings of this study indicate that there are different patterns in information behaviors between the advanced ELL level students with these two different tasks.

In the completion stage, the advanced ELL students in the theme class exhibited more topical knowledge than the advanced ELL students in the biology classes. Moreover, the advanced ELL students in the theme class showed significant increases in

amount of topical knowledge as they progressed, whereas the advanced ELL students in the biology classes did not. These findings imply how systematic interventions and personalized research topic influence students' knowledge development process. The students in the theme class also showed a significant increase in estimated knowledge, whereas those in the biology classes did not.

In spite of systematic interventions, increased complexity of the research task in the theme class made the students significantly more confused than those in the biology classes in the beginning. However, they showed a significant decrease in confusion between the beginning and the completion stages with structured research steps.

These findings imply that systematic interventions in a research project will reduce students' initial confusion and allow them to more effectively build their knowledge.

#### **5.1.4 Ethnicity and Gender**

Asian students exhibited significantly more topical knowledge than the other ethnic groups in the completion stage, regardless of their ELL level. Within the intermediate ELL group, Asian students showed a higher level of estimated knowledge than students of other ethnicities throughout the research process although the differences were not significant. As their learning outcome, all ethnic groups mentioned curriculum content, but Asian students also mentioned information literacy and literacy competence.

Regarding the affective dimension of information behaviors, intermediate ELL level Hispanic or Latino students showed a lower level of confidence and satisfaction than the other ethnic groups with the same level of English proficiency throughout the

research process. They were significantly less confident, less relieved, and less satisfied than the other ethnic groups in the mid-point stage. In addition, Asian students and Hispanic or Latino students within the intermediate ELL level showed a significantly higher level of confusion than Black students with the same English proficiency at the mid-point.

Regarding the impact of gender on information seeking, Burdick (1996) stated that more gender differences were found in feelings rather than in thoughts and behaviors. She found that some girls lacked confidence and felt anxious regardless of whether or not they were clearly focused. In contrast to her findings, this study showed that girls tended to be more confident than boys throughout the research process. In the completion stage, girls tended to show higher averages than boys in all four positive feelings. Also, girls showed a significant increase in relief and satisfaction between the initiation and the completion stages. The different findings from the two studies may be related to whether the participants of the study were native English speakers or English language learners. As this study showed, within ELL students, girls tended to have a higher level of self-rated English proficiency and a lower level of concern about their English proficiency than boys, and their higher confidence in their English proficiency might influence their feelings during the research process.

### **5.1.5 Research Instruments**

The researcher closely observed the students' research process while taking field notes as a participant observer from the initiation to the completion of the project. Field notes were recorded on site at the time without any particular framework and

supplemented with more detailed comments and questions afterwards. In addition to keeping track of the curricular lessons and the research tasks of students, observations mainly focused on students' individual research activities, their interactions with classmates, and interventions of teachers during the project. However, structured field notes will be useful to more effectively transform observations, surveys, and interviews into findings. For instance, *Observation form for Guided Inquiry* (Kuhlthau et al., 2007, p.118), which is an assessment tool for inquiry learning, seems to be a useful research instrument for structured observations.

As addressed in Section 5.1.2, this study showed potential differences in feeling changes and in the knowledge development process among English language learners that varied according to their level of English proficiency. However, in spite of some repeated patterns of their answers by ELL level, these relationships were rarely statistically significant. It might be because there was a small group of participants in this study, and four point scales were not sophisticated enough for ELL students to reflect their changes in knowledge development and feelings. Therefore, seven or nine point scales with a larger group of participants can be applied in future studies to see clearer differences in the information behaviors among the ELL level groups.

Process surveys in this study were scheduled to be implemented at three times during the class periods. Unexpectedly, due to limited time in class, the process survey in the beginning stage was assigned as homework in biology classes. As a result, only 26 (68.4%) of the total 38 students in biology classes returned their completed surveys. Those who did not answer the process survey at the time were not allowed to submit it later, because they progressed further in their research project. The process surveys were

implemented on site in the mid-point and the completion stages, and all present students in biology classes answered them with 87.2% and 97.4% response rates, respectively. To obtain a complete sequence of the surveys from more students, it would seem necessary to have students answer the surveys on site.

Individual interviews were conducted with students in the theme class. However, group interviews were conducted in the biology classes due to the large number of students in them. In general, individual interviews offered more personalized interview questions as well as increased opportunities for students to follow up on their answers from the process surveys. Each interview group in the biology classes consisted of three to eight students. It seemed that three to five students was an appropriate number for the group interviews. When there were more than five students in a group, it was hard for the researcher to ask follow up questions and control the atmosphere.

## **5.2 Implications**

### **5.2.1 Implications for Research**

The different needs of native English speaking students and ELL students in their information search process have been largely ignored in previous studies on human information behaviors. Unique patterns of ELL students' information search process in the cognitive, affective and behavioral dimensions shed light on how different cultural and linguistic backgrounds influence people's information seeking and use.

Besides the ELL students' own characteristics, this study demonstrated that linguistic isolation and the use of English at home are related to their self-rated English proficiency which might impact their thoughts, feelings and behaviors when they are

involved in a research project in English. This finding demonstrates that not only their own characteristics, but the linguistic and cultural diversity of their circumstance should be taken into consideration in studies about the information behaviors of ELL students.

The ISP model has been verified and generalized with various groups of people in diverse contexts. Previous findings on the ISP model were compared with the results of this study with ELL students who are a rapidly growing population across the country. This study showed how ELL students experience information search and knowledge building processes through a complex research project in English. It revealed what factors interact with individuals' primary patterns in their information seeking behavior. At a theoretical level, this study contributes to Kuhlthau's Information Search Process by adding linguistic and cultural dimensions as potential factors which influence human information behavior.

### **5.2.2 Implications for Practice**

The findings of this study will facilitate understanding of efficient strategies and instructional interventions for ELL populations in K-12 school contexts. Teachers need to provide ELL students with specific guidelines for an assignment. To be culturally competent, school librarians need to fully understand ELL students' information search process and various information needs from their unique situations and contexts.

Regarding the students' lack of English language proficiency, teachers need to understand they are conducting research tasks while learning a new language. To better support them, they should supply more background knowledge and vocabulary skills, figure out what they already know from their countries, and providing them with a list of

specific topics they can handle. With respect to students' cultural background, the students need additional lessons about cultural concepts when the project covers something that their country does not have, but exists in the United States. And they might not be familiar with technology or materials because they were not available in their country. Also, since most of the students' parents cannot fluently speak English and do not have much experience in the United States, there is no help available to the students outside the classroom, especially when the project is about the lives or cultural issues in the United States.

As an instructional team, teachers can more efficiently help ELL students with their English proficiency and information literacy skills. When the ESL teachers or subject teachers collaborate with the school librarian, ELL students can be better served through the interventions from a variety of expertise. Todd, Kuhlthau, and Heinström (2005) found that all students in their study, including ELL students, benefited from inquiry learning. The problem is that most ELL students at the high school level came to school without prior research experience. They may not have completed any research projects in their own country. In this case, inquiry learning gives them opportunities to build on basic research abilities with individualized interventions from an instructional team. According to Kuhlthau, Maniotes and Caspari (2007), students need interventions for curriculum content, information literacy, learning how to learn, literacy competency, and social skills; and the instructional team should be built in each of five types of intervention. For ELL students, there should be more careful and systematic intervention in literacy competency and information literacy. Small group interaction among those who speak the same native language will be a helpful intervention for ELL students.

Exams that test whether ELL students possess requisite content knowledge are inherently problematic because they are conducted in English which may hinder their understanding of questions and their ability to express their knowledge. The collaborative research project for ELL students by the school librarian and subject teachers can be a formative assessment that acts as a diagnostic.

System designers need to understand ELL students' unique preference in terms of both information and interface. The system should be able to reply to different information needs in each stage of the ISP and have multiple search functions to enable ELL students to use the system more efficiently. ELL students want to have visuals or multimedia resources, materials at their reading level, online dictionaries, translations, and instant help with choosing search terms and evaluating information. They prefer to have the option of clicking check boxes to narrow down their topic and choosing to search in their native language(s).

ELL students need to know the ISP to understand their stage in terms of actions, thoughts, and feelings. Moreover, user instructions should include search strategies and evaluation skills, such as how to formulate a query, how to refine a query, when to use browsing or keyword searching, and how to evaluate information.

### **5.3 Future Studies**

This study aimed to examine the information seeking and use behaviors of high school English language learners while engaged in a research project. Through the school setting, the study could reflect the curriculum and school environments where ELL students are situated. Therefore, the findings provide implications for designing

instructional interventions for ELL students in a school setting. However, it was not possible to control the variables of ELL students, such as ELL levels, ethnicity, and gender in the school context. Moreover, since students had instructions about new vocabulary and topic knowledge as part of research process, these interventions might impact their performance and learning experience.

When controlling for ethnicity, linguistic isolation and the use of English at home, the impact of ELL students' English proficiency on their information behaviors can be more clearly understood. An experimental design could be used to control for these and other variables.

This study showed that the advanced ELL group initiated the research project with more estimated knowledge and positive feelings than the other ELL groups. However, their increase in estimated knowledge was surpassed by the intermediate ELL group in the mid-point stage, and their positive feelings decreased or fluctuated while the intermediate ELL group showed stable increases. These differences in thoughts and feelings between the intermediate and the advanced ELL groups should be further examined.

This study demonstrated that systematic interventions in a research project help ELL students to develop their knowledge and reduce their initial confusion. It will be worthwhile to further investigate how the nature of research projects and systematic interventions influence ELL students' learning experience and information behaviors.

In contrast to previous studies on how information behaviors vary by gender, this study showed that, within ELL students, girls tended to be more confident than boys throughout the research process. In the completion stage, girls tended to show higher

averages than boys in all four positive feelings. It seems that gender differences of ELL students in self-rated English proficiency might influence their information behaviors. The impact of gender on ELL students' information behaviors should be further studied.

The findings of the study imply that having a fluent English speaker or using some English at home gives ELL students more confidence in their English language abilities, which might impact their information seeking and use behaviors. It will be meaningful to further examine how ELL students' information behaviors are influenced by whether or not they live with fluent English speakers and whether or not they speak English at home.

#### **5.4 Conclusion**

The growing number of students with limited English proficiency has brought significant challenges to education environments, particularly low literacy level of adolescents, low rate of completing high school and providing diverse and meaningful learning experiences. However, few studies have paid attention to how ELL students interact with information during the learning process or when they need instructional interventions throughout the research process. Information literacy education for ELL students has been rarely implemented in the school context.

This study showed what ELL students experienced when searching for information through a research project in English and what factors interact with individuals' primary patterns in their information seeking behavior. The findings of the study indicated that ELL students find the multiple steps of a research project in English challenging. Furthermore, individual students have additional difficulties caused from

their lower level of English proficiency, circumstances around them, and different experience in their own countries. Besides the students' English proficiency, the potential factors to influence ELL students' information behaviors are linguistic isolation, the use of English at home, the nature of research tasks, cultural background, and gender.

The findings of the study contribute to understanding the patterns of ELL students' information search process in the cognitive, affective and behavioral dimensions. Throughout the ISP, ELL students have needs that differ markedly from those of native English speaking students. This study shed light on how cultural and linguistic background can influence people's information seeking and use. Also, this study demonstrates the need for ISP researches to consider not only the innate characteristics of ELLs, but also the linguistic and cultural diversity of their circumstances. At a theoretical level, the findings of this study can be compared with previous findings on Kuhlthau's Information Search Process, and contributes to adding linguistic and cultural dimensions as potential factors which influence human information behavior. At a pedagogical level, the findings suggest effective strategies and instructional interventions for ELL populations in K-12 school contexts.

This study suggests further research on ELL students' information behaviors. To examine the impact of the English proficiency level on information behaviors, experimental design with controlled variables should be taken into consideration. When the variables, such as ethnicity, linguistic isolation and the use of English at home, are controlled, the impact of ELL students' English proficiency on their information behaviors can be more clearly understood. Furthermore, it will be worthwhile to study the impact of systematic interventions on ELL students' learning experience and information

behaviors. Other future topics include the impact of gender differences, linguistic isolation and the use of English at home on ELL students' information behaviors when they conduct a research project.

Future studies on linguistically and culturally diverse students will further contribute to the understanding of how different linguistic and cultural backgrounds impact people's information and seeking behavior. Moreover, they will enrich information behavior theories and models by considering the individual's contexts related to language and culture. Such studies will help teachers and school librarians to better understand the unique needs of ELL students in seeking and using information and to implement instructional interventions that are specialized for ELLs in school settings.

## Appendix 1

### Research Paper Guideline

#### Higher Education Research Paper Guide

The following is a guide to help you get organized during your research paper project. The research paper consists of several parts that will be graded. The following is a Checklist of what you will need for the final grade:

- \_\_\_\_\_ 1. Formal Outline with thesis statement
- \_\_\_\_\_ 2. Three or more resources and citations
  - a. You will need: one or more written resource (books, magazine, brochure, etc.), one or more web sites
- \_\_\_\_\_ 3. Note Cards
  - b. For each piece of information that you research you will need a note card
  - c. Each note card needs to have the proper citation for your researched material (Title, author, publisher, dates, pages, etc.)
- \_\_\_\_\_ 4. Rough Draft and Corrections of writing
- \_\_\_\_\_ 5. Final Draft

**Final FOLDER: This FOLDER WILL BE FOR YOUR FINAL GRADE!!!!!!! In the folder you need to have:**

- \_\_\_\_\_ a. **Final Draft**
  - \_\_\_\_\_ b. **Works Cited Page (a list of all resources using MLA style)**
  - \_\_\_\_\_ c. **Note Cards**
  - \_\_\_\_\_ d. **Rough Draft**
- 

To help you with the paragraphs of the paper I have come up with some suggestions. If you want to add or change this, let me know and I will help you with your paragraphs. The following is the information that should be in each paragraph of the paper. These paragraphs can be big or you can have more body paragraphs depending on your researched information.

- 1. Intro. Paragraph:
  - a. Thesis Statement: this should be about your goals and what you want to study
  - b. You should briefly mention the type of higher education you are researching
  - c. You should briefly mention the names of the institutions you will be researching
- 2. Body paragraphs:
  - a. First body paragraph:
    - i. This paragraph should be about your goals, what you want to accomplish and why

- b. Second body paragraph:
  - i. This paragraph should be about the institutions you are researching: names of schools, locations, what they offer, programs, living, extra curriculum activities, sports, international students, ESL, etc.
  - ii. \*\*\*You could do an individual paragraph for each school to make the organization easier\*\*\*
- c. Third body paragraph:
  - i. This paragraph should be about the \$ COST \$, Financial Aid, Payment Plans, How will you pay for school, books, food, living expenses, etc. YOUR FINANACIAL PLAN!!!
- d. Fourth body paragraph:
  - i. This paragraph should be about the application process, what you will need to get into the school, letters, references, important dates, transcripts, etc.

### 3. Conclusion Paragraph

- a. This paragraph should be a general summary of everything you wrote about in the essay.

Remember this information can change your life...HAVE FUN ☐

## Appendix 2

### Note Card Example

Date 11/29/05 Period 11 Initials J.S.	1
Book Title Author / Editor Publisher & State or Country Copyright Date Pg. # <hr style="width: 20%; margin: 10px auto;"/> Title of Site Title of Article Author or Editor Web Address Page # Month, Day, year	

<p><b><u>Title Question:</u></b></p> <hr/> <p>1. Who?</p> <hr/> <hr/> <hr/> <hr/>
<p><b><u>Answer Sentence / Summary Statement</u></b></p> <hr/> <hr/> <hr/> <hr/>

## Appendix 3

### Outline Guideline

---

Thesis Statement:

#### I. Introduction

- a. The Type of Higher Education:
- b. Name the 3 schools you will research
  - i. First School
  - ii. Second School
  - iii. Third School
- c. Transitional sentence / Conclusion for the paragraph
  - i. Ex. To conclude, the following essay will...

Body Paragraphs

II. 1<sup>st</sup> paragraph: Explain and JUSTIFY your goals / What do you want to accomplish and why

III. 2<sup>nd</sup> paragraph:

- a. 1<sup>st</sup> School: Explain and Justify
  - i. Name of school / location
  - ii. What programs they offer for your career
  - iii. What extracurricular activities they offer (sports, clubs, etc)
  - iv. International Students / ESL
  - v. Work Study
- b. 2<sup>nd</sup> school
  - i. Name of school / location
  - ii. What programs they offer for your career
  - iii. What extracurricular activities they offer (sports, clubs, etc)
  - iv. International Students / ESL
  - v. Work Study
- c. 3<sup>rd</sup> school
  - i. Name of school / location
  - ii. What programs they offer for your career
  - iii. What extracurricular activities they offer (sports, clubs, etc)
  - iv. International Students / ESL
  - v. Work Study

IV. MONEY / FINANCE

- a. The TUITION COST: In-state, out of state, and international student cost
- b. Financial Aid Programs
- c. YOUR FINANCIAL PAY / HOW WILL YOU PAY FOR: tuition, books, parking, food, living, etc.
- d. How much per credit / course / or program?

V. THE APPLICATION PROCESS

- a. What documents will you need to apply?
- b. What do you have to do?
- c. Will you need: birth certificate, social security #, references, transcripts, SAT, HSPA, ACT, TESOL, etc.
- d. Interviews, portfolios, etc.
- e. What are the important DUE DATES

#### VI. Conclusion Paragraph

- a. Summary / What you learned

## Appendix 4

### Works Cited Page Examples

#### Works Cited Page

○ **Book**

Burke, Kenneth. Language as Symbolic Action: Essays on Life, Literature, and Method. Berkeley: U of California P, 1966.

○ **Article in a Magazine**

Poniewozik, James. "TV Makes a Too-Close Call." Time 20 Nov. 2000: 70-71.

○ **An Entire Web Site**

Family Connection. 2009. The College and Career Database for West Orange High School. 2 Feb. 2009 <<https://connection.naviance.com/fc/signin.php?hsid=wohsnj>>.

○ **A Page on a Web Site**

"Financial Aids." Family Connection. 2009. The College and Career Database for West Orange High School. 2 Feb. 2009 <<https://connection.naviance.com/fc/signin.php?hsid=wohsnj>>.

#### In-Text Citations (1) / Citations provided in your writing:

- The work cited page is very important for citations, but it does not tell us exactly what you borrowed from each source and where in the source you found the words or ideas.
- The most common way to supply this information is to insert a brief mark in your paper wherever you use another's words, ideas or facts.

#### Works Cited

Burke, Kenneth. Language as Symbolic Action: Essays on Life, Literature, and Method. Berkeley: U of California P, 1966.

→ Human beings have been described as "symbol-using animals" (Burke 3).

→ Burke's Language as Symbolic Action: Essays on Life, Literature, and Method includes many examples of this trend.

→ Burke broke new ground on the subject.

#### In-Text Citations (2) / Sample Citation Sentences:

Works Cited...

Family Connection. 2009. The College and Career Database for West Orange High School. 2 Feb. 2009 <<https://connection.naviance.com/fc/signin.php?hsid=wohsnj>>.

**Sample Sentence**: → The database Family Connection is an invaluable source for college preparation.

Works Cited...

"Financial Aids." Family Connection. 2009. The College and Career Database for West Orange High School. 2 Feb. 2009 <<https://connection.naviance.com/fc/signin.php?hsid=wohsnj>>.

**Sample Sentence** → The West Orange College has a good financial support for immigrant students ("Financial Aids," Family Connection)

## Appendix 5

### A List of Genetic Disorder Topics

Name \_\_\_\_\_ Genetic Disorder Presentation Notes Per \_\_\_\_\_

Disorder name	Chromo #	One interesting fact written clearly
*PKU		
Duchenne MD		
*Cystic Fibrosis		
*Down's Syndrome		
Albinism		
*Sickle Cell Anemia		
Cri du chat		
Huntington's Disease		
*Hemophilia		
*Turner's Syndrome		
Fragile X		
Klinefelter's Syndrome		
Tay Sachs		
Angelman Syndrome		
Marfan Syndrome		
Edward's Syndrome		
Waardenburg Synd.		
Prader-Willi Syndrome		
Achondroplasia		
*Red-Green Color Blind		
Adrenoleukodystrophy		
Maple Syrup Urine Dis.		
Neurofibromatosis		
Polycystic Kidney Dis.		
Beta-thalassemia		
Celiac Disease		
Alzheimer's Disease		
*Dyslexia		

\* found in your text

## Appendix 6

### Guideline for Searching

#### GENETIC DISORDERS RESEARCH

- Be sure to review information from several sources
- You may research in your own language but must translate to English for the project
- Medical & health sources have a lot of information, also search for sites about your specific disorder
- Print only the parts of the article, website etc. that you need to take to then put in your own words. To do this...use the print “selection” choice after highlighting the parts you need
- Here are some reliable sources to search:  
<http://www.nlm.nih.gov/medlineplus/geneticdisorders.html>  
<http://www.ygyh.org/>  
<http://learn.genetics.utah.edu/>  
<http://ghr.nlm.nih.gov/>  
<http://www.webmd.com>

-----  
 Name \_\_\_\_\_ Period \_\_\_\_\_

List the internet address for 2 sources you used today for research and then state how they were helpful or why they were not helpful. Hand this sheet in at the end of the LMC visit.

- 1.
- 2.

## Appendix 7

### Authorization Letters

**THE PUBLIC SCHOOLS  
WEST ORANGE, N. J. 07052  
973-669-5400 ext. 206**

**OFFICE OF THE SUPERINTENDENT**

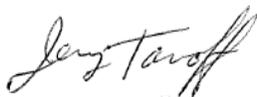
**179 EAGLE ROCK AVENUE**

January 14, 2009

To Whom It May Concern:

I, Jerry Tarnoff, grant permission to Ms. Sung Un Kim, Doctoral Candidate at Rutgers University, to conduct her proposed study at West Orange High School. Such study seeks to understand the information-to-knowledge experience of English Language Learners in a Guided Inquiry Project undertaken by the librarian, Catherine Evanik, and the English as a Second Language teacher, Brenda Avila.

Sincerely,



Jerry Tarnoff  
Superintendent of Schools  
West Orange Public School District

# The Public Schools West Orange, New Jersey

---

179 Eagle Rock Avenue • West Orange, NJ • 07052 • T: 973-669-5400 • F: 973-669-1432

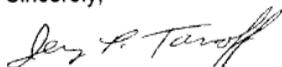
JERRY P. TARNOFF, SUPERINTENDENT

April 1, 2009

To Whom It May Concern:

I, Jerry Tarnoff, grant permission to Ms. Sung Un Kim, Doctoral Candidate at Rutgers University, to conduct her proposed study at West Orange High School. Such study seeks to understand the information-to-knowledge experience of English Language Learners MA Biology project undertaken by the biology teacher, Mrs. Debra Franek.

Sincerely,



Jerry P. Tarnoff  
Superintendent of Schools

## Appendix 8

### Consent Forms

#### 8.1 English Version

Dear \_\_\_\_\_,

Your child is invited to participate in a research study being undertaken at West Orange High School. This research has been approved by the superintendent of the school.

The research is being conducted by Sung Un Kim who is a doctoral student in the School of Communication, Information, and Library Studies Department at Rutgers University. The purpose of this study is to understand the information search process of high school students with diverse linguistic and cultural backgrounds in a collaborative project undertaken by the ESL teacher and school librarian.

Before you agree to let your child participate in this study, you should know enough about it to make an informed decision. If you have any questions, please ask Sung Un Kim or her advisor, Dr. Ross Todd. You should be satisfied with the answers before you agree to the study.

Participating in this study will involve up to 3 hours of your child's time in class for 4-6 weeks with the ESL teacher's agreement from January to March, 2009. He/She will fill out a questionnaire in the beginning and process surveys at three points of the project (beginning, mid-point and completion). After the completion, he/she will be interviewed to further understand his/her their information seeking and knowledge construction process in more detail. His/her name will not be identified.

Please mark with your initials that you have read and understood the information above.

\_\_\_\_\_

If you agree to allow your child to take part in the study, he/she will be assigned an access code number that will be used on the questionnaire. His/her name will not appear on any of the research documentation.

Participation in this study is voluntary. Your child may choose not to answer any questions with which he/she is not comfortable. There are no costs involved in participating in this research. For participating, your child will receive no automatic compensation. If your child withdraws from the study prior to its completion, he/she will receive no penalty. His/her participation is voluntary; he/she may decline to participate without penalty. If he/she withdraws from the study before data collection is completed his/her data will be removed from the data set and destroyed.

This research is confidential. Your child's name will not be identified. This information will be kept confidential. The research team and the Institutional Review Board at

Rutgers University are the only parties that will be allowed to see the data, except as may be required by law. In published reports and conference presentations group results will be presented and illustrative quotations used will not enable the identification of the participant. Data will be stored securely in a locked cabinet and access to computers that have the summaries of your child's responses is only available to persons conducting the study. No reference will be made in oral or written reports which could link your child to the study.

If you have any questions about the study procedures, you may contact Sung Un Kim at 908-420-3510 ([sungunk@eden.rutgers.edu](mailto:sungunk@eden.rutgers.edu)) or her advisor, Dr. Ross Todd, at 732-932-7500 ex. 8223 ([rtodd@scils.rutgers.edu](mailto:rtodd@scils.rutgers.edu)). If you have any questions about your child's rights as a research subject, you may contact the Sponsored Programs Administrator at Rutgers University at:

Rutgers University Institutional Review Board for the Protection of Human Subjects  
Office of Research and Sponsored Programs  
3 Rutgers Plaza  
New Brunswick, NJ 08901-8559  
Tel: 732-932-0150 ext. 2104  
Email: [humansubjects@orsp.rutgers.edu](mailto:humansubjects@orsp.rutgers.edu)

You will be given a copy of this consent form for your records.

Sign below if you agree to participate in this research study:

Student's Parent \_\_\_\_\_ Date \_\_\_\_\_

Principal Investigator \_\_\_\_\_ Date \_\_\_\_\_

## 8.2 Chinese Version

### 同意書

\_\_\_\_\_ 賜鑒：

令郎媛受邀參加在西橘高中進行，學監已核准的一項研究計畫。

本研究由羅格斯新澤西立大學資訊傳播暨圖書館研究學院，博士班研究生金成彥主持。計畫的主要目的在瞭解具多元語言及文化背景的高中生，在英語教師及學校圖書館員引導下，進行合作學習計畫之資訊蒐尋過程。

在同意令郎媛參與研究之前，您應對本研究有充分了解，做出根據資訊判斷的決定。若您有任何問題，請詢問金成彥或其指導教授陶德博士。在同意參與研究之前，應得到令您滿意的答案。

在英語教師同意下，自 2009 年一至三月，共四到六週，研究約需課堂三小時。令郎媛將在進行研究前填答一份問卷，在進行過程中前、中及後段，總計三次調查。最後令郎媛將接受訪問，以增進資訊尋求及知識建構過程的瞭解。令郎媛的姓名絕對保密。

請填入您的姓名縮寫，以示您已閱讀並瞭解上述的訊息。

\_\_\_\_\_

如蒙同意參與此項研究，令郎媛的問卷上將使用代號編碼，其姓名不會出現在任何研究文件中。

此研究自願參與，令郎媛可以選擇不回答任何令人不自在的問題。參與此研究不收取用費，令郎媛也不會得到報酬。在研究完成之前，若令郎媛退出研究，不會有任何處罰。令郎媛參與研究屬自願性質，可以婉拒參加而不受到任何處罰。若令郎媛在資料蒐集完成之前退出，相關資料將不計入研究資料且將予以銷毀。

此研究不對外洩露資料內容。令郎媛的姓名不會出現在研究資料中，且資料不對外洩露。除有法律要求之外，只有本研究團隊和羅斯格大學機構審查委員會有權查閱資料。相關研究報告和會議簡報將呈現群組資料，無法辨認參與者。資料將安全儲存在上鎖的櫃子，只有研究團隊能夠使用儲存令郎媛回答摘要的電腦。口頭或書面報告不會涉及令郎媛與此研究的關係。

若您有任何關於此研究步驟的問題，請聯絡金成彥(908-420-3510, [sungunk@eden.rutgers.edu](mailto:sungunk@eden.rutgers.edu))或她的指導教授陶德博士(732-932-7500 分機 8223, [rtodd@scils.rutgers.edu](mailto:rtodd@scils.rutgers.edu))。

若您有任何關於令郎媛成為研究受試者的權利相關問題，請聯絡羅格斯大學贊助計畫管理員：

Rutgers University Institutional Review Board for the Protection of Human Subjects

Office of Research and Sponsored Programs

3 Rutgers Plaza

New Brunswick, NJ 08901-8559

電話：732-932-0150 分機 2104

電子郵件：[humansubjects@orsp.rutgers.edu](mailto:humansubjects@orsp.rutgers.edu)

將給您一份同意書供您參考。

若您同意參與此研究，請在以下空白處簽名：

學生家長 \_\_\_\_\_ 日期 \_\_\_\_\_

首席研究員 \_\_\_\_\_ 日期 \_\_\_\_\_

### 8.3 French Version

#### Forme de consentement

Cher \_\_\_\_\_,

Votre enfant est invité à participer à une enquête de recherche qui sera faite au lycée West Orange High School. Cette recherche a été approuvée par le directeur de l'école.

La recherche est faite par madame Sung Un Kim qui poursuit un doctorat à l'école de communication, d'information et d'étude de librairie à l'université de Rutgers. L'objectif de cette recherche est d'assembler des informations afin de mieux comprendre le processus de l'acquisition de la langue anglaise (ELL) par les étudiants. Ceci est un projet de recherche faite par le libraire et le professeur de biologie de l'école.

Avant d'accepter de laisser participer votre enfant à ce projet, vous devez comprendre de quoi il s'agit afin de faire un choix averti. Si vous avez des questions concernant le projet n'hésitez pas à contacter Sung Un Kim ou son conseiller, Dr. Ross Todd. Vous devez être satisfait des réponses avant de consentir au projet.

La participation à ce projet de recherche par votre enfant comprendra 3 heures du temps scolaire de votre enfant pendant 4 semaines durant le semestre de printemps 2009. Il/Elle remplira des sondages au début, mi-parcours et à la fin du projet. Après la fin du projet, il/elle sera questionné pour comprendre en plus de détails son/sa construction du processus de l'acquisition de la langue anglaise. Son nom ne sera pas mentionné.

Veuillez écrire vos initiales ci-dessous si vous avez lu et compris les informations ci-dessus.

\_\_\_\_\_

Si vous acceptez de laisser participer votre enfant au projet, il/elle se verra attribuer un code d'accès qui sera utilisé dans les questionnaires. Son nom ne sera mentionné dans aucun document.

La participation de votre enfant dans cette recherche est sur base volontaire. Votre enfant aura le choix de ne pas répondre à des questions s'il le veut. La participation au projet n'est pas rémunérée ni payable. Si votre enfant décide de stopper sa participation avant la fin du projet, ceci se fera sans pénalité. La participation est entièrement volontaire. Si votre enfant stoppe sa participation avant la collection des données, celles-ci seront détruites.

Cette recherche est confidentielle. Le nom de votre enfant ne sera pas identifié. Le groupe de recherche et l'administration institutionnelle de supervision de Rutgers University seront les seules parties autorisées à voir les résultats, à l'exception de celles forcées par la loi. Dans les publications des rapports et l'utilisation des rapports pour des conférences, seuls des résultats de groupe seront présentés. Aucun participant pourra être identifié. Les

données seront tenues dans des tiroirs verrouillés et l'accès aux ordinateurs comprenant les résultats de l'enquête ne seront accessibles que par les personnes qui conduisent la recherche. Aucune référence ne sera faite, ni orale ni écrite, qui pourrait connecter votre enfant à la recherche.

Si vous avez des questions concernant le projet n'hésitez pas à contacter Sung Un Kim ou son conseiller, Dr. Ross Todd.

Sung Un Kim (doctoral student)

Rutgers, The State University of New Jersey  
 School of Communication, Information and Library Studies  
 4 Huntington Street  
 New Brunswick, NJ 08901  
 Email: [sungunk@eden.rutgers.edu](mailto:sungunk@eden.rutgers.edu)  
 Phone: 908-420-3510

Dr. Ross J. Todd (associate professor)

Rutgers, The State University of New Jersey  
 School of Communication, Information and Library Studies  
 184 College Avenue  
 New Brunswick, NJ 08901  
 Email: [rtodd@scils.rutgers.edu](mailto:rtodd@scils.rutgers.edu)  
 Phone: 732-932-7500 ext. 8223  
 Fax: 732-932-2644

Si vous avez des questions concernant les droits de votre enfant vous pouvez contacter l'IRB Administrator at Rutgers University.

Rutgers University Institutional Review Board for the Protection of Human Subjects  
 Office of Research and Sponsored Programs  
 3 Rutgers Plaza  
 New Brunswick, NJ 08901-8559  
 Tel: 732-932-0150 ext. 2104  
 Email: [humansubjects@orsp.rutgers.edu](mailto:humansubjects@orsp.rutgers.edu)

Vous recevrez une copie de ce contrat.

Veuillez signer ci-dessous si vous acceptez la participation de votre enfant au projet de recherche.

Parent de l'enfant \_\_\_\_\_ Date \_\_\_\_\_

Investigateur principal \_\_\_\_\_ Date \_\_\_\_\_

## 8.4 Spanish Version

### Hoja de Consentimiento

Estimado \_\_\_\_\_,

Su hijo/a ha sido invitado para participar de un estudio de investigación por la Escuela Superior de West Orange. Este estudio de investigación ha sido autorizado por el superintendente de la escuela.

Este estudio es realizado por Sung Un Kim quien es estudiante doctoral en el Departamento de Comunicaciones, Informática y Estudios Bibliotecarios en la Universidad de Rutgers. El propósito de este estudio es explorar el proceso de búsqueda de información para estudiante de nivel superior con trasfondos culturales y lingüísticos diversos. Este proyecto es una colaboración entre esta servidora y la maestra del programa de Inglés como segundo idioma y la bibliotecaria.

Antes de solicitar su consentimiento para que su hijo/a pueda participar en este estudio, usted debe obtener información importante para tomar una decisión informada. Si usted tiene preguntas o dudas, favor de comunicarse con Sung Un Kim o su consejera Dr. Ross Todd. Usted debe estar satisfecho y haber contestado todas sus preguntas o dudas antes de consentir o firmar esta hoja.

La participación en este estudio incluye hasta tres horas durante el período de clases coordinado y autorizado por la maestra del programa de Inglés como segundo idioma durante 4-6 semanas entre los meses de enero a marzo 2009. El/La niño/a completará tres cuestionario en tres momentos de este período de tiempo. Luego de completar estos cuestionarios, el/la niño/a será entrevistado para obtener mas información y entender el proceso de aprendizaje en más detalle. Para efectos de análisis de datos, el nombre no será identificado con los cuestionarios y/o respuestas a las entrevistas.

Favor de firmar sus iniciales en la línea abajo consintiendo que ha leído y entendido toda la información aquí provista.

\_\_\_\_\_

Si usted consiente que su hijo/a participe de este estudio, el/la niño/a será asignado un código para analizar cualquier respuesta emitida como parte de la documentación de este estudio investigación.

La participación de este estudio es voluntaria. Su hijo/a puede elegir no contestar cualquier preguntas si no se siente cómodo/a. No hay costos involucrados en la participación de este estudio. Para participar, su hijo/a no recibirá ninguna compensación. Si su hijo/a decide terminar este estudio antes de completarlo, el/la participante no recibirá ninguna penalidad y su información será removida y destruída.

Este proyecto mantiene toda información recopilada bajo estrictos estándares de confidencial. El nombre de su hijo/a no será identificado ni asociado con sus respuestas. Esta información será mantenida en completa confidencialidad. Sólo el equipo de investigación y la Junta de Revisión Académica de la Universidad de Rutgers serán las personas quienes tendrán acceso a estos datos, tanto como la ley lo requiera. Para efectos de publicaciones y presentaciones en conferencias los resultados serán presentados en forma grupal y con gráficas donde no habrá relación con el nombre de ningún participante. Los datos serán archivados en un lugar bajo llave y el acceso a las computadoras es en forma de resumen de las respuestas de cada participante. El acceso al archivo y a las computadoras solo será por el personal del equipo de investigación. No habrá ninguna referencia oral o escrita en reportes que puedan asociar a su hijo/a con este estudio.

Si tiene preguntas sobre este estudio, puede contactar a Sung Un Kim al teléfono 908-420-3510 ([sungunk@eden.rutgers.edu](mailto:sungunk@eden.rutgers.edu)) o a su consejera, Dr. Ross Todd, al teléfono 732-932-7500 ext. 8223 ([rtodd@scils.rutgers.edu](mailto:rtodd@scils.rutgers.edu)). Si tiene preguntas sobre los derechos de su hijo/a al participar de este estudio, puede comunicarse al Administrador de Programas de Auspicio en la Universidad de Rutgers:

Rutgers University Institutional Review Board for the Protection of Human Subjects  
Office of Research and Sponsored Programs  
3 Rutgers Plaza  
New Brunswick, NJ 08901-8559  
Tel: 732-932-0150 ext. 2104  
Email: [humansubjects@orsp.rutgers.edu](mailto:humansubjects@orsp.rutgers.edu)

Usted será provisto de una copia de esta hoja de consentimiento.

Firme abajo si consiente que su hijo/a participe en este estudio:

Padre o Persona Autorizada \_\_\_\_\_ Fecha \_\_\_\_\_

Investigador Principal \_\_\_\_\_ Fecha \_\_\_\_\_

## Appendix 9

### Assent Form

You are invited to take part in a research study about the information search process of high school students with diverse linguistic and cultural backgrounds during the research project. This study is being conducted by Sung Un Kim who is a doctoral student at Rutgers University.

If you agree to participate, you will be asked to participate in questionnaire, process surveys, and interviews during your research project. This will take about 3 hours in class for 4-6 weeks, scheduled from January to March, 2009. Your name will NOT be on the questionnaire. Please don't write your name anywhere on the questionnaire. It will not be possible to link your name with your questionnaire.

Your grades will not be affected in any way by your decision to participate or not participate in the study. You will not receive any benefits from taking part in this study; however, your answers may increase understanding of the factors that influence the information search process of English Language Learner students.

You may skip any questions that you are not comfortable with, and you may decide to stop participating at any time without any penalty to you. One of your parents will also be required to provide permission for you to participate in the study, and they will be given a phone number for Sung Un Kim in case you or your parents have any questions about the research. They will also have a phone number for the Office of Research and Sponsored Programs at Rutgers University, in case there are any questions about your rights as a research subject. You will be given a copy of this form to keep.

If you agree to participate in the study, please sign below:

Student Name (printed)

Student Signature

Date

\_\_\_\_\_

Investigator Signature

Date

\_\_\_\_\_

You are invited to take part in a research study about the information search process of English Language Learners in a research project. This study is being conducted by Sung Un Kim who is a doctoral student at Rutgers University.

If you agree to participate, you will be asked to participate in surveys and interviews during your research project. This will take about 3 hours in class during a 4 week research paper project, scheduled in the Spring semester, 2009. Your name will NOT be on the questionnaire. Please don't write your name anywhere on the questionnaire. It will not be possible to link your name with your questionnaire.

Your grades will not be affected in any way by your decision to participate or not participate in the study. You will not receive any benefits from taking part in this study; however, your answers may increase understanding of the factors that influence the information search process of English Language Learner students.

You may skip any questions that you are not comfortable with, and you may decide to stop participating at any time without any penalty to you. One of your parents will also be required to provide permission for you to participate in the study, and they will be given a phone number for Sung Un Kim and Dr. Ross Todd in case you or your parents have any questions about the research.

Sung Un Kim (doctoral student)

Rutgers, The State University of New Jersey  
School of Communication, Information and Library Studies  
4 Huntington Street  
New Brunswick, NJ 08901  
Email: [sungunk@eden.rutgers.edu](mailto:sungunk@eden.rutgers.edu)  
Phone: 908-420-3510

Dr. Ross J. Todd (associate professor)

Rutgers, The State University of New Jersey  
School of Communication, Information and Library Studies  
184 College Avenue  
New Brunswick, NJ 08901  
Email: [rtodd@scils.rutgers.edu](mailto:rtodd@scils.rutgers.edu)  
Phone: 732-932-7500 ext. 8223  
Fax: 732-932-2644

They will also have a phone number for the Office of Research and Sponsored Programs at Rutgers University, in case there are any questions about your rights as a research subject. If you have any questions about your rights as a research subject, you may contact the IRB Administrator at Rutgers University at:

Rutgers University Institutional Review Board for the Protection of Human Subjects  
Office of Research and Sponsored Programs  
3 Rutgers Plaza  
New Brunswick, NJ 08901-8559  
Tel: 732-932-0150 ext. 2104  
Email: [humansubjects@orsp.rutgers.edu](mailto:humansubjects@orsp.rutgers.edu)

If you agree to participate in the study, please sign below:

Student signature

\_\_\_\_\_ Date \_\_\_\_\_

Student name (printed)

\_\_\_\_\_ Date \_\_\_\_\_

Investigator signature

\_\_\_\_\_ Date \_\_\_\_\_

## Appendix 10

### Questionnaire

Each question in the questionnaire will be read to you. When you need help, you can ask any questions to Ms. Kim. Please try to answer all of the following questions.

1. How old are you? \_\_\_\_\_
2. Are you boy or girl? Boy [  ] Girl [  ]
3. What ELL level are you in? \_\_\_\_\_
4. Are you \_\_\_\_\_ ? Check (✓) one.
  - Caucasian
  - American Indian or Alaska Native
  - Asian
  - Black or African American
  - Hispanic or Latino
  - Native Hawaiian or Other Pacific Islander
5. Were you born in the U.S.? Yes [  ] No [  ]
  - If Yes,
    - 3.1 Have you lived in other countries? Yes [  ] where? \_\_\_\_\_ No [  ]
  - If No,
    - 3.2 Where were you born? \_\_\_\_\_
    - 3.3 When did you come to the U.S.? \_\_\_\_\_ years ago
    - 3.4 Where else have you lived? \_\_\_\_\_
6. Which language(s) do you speak at home? \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_
7. Tell me how good you are at ...

	poor	okay	good	very good
reading in your native language	1	2	3	4
writing in your native language	1	2	3	4
listening in your native language	1	2	3	4
speaking in your native language	1	2	3	4

8. Tell me how good you are at ...

	poor	okay	good	very good
reading in English	1	2	3	4
writing in English	1	2	3	4
listening in English	1	2	3	4
speaking in English	1	2	3	4

## 9. Tell me who you are living with and how good they are at ...

the person who you are living with	poor	okay	good	very good
reading in English	1	2	3	4
writing in English	1	2	3	4
listening in English	1	2	3	4
speaking in English	1	2	3	4
reading in English	1	2	3	4
writing in English	1	2	3	4
listening in English	1	2	3	4
speaking in English	1	2	3	4
reading in English	1	2	3	4
writing in English	1	2	3	4
listening in English	1	2	3	4
speaking in English	1	2	3	4
reading in English	1	2	3	4
writing in English	1	2	3	4
listening in English	1	2	3	4
speaking in English	1	2	3	4
reading in English	1	2	3	4
writing in English	1	2	3	4
listening in English	1	2	3	4
speaking in English	1	2	3	4
reading in English	1	2	3	4
writing in English	1	2	3	4
listening in English	1	2	3	4
speaking in English	1	2	3	4

\* Thank you for answering the questionnaire. ☺

## Appendix 11

### Process Surveys

Each question in the survey will be read to you. When you need help, you can ask any questions to Ms. Kim. Please try to answer all of the following questions.

1. Take some time to think about your topic. Now write down what you know about it.
2. What is the name you have given to your paper at this time?
3. How interested are you in your topic? Check (✓) one that best matches your interest.
 

1	2	3	4
Not at all	a little	some	a lot
4. How much do you know about \_\_\_\_\_? Check (✓) one that best matches how much you know.
 

1	2	3	4
Not at all	a little	some	a lot
5. How do you feel about your research assignment now?

	not at all	a little	some	a lot
confident 😎	1	2	3	4
disappointed 😞	1	2	3	4
relieved 😌	1	2	3	4
frustrated 😡	1	2	3	4
confused 😕	1	2	3	4
optimistic 😊	1	2	3	4
uncertain 😟	1	2	3	4
satisfied 😄	1	2	3	4
anxious 😰	1	2	3	4
other _____	1	2	3	4

5.1 Why do you feel like that?

6. Are you worried about your English for doing this project?

1	2	3	4
Not at all	a little	some	a lot

- 6.1 What concerns, if any, do you have with reading in English for the project?
- 6.2 What concerns, if any, do you have with writing in English for the project?
- 6.3 What concerns, if any, do you have with listening in English for the project?
- 6.4 What concerns, if any, do you have with speaking in English for the project?

7. When you do research, what do you generally find easy to do? Please list as many things as you like. (Process Survey 1)

Thinking of your research so far, what did you find easy to do? Please list as many things as you like. (Process Survey 2)

In the completion phase of the research, what did you find easy to do? Please list as many things as you like. (Process Survey 3)

8. When you do research, what do you generally find hard to do? Please list as many things as you like. (Process Survey 1)

Thinking of your research so far, what did you find hard to do? Please list as many things as you like. (Process Survey 2)

In the completion phase of the research, what did you find hard to do? Please list as many things as you like. (Process Survey 3)

9. What did you learn in doing this research project? Please list as many as you like. (Process Survey 3)

\* Thank you for answering the process survey. ☺

## Appendix 12

### Interview Guideline for Students

1. What did you find hardest/easiest to do?
  - Why was it hardest/easiest?
  
2. Your research project was done in English. Did you have any problems doing this in English?
  - What problems, if any, did you have with reading in English for the project?
  - What problems, if any, did you have with writing in English for the project?
  - What problems, if any, did you have with listening in English for the project?
  - What problems, if any, did you have with speaking in English for the project?
  - How did these problems affect your project?
  - What help did you need to solve these problems?
  - Did you get the helps you needed?
  - Who helped you? *For example, the school librarian, teachers, classmates who are also doing project, people who live with you (or family members), friends and public librarians.*
  - How did \_\_\_\_\_ (each of the people mentioned) help you?
  - What help do you wish you had while doing the project in English?
  
3. When you were doing this project, were you thinking in English or in your native language?
  - When did you think in your native language?
  - If you could read and write in your native language for this project, how would your project be different?
  
4. How could you have been better prepared for the research?

## Appendix 13

### Interview Guideline for Teachers

1. What do you think is the hardest part of a research paper project to ELL students?
2. What do you think is the easiest part of a research paper project to ELL students?
3. What cognitive patterns (i.e. topic selection, focus formulation, knowledge building) do ELL students show during the project compared with native English speaking students?
4. What behavioral patterns (i.e. search terms and tactics, operators, article selection criteria) do ELL students show during the project compared with native English speaking students?
5. What affective patterns (i.e. emotional changes, concerns caused by English language proficiency) do ELL students show during the project compared with native English speaking students?
6. What help do ELL students need in each phase of the research project?
7. What do you consider important when you design the research paper project for ELL students?
8. How differently do you help ELL student between lower levels and higher levels?

#### General thoughts

Please give me your general thoughts on how students' linguistic and cultural background impact on their information seeking and knowledge building process and what kind of help should be provided for ELL students, during the project, from people and information systems.

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